

博士論文

An Analysis of the Link between Optimal Location in  
Fragmented Production System and Socio-economic  
Performance: The Case of the Provinces in the Philippines

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*“The reality is imagined before it manifests itself.”- Paulo Coelho*

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## Contents

1. Introduction .....	8
1.1 Background of the Problem .....	8
1.2 Research Questions .....	9
1.3 Significance of the Study .....	10
1.4 Overview of Methodology .....	10
1.5 Delimitation .....	11
1.6 Structure of the Study .....	11
2. Review of Related Literature.....	12
2.1 Introduction.....	12
2.2 Traditional Location Theories .....	12
2.2.1 Marshall's Industrial District .....	12
2.2.2 Weber's Theory of Industrial Location .....	13
2.3 Emergence of Industrial Clusters .....	17
2.4 Globalization and the Rise of New Economic Geography .....	19
2.5 Fragmentation Theory and Development of International Production Network .....	25
2.5.1 Scott's Functional and Spatial Organization of Production.....	25
2.5.2 Pontes and Parr's Classification of Locational Pattern of the Firms .....	29
2.5.3 Shi and Yang's Theory of Industrialization: Interaction among Division of Labor, Specialization, and Transaction Cost .....	32
3. Formation of Locational Prospective Area and its Significance .....	36
3.1 Framework of the study .....	36
3.2. Theoretical Analysis: The model.....	37
3.3 Derivation of the profit function of a firm .....	38
3.3.1 Profit Function of Factory 1 .....	38
3.3.2 Profit Function of Factory 2 .....	40
3.4 Derivation of optimal location of factory 1(intermediate goods) .....	41
3.4.1 Location of Factory: Same Tax Rate.....	41
3. 4.2 Location of Factory: Different Tax Rate.....	43
3. 5 Determination of type of agglomeration pattern and industrial parks .....	44
3.6 Determination of Factory Location and Agglomeration in Industrial Park .....	45
3.6.1 Location of Factory: Low Transport Cost with High Tax Rate .....	45

3.6.2 Location of Factory: Low Transport Cost with Low Tax Rate.....	46
3.6.3 Location of Factory: High Transport Cost with High Tax Rate .....	46
3.6.4 Location of Factory: High Transport Cost, Low Tax Rate .....	47
3.6.5 Summary of Industrial Park .....	47
3.7 Summary of the Chapter .....	48
4. Empirical Analysis of Prospective Location Area .....	49
4.1 International Production Networks in Asia.....	49
4.1.1 Introduction .....	49
4.1.2 Relevant Statistics on International Production Networks in East Asia .....	51
4.1.3 Development of International Production Network in Asia.....	53
4.2 Philippines: Introduction and Economic Development Strategies.....	56
4.2.1 Basic Information about the Philippines .....	56
4.2.2 Economic Development during Colonization Period.....	57
4.2.3 Regional Development Policies from Post-Independence to Martial Law Period (1947-1986).....	57
4.2.4 Economic Liberalization during Post-EDSA- Present (1986-Present) .....	59
4.2.5 Evolution of Regional Development Policies: From Diffusion to Integration ....	61
4.3 Optimal Location within the Philippines: Comparison of Provincial Socio-Economic Characteristics.....	64
4.3.1 Socio-Economic Data of the Philippines .....	64
4.3.2 Estimation of Socio-Economic Index of the Provinces .....	65
4.3.3 Comparison of Socio-Economic Index .....	66
4.3.4 Results of principal component analysis (PCA) .....	70
4.4 The Urban System Structure in the Philippines .....	72
4.4.1 Definition of Cities.....	72
4.4.2 Spatial Pattern of Cities in the Philippines.....	74
4.4.3 Historical Development of Cities.....	78
4.4.4 Derivation of Urban System Index.....	80
4.4.5 Urban System Index in the Philippines .....	82
4.4.6 Urban System Index and Provincial Socio-economic Performance .....	84
4.5 Industrial System and Local Economic Development: Economic Zones in the	

Philippines.....	89
4.5.1 History of Economic Zones in the Philippines.....	89
4.5.2 Definition and Incentives of Economic Zones.....	89
4.5.3 Location of Economic Zones .....	92
4.6 Policy Implications .....	95
5. Summary and Conclusions .....	97
5. 1 Summary .....	97
5.2 Conclusions.....	97
5.3 Opportunities for Further Research.....	98
6. Appendix .....	100
7. References .....	106

## List of Figures

- Figure 2.1 Weber's Triangle
- Figure 2.2 Minimization of Transport Cost
- Figure 2.3 Inclusion of Agglomerative Factor
- Figure 2.4 Basic Framework of New Economic Geography
- Figure 2.5 Agglomeration Forces
- Figure 2.6 Circular Causation of Agglomeration of Consumer-goods producers and workers
- Figure 2.7 Transport and Spatial Concentration of Economic Activities
- Figure 2.8 Dynamics of the Technical Division of Labor
- Figure 2.9 Intra-and Inter-firm Organization of Production
- Figure 2.10 Locational Firm Types
- Figure 2.11 Patterns of Market Structure
- Figure 3.1 Location figure of the factory 1
- Figure 3.2 Optimal transfer price and prospective location area
- Figure 4. 1 World Trade in Parts and Components
- Figure 4.2 Trade in Parts and Components in East Asia
- Figure 4.3 Top Sources of FDI 2012-2014
- Figure 4.4 HDD Network in East Asia
- Figure 4.5 Administrative Divisions in the Philippines
- Figure 4.6 Map of Socio-economic Indices
- Figure 4.7 Principal component analyses of the provinces in the Philippines
- Figure 4.8 Big Cities Regions
- Figure 4.9 Small Cities Region
- Figure 4.10 Primary City Regions
- Figure 4. 11 Cities, Urbanization, and Economic Growth
- Figure 4.12 Location of Cities Created from 1950s-2000s
- Figure 4.13 Map of Urban System Index in the Philippines
- Figure 4.14 Total Income
- Figure 4.15 Number of Banks and Total Bank Deposit
- Figure 4.16 Number of MSMEs
- Figure 4.17 Number of Higher Education Institutions and Number of College Graduates
- Figure 4.18 Road Density and Number of Telephone Lines
- Figure 4.19 Number of Government Health Workers and Doctors
- Figure 4.20 Number of Barangay Health Stations
- Figure 4.21 Local Finance (Total Local Financial Resources)
- Figure 4.22 Crime Volume
- Figure 4.23 Special Economic Zones in the Philippines
- Figure 4.24 Economic Zones in Provinces by Type

## List of Tables

- Table 3.1 Corporate tax rates and firm's activities
- Table 3.2 Changes of a firm's activities due to the reduction in corporate tax rate
- Table 3.3 Low transport cost with high tax rate
- Table 3.4 Low Transport Cost with Low Tax Rate
- Table 3.5 High Transport Cost with High Tax Rate
- Table 3.6 High Transport Cost, Low Tax Rate
- Table 4.1 Selected Figures in East Asia
- Table 4.2 Direction of Trade in Parts in Components (Percent Share) 2011-2012
- Table 4.3 Regional Development Policies and Historical Event
- Table 4.4 List of Indicators
- Table 4.5 Ranking of the Provinces
- Table 4.6 Barlett's Test and KMO
- Table 4.7 Factor Loadings
- Table 4.8 Definition of Cities in Selected Countries
- Table 4.9 City Income Class
- Table 4.10 City Status
- Table 4.11 Metropolitan Areas in the Philippines
- Table 4.12 Regions and City Sizes
- Table 4.13 Location of Manufacturing Economic Zones, Socio-Economic Index, and USI

## **1. Introduction**

This chapter provides the background of the study, research questions, and the significance of the study

### **1.1 Background of the Problem**

Due to the ever present challenge of competition, firms, particularly manufacturing firms who wish to expand, carry out different cost-saving mechanisms, in particular, locating in areas which offer competitive advantage. Production processes are fragmented into different segments and are located in different areas that offer locational advantages. This fragmentation of production processes occurs not only within a particular country but also involves other countries. The United Nations Conference on Trade and Development (UNCTAD) World Investment Report 2013 noted that there has been rapid expansion of international production since 2000 and as of 2013, the trade in intermediate goods and services accounts to 60 percent of the global trade or equivalent to \$20 trillion.

This international fragmentation or global value chains have been examined from different perspective: economics, geography, development studies, sociology, and international business. This study focuses on the importance of the choosing potential location in the international production network. In general, firms undertake different steps and examine various factors in determining the potential location. Badri (2007) conducted a comprehensive review of the studies regarding industrial and identified the following as general critical factors of industrial location: transportation, labor, raw materials, markets, industrial sites, utilities, government attitude, tax structure, climate, and community. Badri (2007) also enumerated the four general factors for international location: political situation of foreign countries, global competition and survival, government regulations, and economic factors.

This study conceptualizes a model of the firm with two production processes: intermediate good and final product. The study also proposes a framework in determining the potential location which involves two steps: selection at the international level and at the local level. The study also analyzes the factors that can be influential in the both steps. The first step is the selection of the potential location on international or regional-level. On this step, the study conducts theoretical analysis that takes into account the influence of taxation system, transfer pricing system, and agglomeration economies. This study argues it is important to analyze the nature of the taxation system because all profits are subjected to taxes imposed by a particular country. The taxation system also guides the firm in estimating appropriate transfer price. On the other hand, the government also needs to understand the firms' transfer price and profit management system in order to establish appropriate taxes and incentives. Once the firm has selected a particular country to locate, the next step is to examine the regions or provinces and establish their potential location. On the second step, this study performs an empirical analysis on the socio-economic characteristics and urban system structure of the provinces in the Philippines. This study argues that is important to analyze local socio-economic structure as well as the spatial structure because it could impact the production



efficiency of the firms.

This study sets forth to accomplish the following research objectives.

1. To provide a review of related studies about agglomeration and fragmentation.
2. To construct a framework for determining the optimal locations in fragmentation production system.
3. To analyze the dynamics and trends of fragmentation and agglomeration in East Asia.
4. To identify prospective location within the Philippines by constructing a socio-economic index.
5. To evaluate the relation between socio-economic performance and urban system structure.

## **1.2 Research Questions**

This study is constructed on two foundations: theoretical and empirical analysis. Theoretical analysis examines the influence of corporate taxation system transfer price system on the location decision of the firm under the international production system. The theoretical analysis also takes into account the possible impact of agglomeration within industrial parks in the decision-making process.

The theoretical analysis aims to shed light on the following questions:

1. How does corporate tax rate affect the profit function of the firm and the location of the factories?
2. How do firms determine optimal transfer price?
3. How do industrial parks influence the location decision of the firm?
4. How does one determine the optimal location in fragmented system of production?

The empirical analysis regards the Philippines as potential location and thus, conducts an examination of socio-economic standing and the urban system structure of the provinces. The empirical analysis also provides background information about the international production networks in Asia. The analysis also discusses the relevant regional development strategies pursued by the Philippines.

The empirical analysis aims to answer the following questions:

1. What are the characteristics of International Production Network (IPN) in East Asia?
2. What are the industrial/regional development policies pursued in the Philippines?
3. What is the current socio-economic profile of the provinces in the Philippines?
4. Is there a relation between urban system structure and socio-economic performance of the provinces?

### **1.3 Significance of the Study**

This study is considered due to four main reasons.

First, it provides a review of selected relevant theories and studies about agglomeration and fragmentation. The review gives a concise explanation on why firms tend to cluster and why production processes have become fragmented.

Second, this study offers a new approach in determining optimal location in a fragmented system of production as it incorporates the transfer pricing system and the corporate taxation system as well as the agglomeration in industrial parks. Based on the theoretical simulations, chaotic phenomenon has surfaced which makes it difficult to identify a specific location point. Nevertheless, a prospective location area can be determined and as long as the firm decides to locate within the prospective location area, it is still possible to achieve target profits. This prospective area can include a range of countries and in order to identify a particular potential location, a careful examination of each country's characteristics and regional conditions is needed.

Third, given the assumption that the Philippines is within the prospective location area, the study provides a holistic evaluation of the socio-economic conditions of the provinces through the devised socio-economic index. Although, there is a huge gap in terms of growth and development, every province has strengths in which firms could utilize should they decide to move in this province.

Fourth, the study also analyzes the relation between urban structure and socio-economic performance of the provinces in the Philippines. The urban system structure in the Philippines offers an interesting case due to the archipelagic nature of the country and relatively high number of cities. The findings of this study would be valuable for firms, academic researchers, policy-makers, and local administrators.

### **1.4 Overview of Methodology**

The study utilizes gradient dynamics to determine the optimal location of the firm. The study uses the software Mathematica to process the calculation. Meanwhile, the data for socio-economic performance were collected mainly from the statistical reports published by government statistic office, National Statistical Coordination Board (NSCB) and National Statistical Office (NSO). The study processes the data using MS Excel, Xlstat and R software. The study employs the Nearest Neighbor Analysis to determine the spatial pattern of the cities in the Philippines. The study uses MapWindow to generate choropleth maps. The study also uses regression to determine the relation between urban system structure and various socio-economic performances.

## **1.5 Delimitation**

The constructed analytical model of a firm is basic and involves only two production processes located in two different locations: intermediate goods and final goods. The theoretical analysis is purely based on numerical values and does not reflect actual values, in particular, the taxation. Nevertheless, the model is a useful guide in predicting the prospective location. The various socio-economic indicators of the provinces have varying years of publication but this study utilizes the most recent data. The empirical analysis covers 80 provinces but excludes the provinces of Dinagat Islands<sup>1</sup> and Davao Occidental<sup>2</sup> due to lack of available statistics. Metro Manila, although not a province, was considered as such for comparison purposes. While it may be worthy to undertake, the time-series analysis to document how the socio-economic performance and urban system structure have transformed over the past year, due to time and data availability constraints, this study relies mainly on the latest published statistics.

## **1.6 Structure of the Study**

The thesis is organized as follows: Chapter 1 provides background information, enumerates research questions, and explains the significance of the study as well as the methodology and limitations of the research; Chapter 2 presents selected relevant studies about agglomeration and fragmentation; Chapter 3 discusses the results of the theoretical analysis; Chapter 4 explains the results of empirical analysis; Chapter 5 concludes the study.

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<sup>1</sup> Dinagat Islands is separated from Surigao del Norte in 2006. But the Supreme Court deemed it unconstitutional in 2010. However, the Supreme Court recalled its earlier decision and declared Dinagat Island as a province in 2011.

<sup>2</sup> Davao Occidental has separated from Davao del Sur in 2013.

## **2. Review of Related Literature**

This chapter surveys selected relevant literatures about location theories, agglomeration, and fragmentation theories.

### **2.1 Introduction**

Any economic activity occurs in a geographical space, thus the influence of geographical space is undeniable. However, mainstream economic theories have seemingly ignored the role of space in their analysis (Ekelund and Herbert, 1993; Fujita and Thisse, 2002). Krugman (1995) alluded the aspatial nature of many economic analysis to the lack of models incorporating increasing rates of return and imperfect competition. Spatial economics has undergone rapid development over the past fifty years and New Economic Geography (NEG) have significantly transformed the role of geographical space in the analysis.

This chapter aims to survey selected location theories to provide answers to the following questions:

1. How does location theories have developed throughout the years?
2. What is agglomeration of industrial activities? How and why does agglomeration formed?
3. What are the benefits that can be derived from agglomeration of industrial activities?
4. How does globalization influence the spatial pattern of industrial activities?
5. What is fragmentation of industrial activities? How and why does fragmentation occurs?

## **2. 2 Traditional Location Theories**

### **2.2.1 Marshall's Industrial District**

Alfred Marshall in his Principles of Economics and Trade and Industry has introduced significant concepts about agglomeration. Using historical background, Marshall wrote about how the “organization of industry” was formed which eventually gave rise to specialization and localization of industry. In the pre-agricultural/civilized world, people are basically doing the same work and provide for their own needs and wants. The advent of agriculture gives rise to a society built based on land ownership and eventually evolved to archetypal village communities. Although there was difference in employment, there was no particular social structure than can be considered as organization. During those days when plundering and wars were rampant, towns are haven of “order, patient work, of intelligent and peaceful enterprise.” As the industry of towns became organized, villagers started to produce things of only one kind and division of labor has occurred. Villagers have also begun to form town guilds, which functioned as primary organizer of the industry and defender of the members and of their families.

Marshall (1920) observed that this specialization and division of labor have persisted over

time and the prominent division between agricultural and manufacturing labor has emerged. Marshall pointed out the advantages of division of labor such as improvement in dexterity due to focus only one operation and economy of skills where workers are assigned with tasks based on their skills or strength. Marshall has also analyzed the importance of division of labor on the size of the firm and argued that division of labor is only beneficial to large factories. Small factories can obtain the advantage from division of labor if they located together in same districts.

Over time, the improvement in agriculture and machinery has brought about decline in agricultural population. The agriculturists remain scattered but the manufacturers are began to cluster in same districts. Marshall referred to this as, “localization of industry”, which can be defined as the same locality of large member who are engaged in the same trade. Marshall argued that, localization of industry “promotes education of skills and taste, and diffusion of technical knowledge.” In a localized industry, a skilled worker is most likely to find a job suited to his credentials and firms can easily find people fit for their vacancies. Localization of industry have brought about continues and progressive specialization over time.

Marshall also observed that “once the firm decides to locate in a particular district, it will remain there for a long period of time.” Marshall emphasized three main factors that encourages the firm to cluster successfully in the same location and achieves increasing returns to scale: knowledge spill-overs, availability of specialized input services, and abundance of local skilled labor. Knowledge spill-overs depend on the proximity whereby firms locating in the same location have easy access to each other’s knowledge or information. Provision of non-trade or specialized input services is more efficient in the location where firms are clustered than dispersed. Presence of local skilled labor pool provides reduction in acquisition cost both hiring and training for the firms. Firms can easily find labor that would fit their needs and require less training due to high-specialization.

Marshall differentiated between internal and external economies that can be derived from agglomeration. These two different types of profit are important with regards to the location decision of the firms. Internal economies refers to the profit that can be gained only within the firm and cannot be used to attract other firms. On the other hands, external economies or agglomeration economies can draw more firms as it has a “cumulative location-drawing effect” and as more firms locate at the same district, the more profits can be obtained. Some scholars pointed out that Marshall’s concept of agglomeration is vague but it has been widely used by economics and regional science as it denote that agglomeration economies is the outcome of an ‘snowball effect’(Fujita and Thisse, 2002).

### **2.2.2 Weber's Theory of Industrial Location**

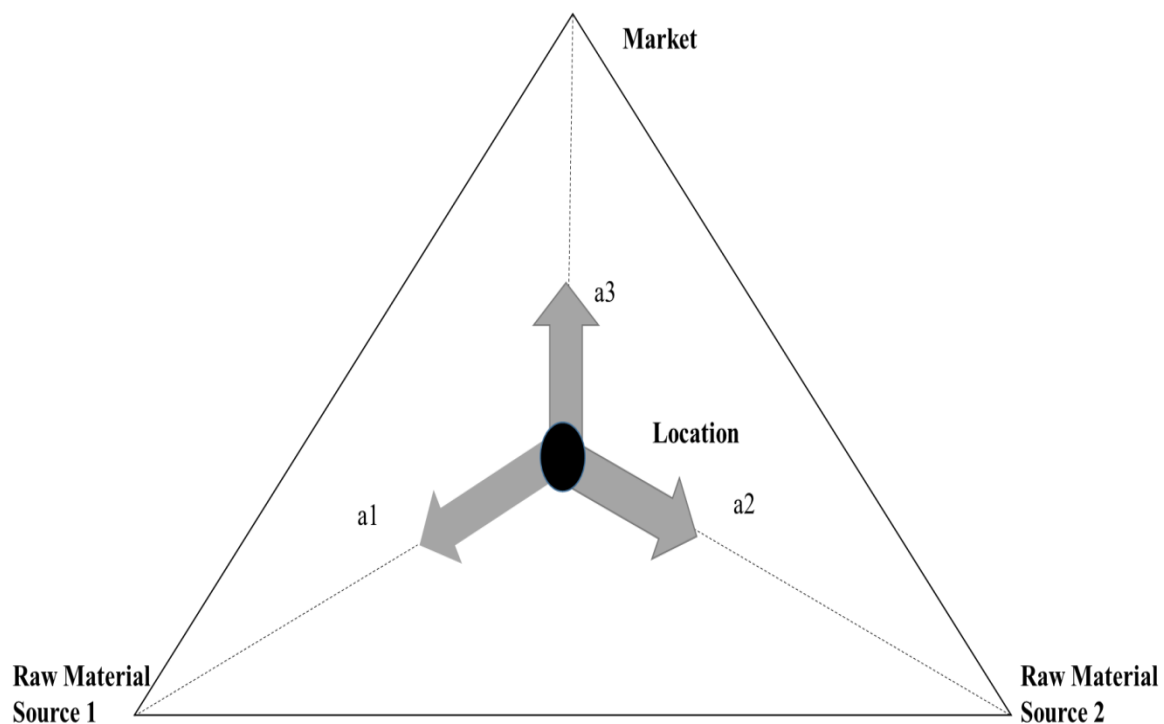
Alfred Weber is considered as the founding the father of the location theory. Weber (1922) sought to explain how and why firms determine the optimal location or identify production site that will supply demand at a least cost. The main focus of the analysis is the productive

processes, which are “made of parts than can be independently separated and undertaken in different location which can provide labor and transportation savings and benefit from economies of agglomeration”. Weber’s location theory is based on classical economic theory in which the firm acts rationally and chooses to locate in particular area which offers lowest cost or the least-cost location theory. Weber identified the productive and distributive processes as follows:

1. Securing a place (real estate or ground site) of the location and fixed capital (rent and depreciation of capital).
2. Securing the material (raw and auxiliary materials as well as semi-finished products) and power and fuel sources.
3. The manufacturing process (labor).
4. The shipping of goods.

In Weber’s theory, the optimal location is determined by the minimization of transportation cost, economies of labor, and agglomeration economies. The location decision among the factors of location is illustrated using the triangle location problem below.

**Figure 2.1 Weber’s Triangle**

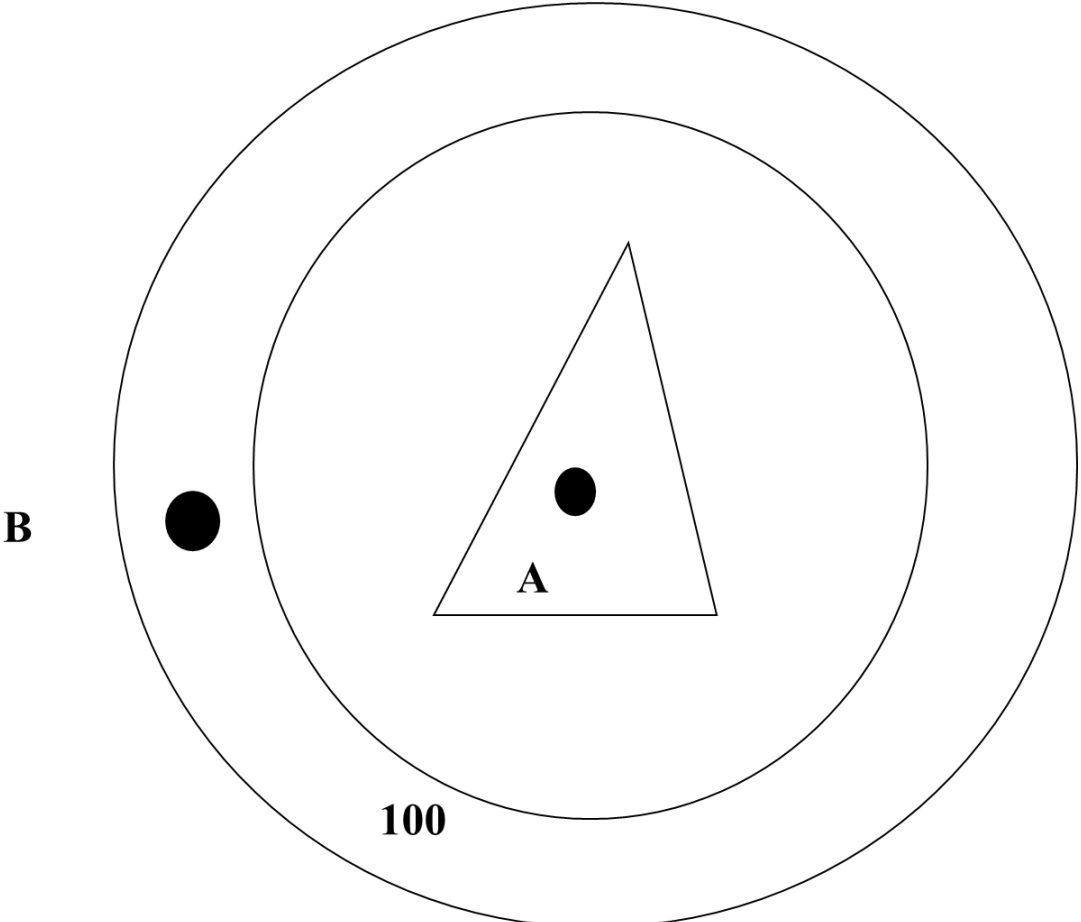


Source: author’s own construction based on Inamizu and Wakabayashi(2013)

The first step in Weber’s analysis is the minimization of transportation cost. Assume that a particular production requires two distinct raw materials (Source 1 and Source 2) and that output is supplied to a market. The points in the triangle represent the market and two source location points. The transportation cost is determined based on the distance and on the weight of both intermediate products and finished good. For example, if the weight of raw materials is heavier than the finished good, it will be cheaper to transport the finished product than the raw materials across distances. It will better to locate the base of production near the source of materials and transport the finished goods to the market.

The second step in Weber’s analysis is the introduction of cheap labor cost. It is assumed that transport cost minimizing location is at point A or the black dot in the triangle. If the production chose to locate away from point A, the transport cost will increase. However, assuming that there is a source of cheap labor (point B) and assuming that point B is within the isodapane or the line of equal transportation cost, then it will more beneficial for the firm to move to point B than point A.

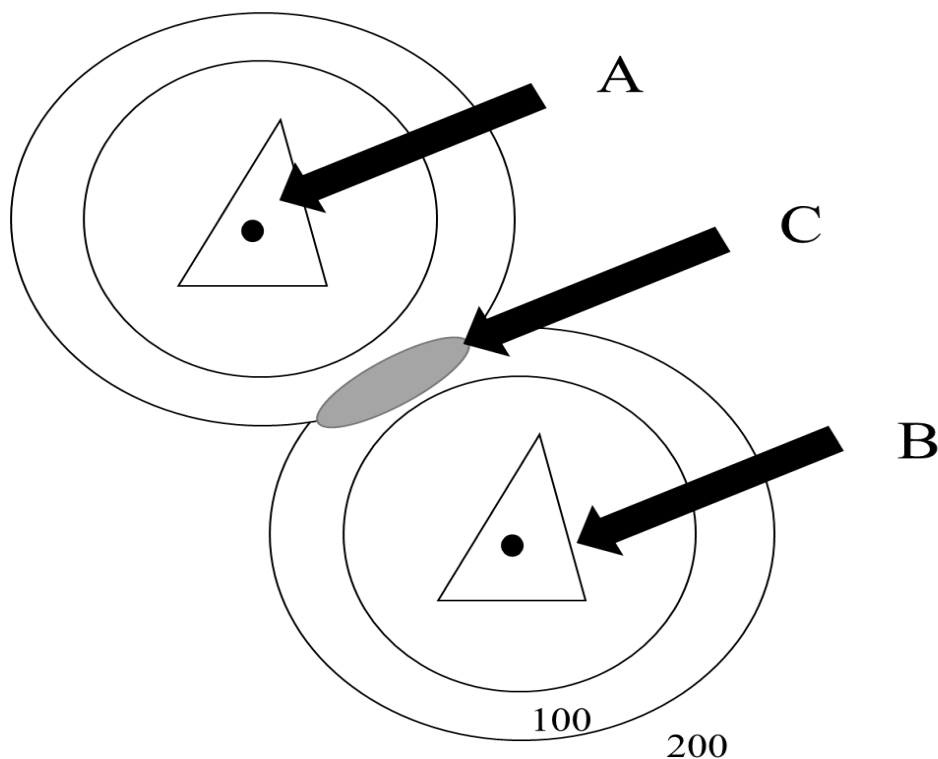
**Figure 2.2 Minimization of Transport Cost**



Source: author’s own construction based on Inamizu and Wakabayashi(2013)

The third step in the analysis is the inclusion of the agglomerative factor. The agglomerative factor is defined as “an advantage or cheapening of production or marketing which results from production undertaken at one place, while deglomerative factor is “cheapening of production which results from the decentralization of production.” Agglomeration may rise from either expansion of a single plant or the clustering of several plants in one location or “social agglomeration.” Assuming that production point A and point B, agglomerate at point C, which is within the cost curve of point A and B, then it is more advantageous for both operations to cluster at point C.

**Figure 2.3 Inclusion of Agglomerative Factor**



Source: author’s own construction based on Inamizu and Wakabayashi(2013)

Weber distinguished the two types of agglomeration: pure agglomeration and incidental agglomeration (Inamizu and Wakabayashi, 2013). Pure agglomeration refers to the agglomeration used as a means of economizing. Incidental Agglomeration refers to agglomeration based from moving production location to save labor and transportation cost.

Weber explained four reasons that drive social agglomeration: First, the development of technical equipment requires close contact, and in turn, this contact results to efficiency. Weber noted that “the necessity for local contact may cause the main process (if at a certain



stage it needs certain kinds of machinery) to tend towards the location of such machinery, for there it would find opportunities for easy and dependable repair and such stimulus to further technical development as would result from local contact. Second, development of labor organization makes production efficient and tends to develop into specialized auxiliary operations. Third, marketing factors in which firms are able to avoid any intermediaries and source raw materials easily. Fourth, general overhead cost tends to decrease as the scale of production expands and firms concentrate in one location.

Weber also discussed the importance of independent productive processes and their relationship to each other. For example, “different processes (or parts of these processes) may be gathered within a single plant, thus leading to a local linking of independent industrial processes (or parts of these processes) initially located at some distance. There are two main reasons why different productive processes are undertaken in the same plant: technical and economic. First, due to technical constraints in some industries, such as the chemical industry, it is difficult to separate productive processes and locate them in different geographical areas. Second, the labor within company can be used optimally in case of economic fluctuations when the production of good decreases, the labor supply can be utilized in the increasing the production of other good.

Inamizu and Wakabayashi (2013) examined the differences between Marshall and Weber location theories. First, Weber uses the term like “localization” and “localized-industry” or the “concentration of many small businesses of a similar character in particular localities.” Meanwhile, Weber uses the term “agglomeration” which is defined as “the concentration of economic activity or entities in particular localities. Inamizu and Wakabayashi (2013) argued that the main difference between these theories lies in the perspective of each theory. Weber’s theory of agglomeration is built upon the emergence of agglomeration based on predictable profit from a prior state of nothingness.” Meanwhile, Marshall’s discussion revolves around the existing agglomeration and its endurance.

### **2.3 Emergence of Industrial Clusters**

Against the backdrop of global economic decline in 1970s, some regions with small clustered industries, majority of which are found in Italy have continuously thrived. This era marked the shift from mass production of Fordism period to increasing subcontracting and flexible specialization as evidenced with the success of small clustered industries in international markets. These industrial clusters have been defined in many ways and analyzed from different perspective. However, most analyses emphasize the concept of “industrial atmosphere” and “division of labor” which are inspired by the earlier works of Marshall on agglomeration; thus, these industrial clusters are often referred to as Neo-Marshallian Industrial District. These industrial clusters have also figured prominently in the economic history of Italy and sometimes referred to as “Third Italy.” At the forefront of the empirical study about industrial district are the Italian scholars such Becattini, Belussi, Piore, Sabel, etc.

From the point of view of industrial organization studies, industrial district is defined as vertically disintegrated clusters of relative small firm spatially continuous and linked together by horizontal relationships. Production decentralization and productive specialization are the main characteristics of the organization of firms within the industrial district. Productive decentralization is subcontracting some production processes, which will often result to production or flexible specialization. Industrial districts is often characterized as smaller-scale productions, specialization, and more social networking between contracting firms to make vertically-disintegrated production processes possible.

Belussi (1999) distinguished the different types of firms within the industrial district according to the processes they perform.

1. Routine activities firm- serve mostly as subcontractors for the final firms and are often very small in size.
2. Final assemblers- focus on most innovative activities such as product design, engineering, marketing, innovation, and new production development. These firms often influence the level of innovation.
3. Intermediate level- performs work between final assemblers and routine activities.

From the socio-economic perspective, Becattini (1990) defined industrial district as a socio-territorial entity which is characterized by the active presence of both a community of people and a population of firms in one naturally and historically-bounded area. Becattini(1990) enumerated the following characteristics of an industrial district:

1. Local community people- presence of relatively homogenous system of values and views, which is an expression of an ethic of work and activity, of the family, of reciprocity, and of change.
2. The population of firms- similar to Marshall's main industry and auxiliary industry where many firms specialize in one phase or a few phases.
3. Human resource- similar to Marshall's idea, where labor should correspond based on the workers abilities and experiences.
4. Market- dynamic interaction between division, integration of labor in the district, a broadening of the market for its products, and the formation of a permanent linking network between the district and the external markets.
5. Competition and Co-operation- balance between co-operation and competition. Firms which are involved in different production processes tend to work together, while firms which are involved in same production processes tend to compete against each other.
6. Adaptive system-all agents in the district are able to adapt to the changes in production organization, and operates a kind of automatic efficiency control of each single phase
7. Technological phase- the introduction of the firm is seen as an opportunity to maintain acquired position.
8. Local credit system- a local bank working closely with local entrepreneurs.
9. Source of dynamism- the continuous comparison between the cost of performing any given

operation inside the firm and the cost of having it done outside, given a pressing and implacable external competition.

10. Consciousness, class and locality. Sense of belonging to the local industrial community, perceived as the objective basis of the fortunes of the individual and the family.

## **2.4 Globalization and the Rise of New Economic Geography**

In the 1990s, there was a massive attention towards theoretical and empirical works on economic geography. The works of Krugman (1991a, 1991b) on the core-periphery model has paved way for more studies related to economic geography or spatial economics: Venables and Krugman on international trade and industrial agglomeration/specialization, Krugman-Fujita on evolution of cities and urban systems. From thereon, the field new economic geography (NEG) has attracted a lot of attention in the light of the increasing borderless global economy. The integration of national economies within trading blocs such as the European Union (EU) and North Atlantic Free Trade Authority (NAFTA) have fueled the growing interest in in this emerging discipline (Fujita and Thisse, 2002).

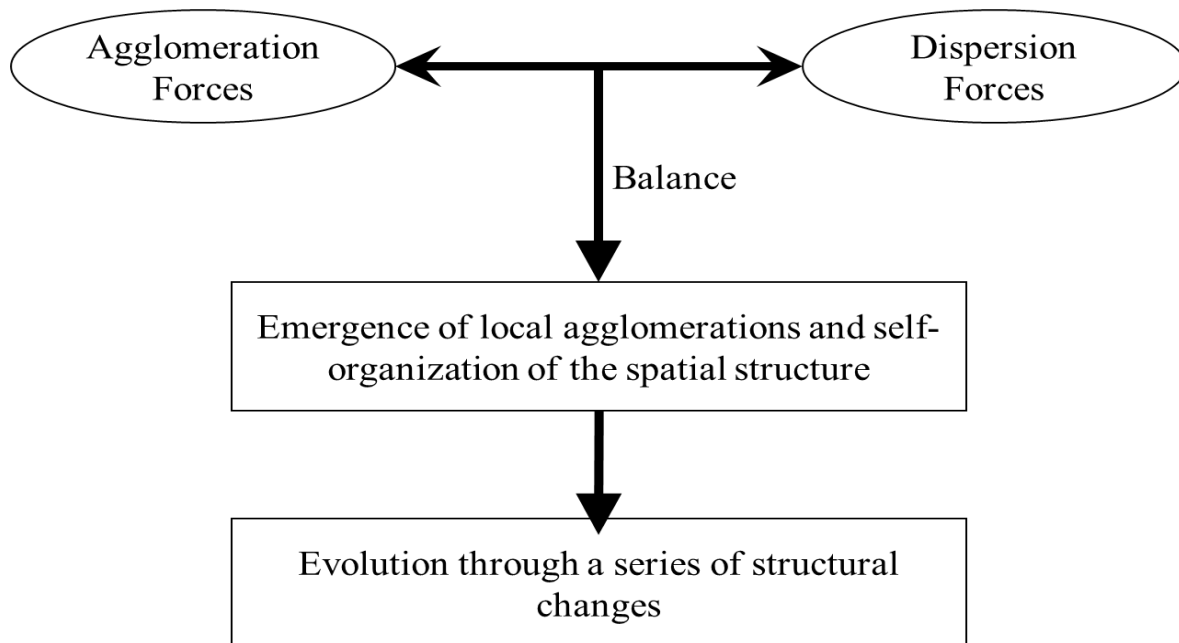
The main agenda of NEG is to explain the formation of economic agglomeration in agglomeration space. The main contribution of NEG is the introduction of a unified approach to modeling a spatial economy characterized by a large variety of economic agglomeration, once that emphasizes the three-way interaction among increasing returns (firm level), transport cost (broadly defined), and the movement of productive factors, in which a general equilibrium model is combined with nonlinear dynamics and an evolutionary approach for equilibrium selection.

NEG explains that spatial configuration of economic activities is a result of a process involving two opposing forces: agglomeration (centripetal) forces, and dispersion (centrifugal) forces (Figure 2.4). Agglomeration forces are based on Marshall's externalities that tend to lead to the clustering of economic activity, including labor market pooling, technological spillovers, intermediate goods supply, and market size. Centrifugal or dispersion forces include immobility of labor, increases in land rents and external diseconomies such as congestion and environmental problems that develop with increased concentration (Krugman and Venables, 1996; Martin, 1999). Agglomeration forces attract different economic activity into one location and this enables the firms to reap the benefits of economies of scale. The same agglomeration forces will also result to dispersion because concentration of economic activity will likely increase land prices and wages, traffic congestion, overcrowded communication system, and pollution. With the complicated balance between these forces, emergence of local agglomerations and self-organization of the spatial structure of the economy could be observed. Due to the technological and socioeconomic changes, the spatial system evolves into a complex through structural changes.

Figure 2.5 shows the key elements behind the formation of agglomeration forces and these key elements are primarily based on Marshallian externalities. The first element is

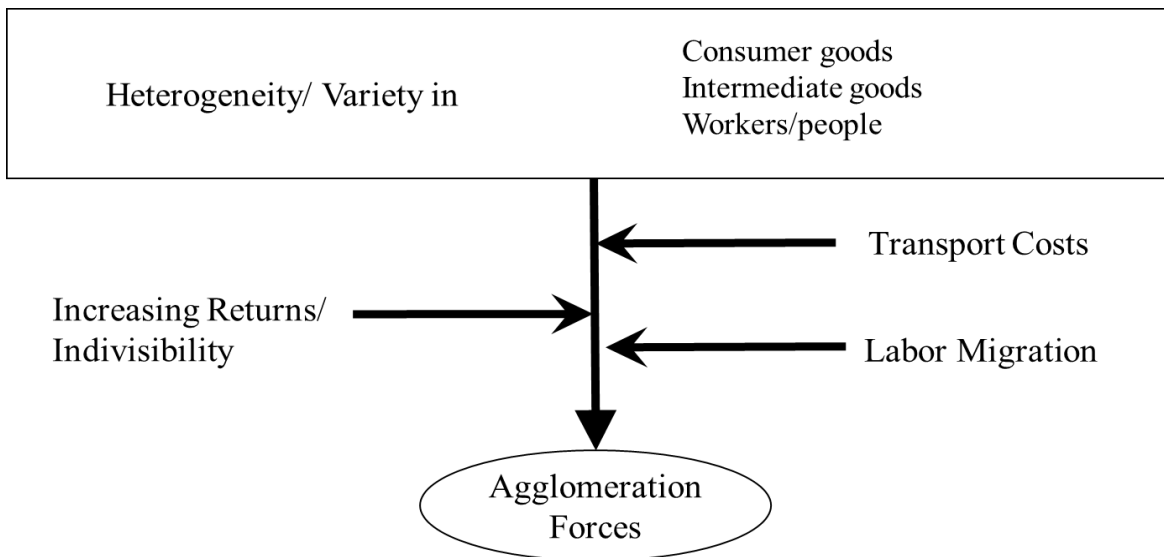
heterogeneity of good which enables the three-way interaction among increasing returns, transport cost, and migration of workers which results to agglomeration of both consumers and suppliers of goods and services. Hence, if the goods and services are differentiated, suppliers can locate close to each other without price competition, and consumers can access the variety of goods and services. This heterogeneity of goods is particularly useful in the analysis of the research and will be discussed in details in the later section. The second element is increasing returns at the firm level which would have to present in a location, otherwise, it makes no sense for the firm to concentrate their production in that location. The third element is transport cost which obviously matters in spatial analysis. The presence of transport costs results to “home market effect” where suppliers tend to locate near the market. The fourth element is the migration of workers or a consumer which is necessary for the agglomeration of workers and firms.

**Figure 2.4 Basic Framework of New Economic Geography**



Source: Fujita (2007)

**Figure 2.5 Agglomeration Forces**



Source: Fujita (2007)

The core model of geographical economics developed by Krugman (1991a, 199b) includes the following specifications: two regions, two sectors (agriculture and manufacturing), and two types of labor. Agriculture is considered immobile in that production cannot move from one location to another. Manufacturing is “footloose” and can locate to other location. Labor is the only production factor. Total labor supply is fixed and workers are the only consumers. Agriculture produces one and the same product in all locations with constant returns to scale at a fixed prices. Manufacturing is based on Dixit-Stiglitz monopolistic competition framework which all manufacturers produce a unique variety of a manufactured good with economies of scale at the level of individual firm. All consumers share the same constant elasticity of substitution (CES) utility function with an elasticity that measures the extent to which consumers have preferences for varieties. Workers consumer both agriculture and manufacturing products from all locations, but they consume fewer products from locations that are further away due to the higher transportation costs.

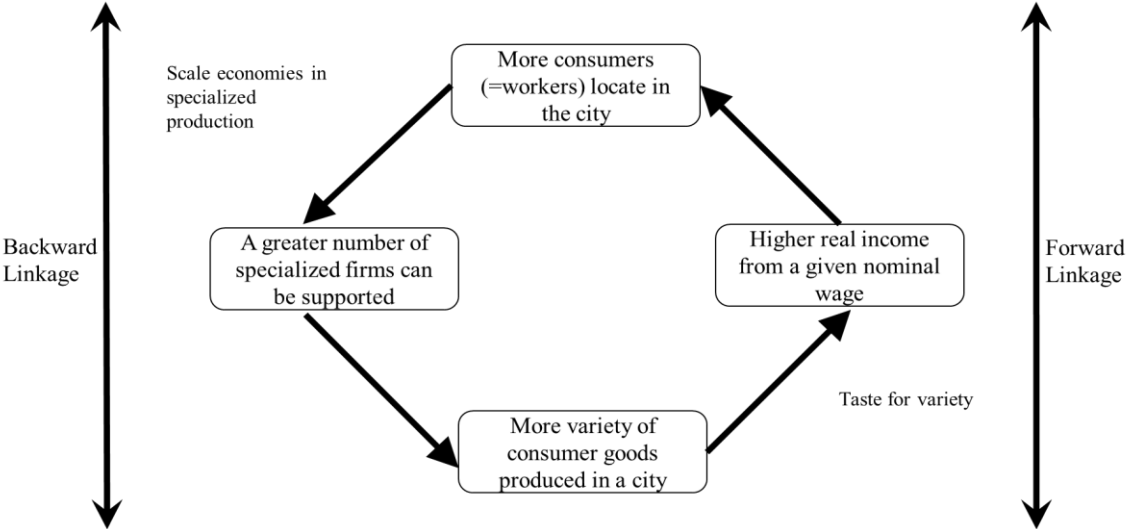
The model assumed initial distribution of agriculture and manufacturing over the n locations of the economy. In the short-run equilibrium, utility maximization of the consumers leads to a distribution of products from each location to consumers in all other locations. With a fixed nominal wage, however, the real wage for manufacturing workers increases when they migrate to locations which produce more varieties of manufacturing products.

The circular causation in spatial agglomeration of consumer-goods and producers and workers can be explained as follows (Figure 2.6). Home-market effect encourages firms to locate near a large market which results to the availability of variety of goods in a city. The circular causation of the agglomeration of firms and workers in the city is created through forward linkages which means that if there more variety of goods, the worker’s real income

can increase; and backward linkages which denotes that presence of big consumer base draws more firms.

NEG also examines the relationship between decreasing transport cost on the spatial distribution of economic activities. The transport cost and dispersion tendency exhibits a reverse U curve. Given the extreme high transport cost, inter-regional/international trade is impossible and non-land based activities such as manufacturing and services have no choice but to disperse in proportion to local demands arising from land-based activities and immobile people (due to national borders). As the transport cost decreases, more differentiated goods with low transport costs concentrate into an even smaller number of cities or industrial agglomerations. The hierarchical spatial structure emerges in which larger agglomerations provide more variety of goods and services. However, further reduction in transport in cost and high land prices and wages, would lead to dispersion into other regions. Many industries moves from the core region to peripheral regions, which is similar to what happened in the “flying geese process<sup>3</sup>” of economic growth in East Asia. In sum, only with a sufficient reduction in transport costs do agglomeration economies start dominating the dispersion forces of transport costs, leading to the formation of economic concentrations. However, with too much concentration of economic activates in core regions, wage rates there increase together with higher land costs, which tend to push some of activities having high labor (or land) intensity to peripheral regions.

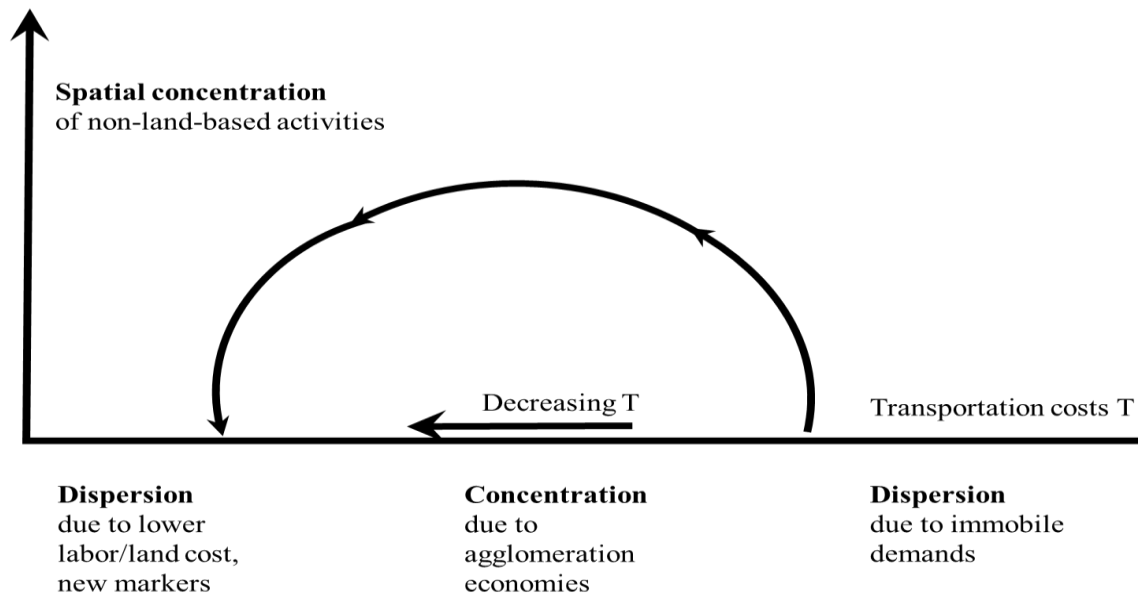
**Figure 2.6 Circular Causation of Agglomeration of Consumer-goods producers and workers**



Source: Fujita (2007)

<sup>3</sup> The flying geese model is a theory of industrial development in latecomer economies developed by Akamatsu Kaname (1961).

**Figure 2.7 Transport and Spatial Concentration of Economic Activities**



Source: Fujita (2007)

As mentioned earlier, one of the key elements of NEG is heterogeneity of goods which is mainly based on Dixit-Stiglitz monopolistic competition model. This section will further discuss this particular element as it is deemed important in understanding the fragmentation of production processes. In order to determine the optimal spending allocation, the relation between preferences for the aggregate consumption of manufactures and consumption of a particular variety needs to be examined.

Klaesson (2001) condensed the discussion of the Dixit-Stiglitz monopolistic competition model and adopted main ideas of the model in his paper.

The basic assumptions of the Dixit-Stiglitz monopolistic competition model are as follows:

1. There are different firms selling one product only.
2. These products are differentiated so firms have their own demand function
3. The entry of new firms does not affect the demand function of the current firms as it can be assumed that new firms can only attract very few customers.
4. The firm can enter the market until the profits in the industry are zero.

In the Dixit-Stiglitz model, the interaction between monopolistically competitive industry and consumers' preference for variety results to increasing returns. Klaesson (2001) adopted this idea in his own model that explains wherein there is an increasing returns generated from the linkages between two industries: monopolistically competitive industry that produces intermediate goods and perfectly competitive industry that produces a final output. This model can serve as useful guide on understanding the interaction between intermediate goods

industry and final output industry. The final output production function is given below.

$$Q = \left( \sum_{i=1}^n q_i^{1-1/\sigma} \right)^{\sigma/(\sigma-1)}, \quad \sigma > 1 \quad (2-1)$$

Where  $q_i$  is the input produced by the firm  $i$ ;  $\sigma$  is the elasticity of substitution between any two intermediate outputs and has to be larger than one. The higher the value of  $\sigma$ , the intermediate inputs are close substitutes and variety is not significant; if the value of  $\sigma$  is close to one, the intermediate goods are complementary and preference of variety is high. The equation above can be further simplified as below and this can provide easier understanding of the different values of  $\sigma$ . The large value of  $\sigma$  will denote that the power expression will be close to one, while if the value of  $\sigma$  is close to one, the power expression will be large. This will impact on the number of inputs.

$$Q = n^{\sigma/(\sigma-1)} q \quad (2-2)$$

This equation could show the increasing function of  $n^l$ , given that  $K = nq$  be total inputs used.  $Q/K$  is the average productivity of inputs. It can be observed that there are increasing returns to diversity of inputs regardless of the fact that the total number of inputs used by the final output industry is unchanged. Either (1982) and Weitzman (1994) argued that this increasing returns to diversity of inputs could be attributed to specialization or division of labor.

$$\frac{Q}{K} = n^{1/(\sigma-1)} \quad (2-3)$$

The next step is to solve for the optimal number of firms given the fixed cost constraint. Assuming that to produce  $q$  units of each variety requires  $aq + F$  units of labor;  $a$  is marginal labor-input required and  $F$  is a fixed amount of labor inputs. It can also be assumed that the marginal and fixed labor input coefficients are equal for all firms  $i$ . The labor resource constraint is given in the equation below.

$$L = n(aq + F) \quad (2-4)$$

The combination of labor constraint equation and production function above can solve the optimal number of inputs. The optimum variety is determined by the interaction among available labor force ( $L$ ), preference for variety ( $\sigma$ ), and fixed labor requirements ( $F$ ).  $L$  can be assumed to be size of the economy and the more intermediate inputs, the larger the size of the economy. The higher the value of  $\sigma$  signifies more diversity. However, the number of firms that can exist and enter is limited by fixed-labor requirement.



$$n = \frac{L}{\sigma F} \quad (2-5)$$

After the number of optimal diversity of inputs has been estimated, the total production of the final output can now be established using the equation below. The total output will decrease if the value of  $a$  (*higher marginal labor-input*) increases. The total output also decreases if the value of  $F$  increases. The high value of fixed-labor requirements limits the number of firms. On the other hand, the effect of  $\sigma$  (*variety*) is dependent on the relative sizes of  $\sigma$ ,  $F$ , and  $L^4$ . The total output will increase with the decrease in  $\sigma$  if  $\sigma F/L > 1$ . The total output will fall with the decrease in decrease in  $\sigma$  if  $\sigma F/L < 1$ .

$$Q = \frac{(\sigma-1)}{a} \left(\frac{L}{\sigma}\right)^{\sigma/(\sigma-1)} F^{-1(\sigma-1)} \quad (2-6)$$

This could basically mean that preference for variety will increase only if the number of inputs is larger than one. As the model assumed that the number of differentiated inputs is larger than one, the increase in taste for variety (reduction in  $\sigma$ ) effectively leads to increase number of total output.

## 2.5 Fragmentation Theory and Development of International Production Network

Central to the understanding of the mechanism of fragmentation are the fundamental concepts of division of labor, transaction cost, economies of specialization, and economies of diversity. This section discusses three selected studies that explain the interplay among aforementioned concepts.

### 2.5.1 Scott's Functional and Spatial Organization of Production

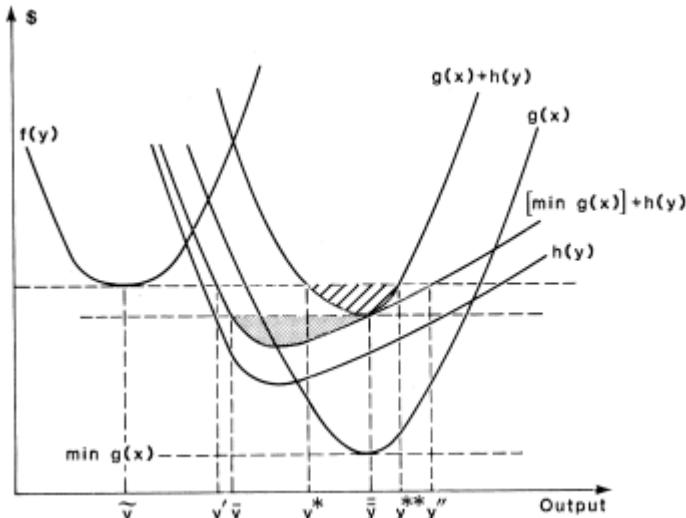
Scott (1986) examined the functional and spatial organization of production and the interplay among issues of the division of labor, the firm, and spatial processes. Scott also highlighted the importance of transaction cost (Internal and external) in determining the levels of vertical disintegration and integration.

Scott (1986) started the analysis with the examination of the division of labor within and between firms and how it relates to economies and diseconomies of scope and the costs of transactional activity. Scott (1986) gave the example of a law firm and printing services in explaining the internal diseconomies of scope. Most law firms will usually contract out their printing services as the transaction cost of keeping in-house printing function is high. On the other hand, the internal economies of scope is present in markets in molten steel where rolling mill can significantly reduce their production costs if they consume molten steel as an input rather than steel ingots. Market failure in molten steel means that rolling mills have a very strong incentive to integrate backwards into steel smelting and as a result, achieve thermal efficiency in production. Diseconomies of scope emerges when  $g(x) + h(y) \leq c(x, y)$ ,

where  $x$  and  $y$  are (as before) quantities of output,  $g(x)$  and  $h(y)$  are separable and additive, average cost functions, and  $c(x, y)$  is the joint average cost of producing  $x$  and  $y$  in an integrated firm. Meanwhile, if  $g(x) + h(y) \geq c(x, y)$ , the economies of scope arises.

Vertical disintegration occurs when internal transaction cost exceeds external transactions costs. Once the firm exceeds the limit of the functions it can effectively perform, it is more efficient to externalize specific functions. There are two special cases that needs to be highlighted when the internal transaction cost is higher than external transaction cost. First, in the case of existence of segmented labor markets, labor cost can be reduced through subcontracting the function to secondary and cheap-labor markets. Second, when the markets for final output is relatively uncertain, uncertainty can be diffused through subcontracting activity. Using the Law of Large Numbers, the extensiveness of subcontracting activities reduces the overall uncertainty and cost. Meanwhile, routinization of labor processes and standardization of outputs also increases the probability of engaging in vertical disintegration.

**Figure 2.8 Dynamics of the Technical Division of Labor**



Source: Scott (1986)

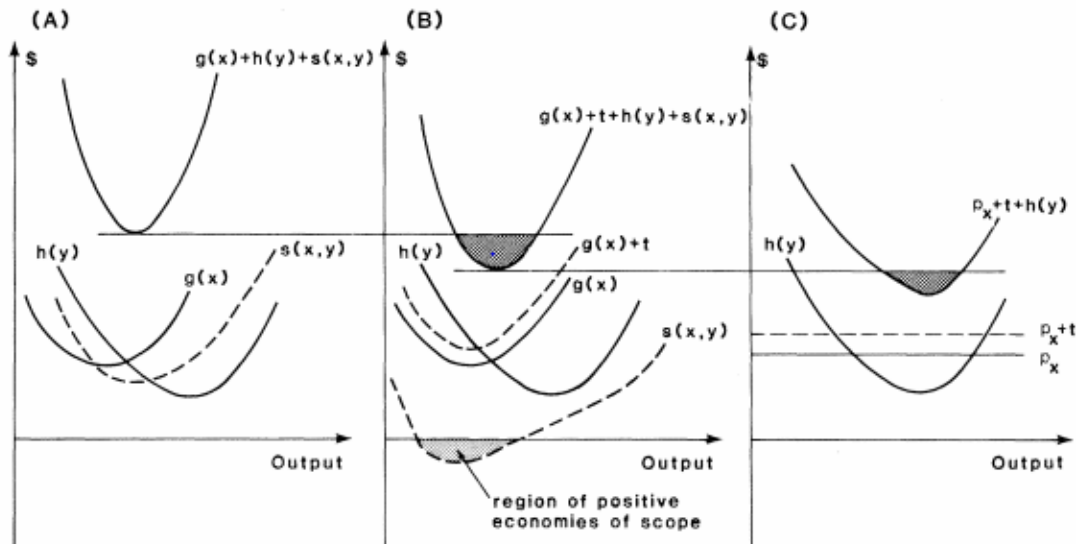
Vertical integration arises when the ratio of internal transaction cost to external transaction cost is low. Market failures in external transactions influences the occurrence of vertical integration (Williamson, 1979). These market failures are likely to occur given the following situation: critical information is not being shared equally to all parties involved; and costly future contingencies in the context of the complexity and unpredictability of the economic environment. Vertical integration is likely to occur when there are transactions involving firm-specific know-how and complex technological process. For example, semi-conductor production, R&D work, wafer diffusion and testing are vertically integrated as these

functions are highly-complex.

Scott (1986) argued that levels of functional and spatial organization of production are determined by the combination of the following factors: average production costs, internal economies and diseconomies of scope (a function of internal transactional relations), interplant and interfirm transaction cost, and market prices. Scott elucidates the analytical framework involving intra and inter-firm organization of production: vertical and spatial integration; vertical integration, spatial integration; vertical and spatial disintegration.

In the case of vertical and spatial integration (Panel A),  $x$  and  $y$  are assumed to produce in perfectly balanced proportion and every level of output. Total average cost is shown at the curve  $g(x) + h(y) + s(x,y)$ . The curve  $s(x,y)$  lies within the region of diseconomies of scope. In the case of vertical integration, spatial integration (Panel B),  $x$  and  $y$  are vertically integrated but produced at different locations or represents the integrated but multi-establishment firm. The curve  $s(x, y)$  passes through a region with positive internal economies of scope. This set-up also introduces cost  $t$ , or the cost (includes physical transports cost and communication or coordination cost) incurred in transferring  $x$  from its point of production to the location where  $y$  is manufactured. Cost  $t$  is assumed to be constant no matter what the value of  $x$  and  $y$ . The total average costs are expressed through the curve  $g(x) + t + h(y) + s(x, y)$ . In this case, vertical integration and spatial separation of function are possible and economical. In the case of vertical and spatial disintegration (Panel C), the two processes are vertically and spatially separated from each other. The producers of  $y$  would now have to buy  $x$  through the external market transactions and the input will be valued at market price,  $p_x$ . In this kind of set-up, internal economies and diseconomies of scope have no influence in total average cost. The total average cost is expressed as  $p_x + t + h(y)$ .

**Figure 2.9 Intra-and Inter-firm Organization of Production**



Source: Scott (1986)

Scott (1986) clarified that the goal of the analysis is not to demonstrate that single establishment forms of production are inferior to multi-establishment structures but to explain the interplay of factors that determine the functional and spatial relation of vertically-adjacent labor processes. This analytical framework presents a novel way of location theory including division of labor and roundaboutness of production. Scott also elaborated the relationship between vertical disintegration and agglomeration. Young (1928) asserted that a deepening (technical and social) division of labor is equivalent to an extension of the “roundaboutness of production.”

1. Roundaboutness of production, is the more intricate network of productive tasks that intervenes between raw materials on the one side and final consumer on the other.
2. This then gives rise to more finely-grained patterns of geographical variation in the space-economy as different functions gravitate to different specialized locations.
3. Some of these functions will likely to form localized industrial complexes board out of the particularly transactions-incentive relation of certain types of producers with one another.
4. These geographical outcomes will have complicated relations to organization dynamics of firms as disintegrated/integrated and single establishment/multi-establishment institutions.

In sum, it can be argued that vertical disintegration is both a cause and an effect of falling production cost in such social division of labor. The growth of the market is positively correlated with more specialization of these externalities or the Verdoon effect<sup>4</sup> where

<sup>4</sup> Named after the Dutch Economist, Petrus Johannes Verdoon. The Verdoon’s law explains relation between productivity and output growth in the long run.

productivity gains grow as aggregate industrial production increases. As the firms disintegrate vertically (and horizontally), the level of external transaction activity increases. This encourages producers, especially those with “intense and costly” linkages to locate close to the center of production. This clustering would then result to lower spatial costs of external transactions. This further stimulates vertical disintegration by reducing the search and recontact costs and gives incentive to producers whose input demands are not standardized and requires face-to-face interaction. In other words, vertical integration encourages agglomeration and vice-versa. This mechanism explains how localized industrial complexes or growth emerges and how they further expand.

Scott (1986) also enumerated two major types of industrial complexes. The first type is industrial complexes with large-scale central industries (car industry) surrounded by smaller input producers and subcontractors. The second type is complexes with small specialized producers without central dominant firms, which is similar to industrial districts in Third Italy.

Scott (1986) also discussed the process on how multi-establishment firms are being organized. At the beginning, multi-establishment firms were functionally integrated but spatially disperse. Meanwhile, multinational enterprises are multi-establishment with its internal parts that can be located to geographically-specialized operating units. There are various factors that critical on the development of multi-establishment/multinational firm: steady enhancement of managerial capacities, the increased efficiency and growth of production unit, and a deepening division of labor between the task of conception and execution in manufacturing. The emergence of multi-establishment/multinational firms have induced significant changes in spatial and international division of labor. In particular, the patterns of spatial location is related to the different functions, in particular: management and control function, skilling manufacturing tasks requiring qualified works, and deskilled process and assembly work. Management and control function tends to locate in business complexes in large cities where they can easily do business transactions. Meanwhile, skilled manufacturing tasks requiring qualified workers typically locates to particular kinds of growth centers where they can access specialize material and labor inputs. Lastly, deskilled process and assembly work tend to gravitate towards peripheries where labor is abundant and cheap. These specific functions located in multiple locations increases the operating flexibility of the modern corporation.

Scott (1986) also discussed the limits of vertical disintegration. Branch plants commonly function within a national and or global assembly line, and this imposes on them the need to highly-synchronized, firm-wide production schedules. Vertical integration is hampered wherever these plants embody specific human and physical capital.

### **2.5.2 Pontes and Parr's Classification of Locational Pattern of the Firms**

Pontes and Parr (2005) created a classification of the locational patterns of the firms incorporating three forces: spatial economies of scope; transportation costs on the final good;

and factor mobility. The literatures on the location of the multinational firm often include the following characteristics:

1. Firm can be a single-plant firm, located in one nation and exporting to other nations.
  - This produces each good at the same location within a single region and benefits from spatial economies of scope.
2. A vertical multi-plant firm is with segmented production processes, each segment being undertaken by a plant located in a different nation.
  - This produces each good in different region in order to economize on the assembly cost of each region-specific raw material.
3. A horizontal multi-plant firm supplies the market in each nation from a decentralized plant located within that nation.
  - This produces all goods in each region in order to save on the distribution cost to each regional market.

Differences in factors endowments as well as differences in factor requirements of various segment of the firms are said to have encourages the development of vertical multinationals. On the other hand, when economies of scale at the plant level are low in relation to economies of scale at the firm level and in relation to transportation on the final goods, horizontal multinationals emerges. (Helpmann, et.al, 2004; Markusen and Venables, 1998).

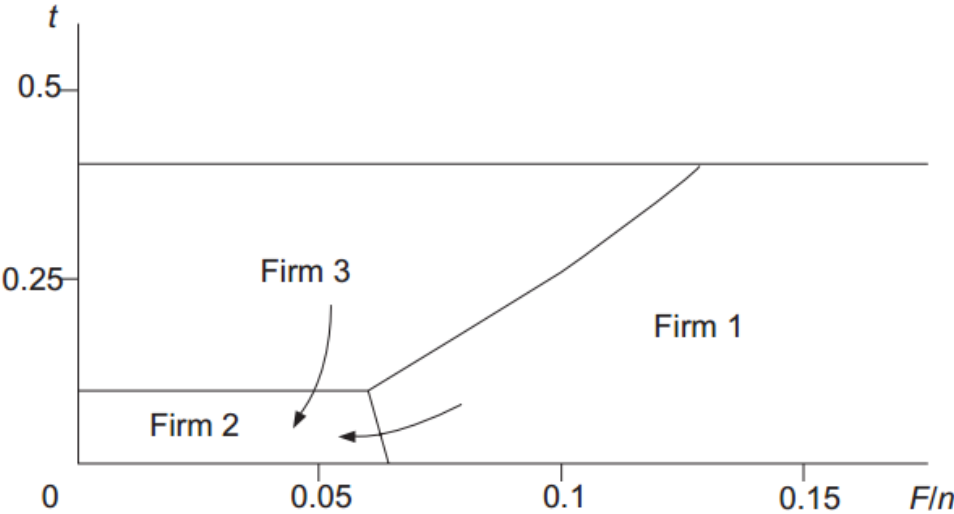
Pontes and Parr (2005) pointed that the lack of unity within theory due to the different significance of the concept of economies of scale from horizontal multinational firms and vertical multi-plant firms. However, this can be complemented by the concept of economies of scope wherein the efficiency can be derived from the different activities undertaken by the same firm (Panzar and Willig, 1981; Goldstein and Gronberg; 1984).

The main focus of this study is on economies of scope wherein the firm produces one or more intermediate inputs for the final good, and disregards those where the firm produces two or more final products. In this model, there are two nations: U (Unskilled workers) and S (Skilled workers). The distance between nations is 1 and within nations is 0. Firm produces a consumer good by two related activities: R&D  $R$ , production and sale of good  $M$ . Each unit of the consumer good requires one unit of  $R$  and one unit of  $M$ . Firm is monopolist in the consumer-good market, and charges mill price  $p$ . The firm is also a price taker in the factor market, with  $w_u$  and  $w_s$  as the respective unit cost unskilled and skilled labor. The transportation cost, is denoted by  $t$ . Labor from one national can be hired in another nation, if the employer pays a mobility cost  $m$  per unit of labor hired. The demand function is linear, so that  $q = a - bp$ , where  $q$  is the quantity demanded. There are  $n$  consumers in each nation. The cost function of the complementary activities has a fixed part  $F$ , which represents a capital good and a variable part. The variable cost of activity  $R$  is the cost using  $\alpha$  unit of skilled labor per unit of output of the consumer good. The variable cost of  $M$  is the cost of using  $\alpha$  unit of unskilled labor per unit of output of the consumer good. Spatial economies of scope are present if activities  $R$  and  $M$  are undertaken at the same location, so that the fixed cost  $F$  is shared. Spatial economies of scope are represented by the ratio  $F/n$ .

Using the three firm types identified by Parr (2004), the study calculated the optimal locational strategy and plotted them in parameter space. The three firm types are as follows:

1. The single-plant firm (Firm 1): the firm locates activity  $R$  and activity  $M$  at the same location within a single-nation.
2. The vertical multi-plant firm (Firm 2): the firm locates activity  $R$  in nation  $S$  and activity  $M$  in nation  $U$ , thus revealing a complete separation of activities between the two nations.
3. The horizontal multi-plant (Firm 3): the firm locates activity  $R$  in nation  $S$ , and activity  $M$  in both nations  $S$  and  $U$ .

**Figure 2.10 Locational Firm Types**



Source: Pontes and Parr (2005)

As the plot shows, if the values of  $F/n$  is high, the locational pattern that would develop is the same with Firm 1. However, if the values of  $F/n$  are low, the locational strategy that would develop is the same with multi-plant firms (Firm 2 and Firm 3). If the transportation cost is low, the locational strategy that would be likely to be pursued is vertical multinational (Firm 2). On the other hand, when the transportation cost is high, the locational pattern that would emerge is horizontal multinational (Firm 3).

Pontes and Parr (2005) also explain the probable evolutionary trends within the product market. Improvement in transportation over time reduces the value of transportation cost; while standardization of technology and increase in the number of consumers decrease the ratio of economies of scope. Given this trend, the firm is likely to start as a single-plant exporting firm (Firm 1) or the horizontal multinational firm (Firm 3) and then transform as a vertical multinational firm (Firm 2). Various empirical studies done on the relationship

between foreign direct investment and trade have agreed on the fact that Firm 2 is a common end point in the evolution.

### **2.5.3 Shi and Yang's Theory of Industrialization: Interaction among Division of Labor, Specialization, and Transaction Cost**

Shi and Yang (1995) proposed an equilibrium model which captures the interaction among division of labor, economies of specialization, and transaction costs. The constructed model is useful in analyzing various phenomena related to industrialization as well as agglomeration and fragmentation such as productivity, specialization, the number of goods, the length of the production, the diversity of economic structure and degree of economic integration.

The proposed equilibrium model includes the following specifications: an economy with  $M$  ex ante identical consumer-products and there is hierarchical structure of consumers and producer goods and factors with at least and at most four layers of the hierarchy. The first-layer consists of a consumer good (food) and utility function. The second layer consists of at least one and at most two producer goods: tractor( $x$ ) and hoe( $y$ ), and labor used for producing food at the first layer. To produce tractors, producer, producer good, machine tool ( $w$ ), at the third layer and labor are needed as inputs. In order to produce hoes, only labor is needed. The third layer consists of, at most, machine tools ( $w$ ) which are used to produce tractors( $x$ ), and labor spent producing tractors and hoes. The fourth layer consists only for labor used for producing machine tools.

The model also assumed that, all individuals can enter into any sector and there is a large economy (market), “every individual also has fixed amount of labor and has a system of “individual-specific Cobb-Douglas-CES production function for producing the producer and consumer goods.” The relationship between labor and producer goods is specified by a Cobb-Douglas function, while relationship between hoes and tractors is specified by a CES function. It is also assumed that an individual sells at most one good, does not buy and sell or self-provide the same good and does not provide intermediate goods if he does not produce the final good. Or in other words, for any trade good, demand for the good is matched by supply of the good.

Given the aforementioned model specifications, the following possible market structure can be conceived (Figure 2.11):

1. Autarkical Structure A & B, with zero quantities of all traded good.
2. Structure C- which an individual sells hoes and buys food ( $y/z$ ), sells food and buys hoes ( $z/y$ ). This structure has complete specialization in hoes and food.
3. Structure D- which an individual sells tractors, self-provides machine tools, and buys food( $x/z$ ); and sells food, self-provides food and hoes, and buys tractors ( $z/x$ ). This structure has no complete specialization in producing any good.
4. Structure E- sells tractors, self-provides machine tools, and buys food ( $x/z$ ); sells hoes and

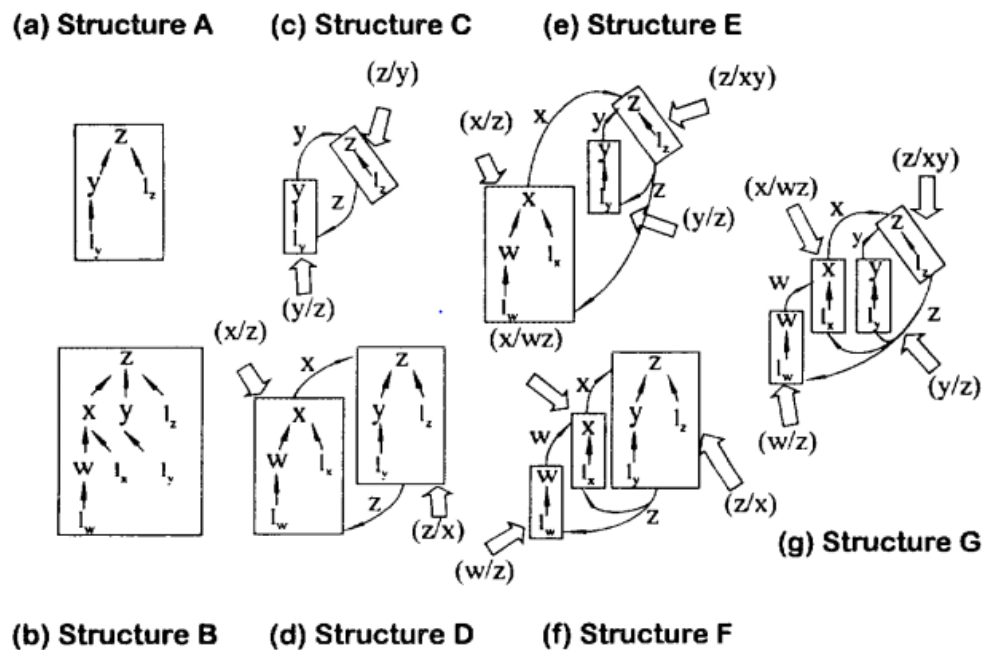


buys food ( $y/z$ ), sells food, and buys tractors and hoes ( $z/xy$ ). This structure has complete specialization in the production of food and hoes and incomplete specialization in machine tools and tractors.

5. Structure F- self-provides food and hoes and buys tractors ( $z/x$ ), sells machine tools and buys food ( $w/z$ ), sells tractors and buys machine tools and foods ( $x/zw$ ). This structure has complete specialization of tractors and machine tools and incomplete specialization in the food and hoes.

6. Structure G- sells food and buy tractors and hoes ( $z/xy$ ), sells hoes and buys food ( $y/z$ ), sells tractors and buys machine tools and foods ( $x/zw$ ), sells tractors and buys machine tools and foods ( $x/zw$ ). This structure has complete specialization in all goods.

**Figure 2.11 Patterns of Market Structure**



Source: Shi and Yang (1995)

The result of the simulation purports that given the large elasticity of substitution, the number of producer goods at each layer and number of layers of the hierarchy of goods increases as transaction efficiency is improved as well as trade dependence, per capita income and level of specialization.

The idea of different market configurations can be applied to firm-level as shown in the study by Ishikawa (2014). In general, these configurations can be summarized into three types of production system: single-plant firms which produces few goods or intermediate goods and using one unit of labor to manufacture final goods without any trade with outside firms;

single-plant with economies of scope which has two production processes undertaken within the same factory; multi-plant firm, which has two production processes undertaken in the 2 different factories (abroad or home).

The simulations done by Shi and Yang (1995) have successfully captured the interaction among division of labor, elasticity of substitution, transaction costs, economies of specialization and diversity. Based on the calculations, if the transaction cost is too high, the resulting market structure is autarky. Applying this notion to the firm-level, the firm will recourse to producing the goods within the firm without any trade. On the other hand, lower transaction cost enables the division of labor and generates new layers of hierarchy and new goods at each layer of hierarchy. At the firm level, firms can separate production processes and outsource to other firms instead of undertaking all production processes in-house. This structure is similar to vertical or horizontal multi-plant firms. It must be noted that this kind of configuration, particularly emerges when there is high specialization and elasticity of substitution. In this case, we can think of a firm that is involve mainly in producing final goods and sourcing inputs from other firms that are specialized in particular parts and components.

Ishikawa (2014) adopted this approach to compare the three types of firms mentioned above and explain the interaction among economies of specialization, diversity, and availability of labor. Given the fixed level of diversity and varying values of economies of specialization, the analysis shows that type 3 firm or multi-plant firms would yield highest profit and total output in low level of specialization to high-level of specialization ( $a=0.6-1.4$ ). However, at the very-high level of specialization, the type 1 firm or single-plant firms has the highest profit but the type 2 firm or single-plant firm which undertakes two production processes will have the highest total output. Given the fixed level of specialization and different values of diversity, the results show that type 3 firm will have highest profit and total number of output in both low and high level of diversity.

Ishikawa (2014) also analyzed the effect of specialization and diversity on labor distribution and employment from other region. If the economies of specialization are not high, the employment from other regions tends to be higher. It can also be observed that as the economies of specialization become higher, the total labor decreases as well as the employment from other region. Furthermore, the amount of labor under the diversified production process is also low. If the economies of diversity is high, the total amount of labor and employment from other region is low. Moreover, the total number of employment under diversified production processes increases. Thus, it can be inferred that an increased in specialization will likely result in agglomeration of labor, while increased in diversity will lead to dispersion of labor.

Shi and Yang (1995) also outlined the probable evolution of market structure in relation to the elasticity of substitution and degree of specialization. If the elasticity and specialization are low, the market structure will likely evolve from structure B-D-F-G where each individual self-produce food using only hoes as input at the beginning. As transaction efficiency

increases to intermediate level, the structure evolves to D where there is no complete specialization in producing goods and low-substitution between tractors and hoes. As the transaction efficiency further increases, the structure transforms to G where new producer goods and new production layers emerge. Improvement of transaction efficiency gives rise to increased specialization and more diverse professions. Under this structure, there are farmers who produce only food or workers who produce only food, as well as workers who produce only hoes or tractors.

If the elasticity of substitution and degree of specialization is high, the possible evolution is A-C(F)- G where at the early stage, the individual produces few goods on his own without any trade with other individual. As the transaction efficiency rises, the market structure evolves to C(F) where there is complete specialization in hoes and food(C) or tractors and machine tools(F). The market structure will eventually transform to structure G where there are more specialized producer goods and many layers of industrial hierarchy. It should be noted that high transaction efficiency, whether or not elasticity of substitution and specialization is high or low, will ultimately evolve to structure G where there are producer goods and more number of professions that are distinct from each other. Furthermore, the simulations have shown that per capita real income, capital-labor ratio, trade dependence emerge with the improvement in transaction efficiency.

Shi-Yang's evolution of market structure is congruent with the previously discussed studies (Scott, 1986; Pontes and Parr, 2005). The two studies focuses on the firm-level but Shi-Yang's study analysis concentrated on the general market structure; nevertheless, the concepts applied are intuitively very similar. The initial system production is often characterized by various production processes are all done in-house. With the technological development and improvement in transportation system, the firms have started to divide production process and allocate them to specific firms and location. Low transaction cost enables to the firm to cut production processes and produce more quantity and higher profits. In the firm-level configuration, this refers to Type 3 where production processes are fragmented, thus enabling it to achieve higher output and profit.

### **3. Formation of Locational Prospective Area and its Significance**

This chapter describes the analytical model developed based on the dispersion of economic activities and its location.

#### **3.1 Framework of the study**

Greenhut (1974) argued that location factors can be classified as general or specific. General factors refer to state or regional forces. Meanwhile, specific factors refer to a particular city or district within a city. These factors have various aspects- governing and general, secondary and general or secondary and specific. To illustrate the differences among these categories, an example of a firm looking for location with seaport facilities as basic consideration and New York, Norfolk, Mobile, and New Orleans as possible locations. New York is will not be chosen if a particular type of labor in the South is needed. Meanwhile, New Orleans has availability of capital and favorable tax rates and was selected. In this case, transportation can be considered as governing factor and limits the possible location; labor as secondary and general factor; availability of capital and taxes are both secondary and specific.

Greenhut (1974) also introduced the concept of maximum satisfactions in the objective of site-selection. Based on their survey of the location of firms, the importance of personal factor or psychic income has surfaced, thus it was suggested that psychic income must be assigned a pecuniary value and develop a general theory of firm location based on maximum satisfactions. It was pointed out that most analysis on plant location have focused heavily on “transport and processing cost.” The locating factors can be categorized into three groups: demand, cost, and purely personal considerations. Both demand and cost factors are considered influential in all site-selections, while personal considerations partially determine the demand for a good or its cost of production. In particular, personal considerations often influence the site-selection of small firms.

This study adopts Greenhut’s idea of site-selection which incorporates the concept of maximum satisfactions. There have been a number of studies regarding site selection, this study aims to augment the discussion by including the agglomeration pattern in industrial park in the analysis. This study conducts both theoretical and empirical analysis to determine the optimal location in fragmented system of production. The theoretical analysis incorporates the transfer price and the corporate taxation rate in the location decision of the firms with a fragmented production system. The theoretical analysis also examines the influence of industrial parks in co-location and agglomeration of the firms. These aforementioned factors could be considered mainly as demand or cost factors as outlined by Greenhut (1974). This study constructed a model of a firm with two production processes located in two different locations: intermediate goods producers and final goods-producers. This study employs gradient dynamics to determine the optimal location of production processes. This analysis is purely numerical but nevertheless could give useful results in the determination of optimal location in a fragmented production system which is often a cross-border transaction and subject to transfer price and different corporation tax rate.

The theoretical analysis aims to give light the following questions:

1. How does corporate tax rate affect the profit function of the firm?
2. How do firms determine optimal transfer price?
3. How do industrial parks influence the location decision of the firm?
4. How does one determine the optimal location in a fragmented system of production?

The empirical analysis focuses on the socio-economic profile of the Philippines. The discussion will take off by examining the general characteristic of the international production networks in East Asia. The analysis also provides background information about the Philippines and relevant industrial and regional development strategies pursued during post-war to the recent years. This study uses socio-economic statistics published by the government statistical offices to construct the socio-economic index which is used to compare the socio-economic characteristics of the provinces in the Philippines. The study also explores the urban system structure of the Philippines and analyzes its relation to the socio-economic performance of each province. These socio-economic characteristics and urban system structure can be considered as demand, cost, and to some extent personal considerations.

The empirical analysis aims to answer the following questions:

1. What are the characteristics of IPNS in East Asia?
2. What are the industrial and regional development policies pursued in the Philippines?
3. What is the current socio-economic profile of the provinces in the Philippines?
4. Is there a relation between urban system structure and socio-economic performance of the provinces?

### **3.2. Theoretical Analysis: The model**

The basis of the theoretical analysis is based on Ishikawa (2015) analytical framework explaining the role of transfer price in the determination of optimal location in fragmented production system. This analysis involves a firm which has two affiliate factories producing two goods: intermediate goods and final products. Factory 1 manufactures intermediate goods in its home country. Factory 2 uses the intermediate goods to manufacture final output and sells them in a foreign country. As the intermediate goods must move not only across the borders but also within the firm's affiliate factories, this would entail a transfer price. Eden (1985) defined transfer price as the price that applies to intra-firm trade tangible goods between multinational enterprises. Bond (1980) noted that transfer price is important in the efficient allocation of resources and income, particularly when decision making is decentralized and corporate tax rates differ among countries. In this analytical model, transfer price determine the profitability of Factory 1, which main revenue is based from selling intermediate goods to factory 2. On the other hand, transfer price influences the cash flow of factory, which is based from the purchase of intermediate goods from Factory 1. Setting the transfer price is either market-based or negotiated-based. From the point of view of the

firm, transfer price is important in estimating factories production level and profit. On the other hand, from the point of view of government, transfer price necessitate the regulation of the corporate taxation system and evaluation of the incentives.

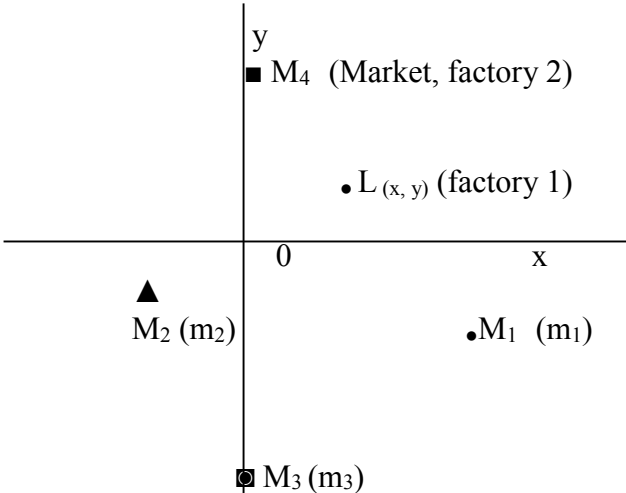
This model incorporates transfer price in the analysis of the location of the factories and aims to analyze the interaction among transfer price, corporate tax rate, transportation cost, agglomeration economies, and industrial parks. The analysis will proceed as follows: Derivation of the profit function of a firm; Determination of optimal location of Factory 1(intermediate goods) under different levels of tax rate; Determination of type of agglomeration or dispersion pattern.

**3.3 Derivation of the profit function of a firm**

**3.3.1 Profit Function of Factory 1**

A transnational firm manufactures final goods through two production processes, Factory 1(intermediate goods) and Factory 2(final goods). Factory 1 manufactures intermediate goods,  $m_4$ , in home country. Factory 2 uses one unit of the intermediate goods to produce one unit of the final goods in a foreign country. The transfer price arising from the purchase of intermediate goods from Factory 1 by Factory 2 is given by  $mp_4$ . Factory 2 sells the finished goods by the price  $p$  to the market which is at the same city in the foreign country. The tax rates of home and foreign country are represented by  $t$  and  $t^*$ , respectively.

**Figure 3.1 Location figure of the factory 1**



Source: Ishikawa (2015)

The profit function of factory 1 is given in the equation below (3-1)

$$Y_1 = (1-t)[mp_4 * m_q - C(m_q) - F_1] \quad (3-1)$$

where  $m_q$  is quantity of the finished goods,  $C(m_q)$  is the cost function and  $F_1$  is fixed costs. The cost function  $C(m_q)$  of the Factory 1 is derived from the basis of the following assumptions: Factory 1 uses two different kinds of materials  $m_1, m_2$  to produce the intermediate goods  $m_q$ . In addition to this, factory 1 also uses lubricating oil  $m_3$  to operate machines. Figure 1 shows the hypothetical location coordinates of where the materials,  $m_1, m_2, m_3$  are produced,  $(x_1, y_1), (x_2, y_2), (x_3, y_3)$ . These materials are then shipped to the factory 1, located at point,  $(x, y)$ . The freight rates of these input materials  $m_1, m_2$  are denoted by  $t_m$ , and the price of oil  $m_3$  is given by  $t_e$ . Mill prices of these materials are given by  $p_1, p_2$ , respectively. The intermediate goods are transported from the Factory 1 to Factory 2 which is located at the market at point  $M_4 (x_4, y_4)$ . The freight rate of intermediate goods  $m_q$  is denoted by  $t_g$ . Figure 3.1 illustrates the hypothetical geographical location of Factory 1, Factory 2, and sources of input materials. The production function of the Factory 1 is represented by equation (3- 2):

$$m_q = A m_1^\alpha m_2^\beta \quad (3-2)$$

where  $A, \alpha$  and  $\beta$  are parameters which values are defined as  $A > 0, 0 < (\alpha + \beta) < 1$ .

The distances between the material places,  $M_i (i=1, 2, 3)$  and the Factory 1,  $L(x, y)$  are represented by  $d_1, d_2, d_3$ , respectively:

$$d_1 = ((x - x_1)^2 + (y - y_1)^2)^{0.5}, \quad (3-3)$$

$$d_2 = ((x - x_2)^2 + (y - y_2)^2)^{0.5}, \quad (3-4)$$

$$d_3 = (x^2 + (y - y_3)^2)^{0.5}. \quad (3-5)$$

The distance between the Factory 1 and the Factory 2 located at the market  $M_4$  is given by  $d_4$ :

$$d_4 = (x^2 + (y - y_4)^2)^{0.5}. \quad (3-6)$$

The profits of the Factory 1,  $Y_1$ , is given by equation (3-7),

$$Y_1 = (1-t)[m_q((mp_4 - t_g d_4) - (p_3 + t_e d_3)) - (p_1 + t_m d_1) m_1 - (p_2 + t_m d_2) m_2 - F_1] \quad (3-7)$$

The model the applies the law of equi-marginal productivity in which the ratio between the productivities of the two intermediate goods should be equal to the ratio between the delivered prices of them, the quantities of the input materials are derived in equations (3-8) and (3-9). For simplicity,  $\alpha$  and  $\beta$  are assumed  $\alpha=\beta=0.4$ .

$$m_1 = A^{-1.25} m_q^{1.25} (p_2+t_m d_2) / (p_1+t_m d_1))^{0.5}, \quad (3-8)$$

$$m_2 = A^{-1.25} m_q^{1.25} (p_1+t_m d_1) / (p_2+t_m d_2))^{0.5}. \quad (3-9)$$

Since quantity of oil  $m_3$  is assumed to be a linear function of amount of the final goods, it is simply given by (3-10),

$$m_3 = m_q. \quad (3-10)$$

From the above equations, the cost  $C(m_q)$  of the factory 1 is obtained as equation (3-11),

$$C(m_q)=2A^{-1.25}m_q^{1.25} (p_1+ t_m d_1)^{0.5}(p_2+t_m d_2)^{0.5} +x ((p_3+ t_e d_3)+ F_1 \quad (3-11)$$

Thus, the profit function of the factory 1 is rewritten as equation (3-12):

$$Y_1=(1-t)[ m_q ((mp_4-t_g d_4)- (p_3+ t_e d_3) ) -2m_q^{1.25} A^{-1.25}(p_1+t_m d_1)^{0.5}(p_2+t_m d_2)^{0.5} - F_1] \quad (3-12)$$

In this model, factory 1 determines the transfer price and its location in order to maximize the firm's total profits by using the equation (3-12).

### 3.3.2 Profit Function of Factory 2

The profit function of factory 2 is estimated using the following assumptions: Factory 2 uses one unit of intermediate goods to produce one final goods, thus, the quantity of the final goods  $Q$  is equal to the intermediate goods  $m_q$ , (that is,  $Q=m_q$ ). The market price of the finished goods is shown by  $p$  which is determined by the market demand function given by equation (3-13).

$$Y_2 = (1 - t^*)[(p - mp_4)Q - C(Q)-F_2] \quad (3-13)$$

$$p=600 - Q \quad (3-14)$$

where  $F_2$  is the fixed cost, and  $C(Q)$  is the costs of assembling the intermediate goods to become finished goods,  $C(Q)$  is given by equation (3-15).

$$C(Q) = 1.5Q(2+Q)^2/B \quad (3-15)$$

Factory 2 determines the quantity supplied at the market to maximize its profits, the quantity supplied to the market is derived by using equation (3-13), (3-14), and (3-15), it is shown by equation (3-16) where parameter  $B$  is assumed 200 for simplicity,



$$Q=0.22(-206 + (582409 - 900mp_4)^{0.5}) \quad (3-16)$$

Since the supply quantity  $Q$  is a function of the transfer price  $mp_4$ , the total profits of the firm can be rewritten as a function of the transfer price as equation (3-17),

$$\begin{aligned} Y = & (1-t)[(0.22(-206 + (582409 - 900mp_4)^{0.5}))(mp_4 - t_g d_4) - (p_3 + t_e d_3)] - \\ & -2(0.22(-206 + (582409 - 900mp_4)^{0.5}))^{1.25} A^{-1.25} (p_1 + t_m d_1)^{0.5} (p_2 + t_m d_2)^{0.5} - F_1] \\ & + (1-t^*) [(600 - (0.22(-206 + (582409 - 900mp_4)^{0.5})) - mp_4)(0.22(-206 + \\ & (582409 - 900mp_4)^{0.5})) - F_2] \end{aligned} \quad (3-17)$$

### 3.4 Derivation of optimal location of factory 1(intermediate goods)

#### 3.4.1 Location of Factory: Same Tax Rate

As mentioned in the previous section, factory 1 can determine the transfer price and move to other location to maximize the overall profits of the firm. Gradient dynamics is used to determine the optimal location of the factory 1 and the optimal values of the transfer price. The initial value set is given to  $x_n$ ,  $y_n$ , and  $p_{4n}$  in the following equations (3-18, 19, and 20) as a temporal solution. The values of  $x_{n+1}$ ,  $y_{n+1}$ , and  $p_{4n+1}$  by calculations indicated by the three equations (13a,b,and c) is then calculated and repeated until a given tentative solution can be approximately accepted as the solution. If the values of  $(x_{n+1}, y_{n+1}, mp_{4n+1})$  in equations (3-18, 19, and 20) become approximately the same as those of  $(x_n, y_n, mp_{4n})$ , the values can be recognized as the solution. The tax rate is assumed to be the same in both home and foreign country,  $t=t^*=0.82$ .

$$x_{n+1} = x_n + j^* \partial Y / \partial x, \quad (3-18)$$

$$y_{n+1} = y_n + j^* \partial Y / \partial y, \quad (3-19)$$

$$mp_{4n+1} = mp_{4n} + j^* \partial Y / \partial mp_4, \quad (3-20)$$

where  $j$  is the width of a step and  $n$  shows the number of the calculation. And  $\partial Y / \partial x$ ,  $\partial Y / \partial y$ , and  $\partial Y / \partial mp_4$  are given by equations (3-21, 22, and 23). Parameters value are assumed as follows:  $(x_1=3, y_1=-0.5)$ ,  $(x_2=-3^{0.5}, y_2=-0.5)$ ,  $(x_3=0, y_3=-1.5)$ ,  $(x_4=0, y_4=1)$ ,  $A=1$ ,  $p_1=0.25$ ,  $p_2=2$ ,  $p_3=0.2$ ,  $t_m=0.11$ ,  $t_e=0.01$ ,  $t_g=0.225$ ,  $F_1=5000$ ,  $F_2=2500$ .

$$\begin{aligned} \partial Y / \partial x = & 0.18[-A^{-1.25} Q^{1.25} t_m [ \{ (p_2 + t_m d_2)^{0.5} / (p_1 + t_m d_1)^{0.5} \} (x - x_1) / d_1 + \\ & + \{ (p_1 + t_m d_1)^{0.5} / (p_2 + t_m d_2)^{0.5} \} (x + x_2) / d_2 - t_g x / d_4 + \\ & + Q (-t_g(x/d_4) - t_e(x/d_3))] = 0 \end{aligned} \quad (3-21)$$

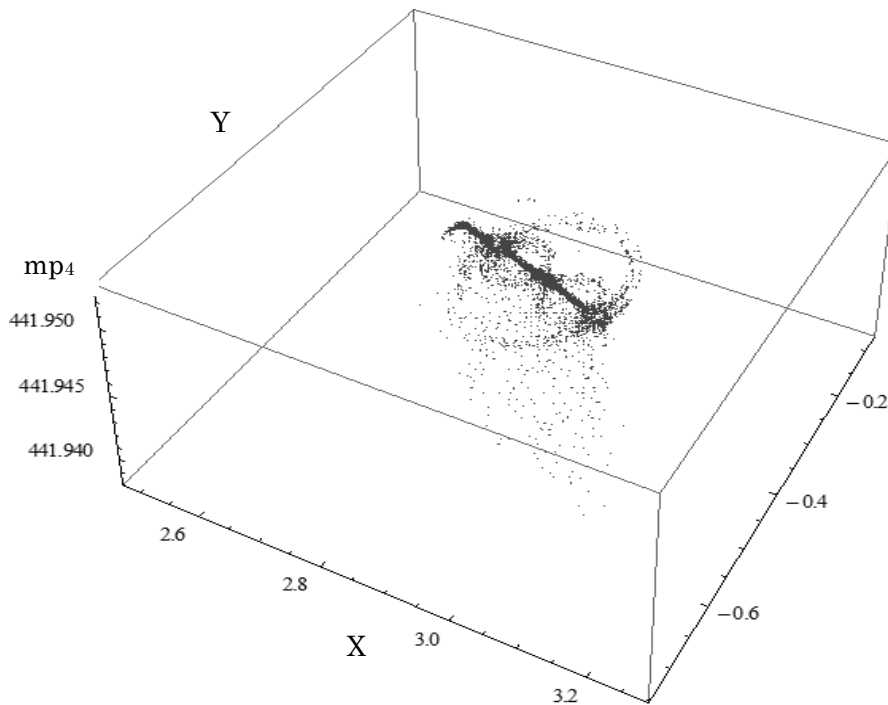
$$\begin{aligned} \partial Y / \partial y = & 0.18 [-A^{-1.25} Q^{1.25} t_m [ \{ (p_2 + t_m d_2)^{0.5} / (p_1 + t_m d_1)^{0.5} \} (y + y_1) / d_1 + \\ & + \{ (p_1 + t_m d_1)^{0.5} / (p_2 + t_m d_2)^{0.5} \} (y + y_2) / d_2 - t_g (y-1) / d_4 + \end{aligned}$$

$$+Q (-t_g ((y -y_4)/d_4)-t_e ((y-y_3)/ d_3))]=0 \quad (3-22)$$

$$\begin{aligned} \partial Y/\partial mp_4 = & 0.18 [(Q - 99mp_4/ (582409-900mp_4)^{0.5} ) +(99mp_4/(582409-900*mp_4)^{0.5})t_g(x/ d_4) + \\ & +(99mp_4/(582409-900mp_4)^{0.5})t_e(x/d_3) + \\ & +2.5*0.5A^{-1.25} ( p_2+t_md_2)^{0.5} (p_1+t_md_1)^{0.5}Q^{0.25} ) - 0.18[-Q-99(600-Q))/(582409- \\ & 900*mp_4)^{0.5}+ \\ & +(0.7425(2+Q)^2)/(582409-900*mp_4)^{0.5} \\ & + (21.78Q)/ (582409-900*mp_4)^{0.5} + \\ & +(0.3267(2+Q)*(-206+(582409-900*mp_4)^{0.5})/(582409-900*mp_4)^{0.5}+ \\ & +99mp_4/ (582409-900mp_4)^{0.5}]] = 0 \end{aligned} \quad (3-23)$$

The result of the calculation derived from the Gradient dynamics using equation (3-21, 22, and 23).

**Figure 3.2 Optimal transfer price and prospective location area**



Source: Ishikawa (2015)

Figure 3.2 shows that chaotic phenomenon<sup>5</sup> appears along the area of  $M_1$  or the source of raw material. It can be inferred that although the optimal transfer price is determined at 442, it appears difficult to establish the exact location point for the factory 1 which produces intermediate goods. On the other hand, the results present a range of prospective location which is proximate to the area of point  $M_1$ . If Factory 1 chooses to locate within that range of prospective location, the firm will be able to obtain similar level of profits. Total profits will be about 3308. The price of the finished goods, production volume, and profits of two factories are also obtained by using the above equations, and the calculated results are shown at the first column of Table 3.1.

**Table 3.1 Corporate tax rates and firm's activities**

	$t=t^*=0.82$	$t=t^*=0.82$
location point	(3,-05)	(0,1)
transfer price	442	442
product price	551	551
volume of production	49	49
profit(Y)	3308	3296
factory( $Y_1$ )	2968	2957
factory( $Y_2$ )	339	339

Source: Author's calculations

### 3. 4.2 Location of Factory: Different Tax Rate

Suppose that the tax rate of the home country is to be reduced from 0.82 to 0.70, while the tax rate of the foreign country is maintained at 0.82. Factory 1 is located in the home country with a lower corporate tax rate of 0.70, and Factory 2 is located in the market with tax rate of 0.82.

The analysis on the different tax rate scenario uses the same methods in preceding section. Based on the calculation, it can be inferred that the prospective location area is situated within the same area that was shown in Figure 3.2. The derived results are presented in the first column of Table 3.2. As expected, the transfer price decreases from 442 to 417, the total profit of firm's and profits of two factories increase. In addition, product price decreases and the production volume increases. It must be noted that the location of Factory 1 does not change since the range of prospective area remained the same.

<sup>5</sup> Figure 3.2 shows that a chaotic phenomenon or the Cauchy Convergence occurred in the derivation of optimal location and price. This phenomenon needs further analysis but this will not be discussed in this study. However, Puu (1998) explained that chaos appears when the optimal location is derived in the two-dimensional space.

**Table 3.2 Changes of a firm's activities due to the reduction in corporate tax rate**

	t=0.70 t*=0.82	t=0.70, t*=0.82
location point	(3,-05)	(0,1)
transfer price	417	417
product price	545	545
volume of production	55	55
profit(Y)	5844	3723
factory(Y <sub>1</sub> )	5268	3147
factory(Y <sub>2</sub> )	576	576

Source: Author's calculations

### 3.5 Determination of type of agglomeration pattern

Assume that when Factory 1 and Factory 2 locate at the market, economies of agglomeration and economies of scope is generated. The benefit from economies of scope is represented in the reduction of costs in the factories; specifically, the reduction of fixed cost (F<sub>1</sub>) in Factory 1. Given this kind of economies of agglomeration and economies of scope, what level of fixed cost can facilitate the co-existence of the two factories at the market place? In the first scenario, corporate tax rate is assumed to be 0.82 for each location point. If factory 1 moves to the market (0, 1), keeping the transfer price, products price, and volume of production at the same values that are derived when Factory 1 locates at (0, 1), the firm's total profits is 3296 as shown in the second column of Table 3.1. The firm's profit is reduced by 12 by shifting the factory 1 to the market. If the fixed cost (F<sub>1</sub>) will be reduced from 5000 to 4936, co-existence of intermediate goods producing factory 1 and assembly factory 2 at the market location is feasible. On the other hand, in case the fixed cost will not be reduced by 62, these two factories will have to be diffused to the two countries.<sup>6</sup>

The second scenario is where tax rate differs, corporate tax rate is assumed to be t=0.70, t\*=0.82. Assuming that agglomeration-based fixed cost reduction F<sub>1</sub> of Factory 1, if the firm's profit exceeds 5844, it is possible to put Factory 1 at the market. As reflected in the values in the second column of Table 3.2, the firm's profit is reduced to 3723, even though agglomeration-based fixed cost reduction drops to zero, the target profit of 5844 will not be achieved. Therefore, given the two country's different tax rate as t=0.70, t\*=0.82, the firm will not move their intermediate goods factory 1 to the location of the market. Thus, in this case, if the firm would not receive a huge support from the government, spatial dispersal of the firm's factories will happen<sup>7</sup>.

<sup>6</sup> For concise discussion about co-existence and dispersion of production processes, refer to Stigler (1956).

<sup>7</sup> On the other hand, if tax rates are t=0.82, t\*=0.70, even without the benefits of agglomeration economies, the intermediate goods factory can co-locate at the market. In such case, considering the fragmentation of factory 1 and factory 2, the amount of diseconomies of scale will be huge.

### 3.6 Determination of Factory Location and Agglomeration in Industrial Park

This section will extend the discussion with the inclusion of industrial parks in the analysis. Many countries have constructed industrial parks in the hopes of attracting, mainly international firms to move their operation. From the point of the view of the firm, industrial parks are attractive locations as it is usually built with necessary infrastructures such as factory buildings, roads, and communication facilities; and are likely to be located where there is abundance of both skilled and unskilled workers.

To analyze the interaction among transport cost, corporate tax rate, and agglomeration in industrial park, the same methods used in the preceding sections were used. The following scenarios were analyzed: low transport cost with high tax rate; low transport cost with low tax rate; high transport cost with high tax rate; and high transport cost with low tax rate. The assumed benefit from the agglomeration economy represented through reduction of fixed cost of factory is set at 200. It is also assumed that industrial park is located in the home country.

#### 3.6.1 Location of Factory: Low Transport Cost with High Tax Rate

The price for the transporting the intermediate good is set at low level of 0.225 and tax rate for both home and foreign country is assumed to be same at  $t=t^*=0.82$ . If Factory 1 locates near the market, the firm's profit will be 3333. On the other hand, if the factory location will be dispersed between  $M_1$  and  $M_4$ , the total profit will be 3307. However, given that the industrial park in the home country could provide 137 scale economies, it is more beneficial for the Factory 1 to locate at the industrial park of the home country.

**Table 3.3 Low transport cost with high tax rate**

$t_g=0.225$	$t=t^*=0.82$	
Economies of scope	200	
Location point	Dispersed between $M_1$ and $M_4$	Agglomerated in $M_4$
Transfer price	442	442
profit(Y)	3307	3333
Scale economies in industrial parks	137	
Location pattern	Possible to move in the industrial park	Possible to be located near the market

Source: Author's calculations

### 3.6.2 Location of Factory: Low Transport Cost with Low Tax Rate

The transport cost of the intermediate goods is set at 0.225, but the tax rate for both countries is low at  $t=t^*=0.27$ . If the factory 1 locates near the market,  $M_4$ , the total profit that the firm can achieve is 13517. On the other hand, if the factory 1 and factory 2 will be dispersed between  $M_1$  and  $M_4$ , the total profit will be 13417. Locating within the industrial park of the home country guarantees additional 137 scale economies. In this case, it is more advantageous to locate within the industrial park located in the home country. It can be pointed out that whether the tax rate is low or high, the benefit from the scale economies in the industrial park will be the same.

**Table 3.4 Low Transport Cost with Low Tax Rate**

$t_g=0.225$	$t=t^*=0.27$	
Economies of scope	200	
Location point	Dispersed between $M_1$ and $M_4$	Agglomerated in $M_4$
Transfer price	442	442
profit(Y)	13417	13517
Scale economies in industrial parks	137	
Location pattern	Possible to move in the industrial park	Possible to be located near the market

Source: Author's calculations

### 3.6.3 Location of Factory: High Transport Cost with High Tax Rate

The transport cost of intermediate goods is set at a high level of 0.85 and the tax rate of  $t=t^*=0.82$  is the same for both country. If the Factory 1 locates near the market,  $M_4$ , the firm's total profit will be 3315. If the Factory 1 and Factory are dispersed between the location,  $M_1$  and  $M_4$ , the firm's profit will be 3279. In addition to this, moving within the industrial park of the home country provides additional benefit of scale economies at 240. Given this kind of condition, the Factory 1 is likely to locate at the industrial park of the home country.

**Table 3.5 High Transport Cost with High Tax Rate**

$t_g=0.85$	$t=t^*=0.82$	
Economies of scope	200	
Location point	Dispersed between $M_1$ and $M_4$	Agglomerated in $M_4$

Transfer price	443	443
profit(Y)	3279	3315
Scale economies in industrial parks	240	
Location pattern	Possible to move in the industrial park	Possible to be located near the market

Source: Author's calculations

### 3.6.4 Location of Factory: High Transport Cost, Low Tax Rate

The transport cost of the intermediate goods is set at 0.85 but the tax rate for both countries is low at  $t=t^*=0.27$ . If factory 1 chooses to locate near the market, the firm can achieve a total profit of 13443. On the other hand, if the operation of the Factory 1 and Factory 2 are to be located separately in  $M_1$  and  $M_4$ , the total profit will be 13297. If Factory 1 locates inside the industrial park of the home country, the firm can achieve 240 scale economies. Given that level of scale economies, it is more efficient for Factory 1 to locate inside the industrial park of the home country.

**Table 3.6 High Transport Cost, Low Tax Rate**

$t_g=0.85$	$t=t^*=0.27$	
Economies of scope	200	
Location point	Dispersed between $M_1$ and $M_4$	Agglomerated in $M_4$
Transfer price	443	443
profit(Y)	13297	13443
Scale economies in industrial parks	240	
Location pattern	Possible to move in the industrial park	Possible to be located near the market

Source: Author's calculations

### 3.6.5 Summary of Industrial Park

As the analysis revealed, the scale economies that can be enjoyed within the industrial parks of the home country is a push factor for the factory to locate their operation within industrial parts. The attractiveness of an industrial park in the home country is dependent on the scale of economies and transports cost. Therefore, to draw more interest from the factories to locate in an industrial park, the home country should do the following: 1. Reduce the corporate tax rate than foreign countries; 2. Increase economies of scale in the industrial park; 3. Decrease

transport costs.

### **3.7 Summary of the Chapter**

From the viewpoint of spatial economics, chaotic phenomenon shown in Figure 3.2 can be interpreted as follow: If the firm decides to locate the factory 1 within the range where chaotic phenomenon appears, the firm can obtain the target profits which may not significantly decrease from the maximum level because the optimal solution is within this sphere. Therefore, it can be surmised that the range indicates a prospective area for factory's location. This enables the firm to narrow down the search area and reduce the search cost.

There are some cases when the firms has established the potential location for the factory but it cannot move their operation due to various reasons such as unavailability or unsuitability of the potential site. In such cases, the firm has to search for second best sites around the prospective location range and chaotic phenomenon is useful as it provides a range of prospective location.

The prospective location range denoted by chaotic phenomenon generates new location-related issues for both firms and regional governments. As discussed earlier, the firm takes into account various factors when deciding the potential location. Aside from the factors that have direct impact on profit level, it also evaluates location factors such as education, culture, housing, safety, and welfare. After a careful evaluation of the above-mentioned location factors, the firm can decides the location of the factory. At the same time, the regional and national governments must pay attention to above-mentioned location factors to attract firms from foreign countries and create a desirable business environment.



## 4. Empirical Analysis of Prospective Location Area

This chapter offers an empirical analysis of locational prospective area model by examining the socio-economic characteristics of the provinces in the Philippines. This chapter also discusses the relevant spatial policies and strategies in the Philippines.

### 4.1 International Production Networks in Asia

#### 4.1.1 Introduction

East Asia is home to perhaps the most sophisticated international production networks (IPNs) in the world. East Asia is very diverse regions in terms of economic development. It is home of the advanced economies of Japan and Singapore and at the same time developing economies of Myanmar, Lao, and Cambodia. Table 4.1 presents selected figures of countries in East Asia.

**Table 4.1 Selected Figures in East Asia**

Country	Population 2014	GDP per capita, PPP (constant 2011 international \$) 2013	GDP growth (annual %) 2013	Trade (% of GDP)	Exports of goods and services (% of GDP) 2013	Foreign direct investment, net inflows (BoP, current US\$) 2013	Ease of doing business index 2013 (1=most business-friendly regulations)
Brunei	423,205	69,474	5.30	108.64	76.16	895,000,000	101
Cambodia	15,408,270	2,942	7.03	139.61	65.77	1,345,044,252	135
China	1,364,270,000	11,805	7.35	43.90	23.32	347,848,740,397	90
Indonesia	252,812,245	9,729	5.02	48.75	23.98	23,344,321,821	114
Japan	127,131,800	35,614	-0.10	35.14	16.15	7,412,010,906	29
Korea, Rep.	50,423,955	32,684	3.31	102.77	53.88	12,766,600,000	5
Lao PDR	6,894,098	4,667	7.46	83.37	37.22	426,667,686	148
Malaysia	30,187,896	22,589	6.03	154.08	81.68	11,582,675,744	18
Philippines	100,096,496	6,326	6.10	59.89	27.91	3,737,371,740	95
Myanmar	53,718,958	..	8.50	..	..	2,254,603,972	177
Singapore	5,469,700	77,721	2.92	359.89	191.55	64,793,175,098	1
Thailand	67,222,972	13,932	0.71	143.85	73.57	14,305,004,118	26
Vietnam	90,730,000	5,125	5.98	165.09	83.63	8,900,000,000	78

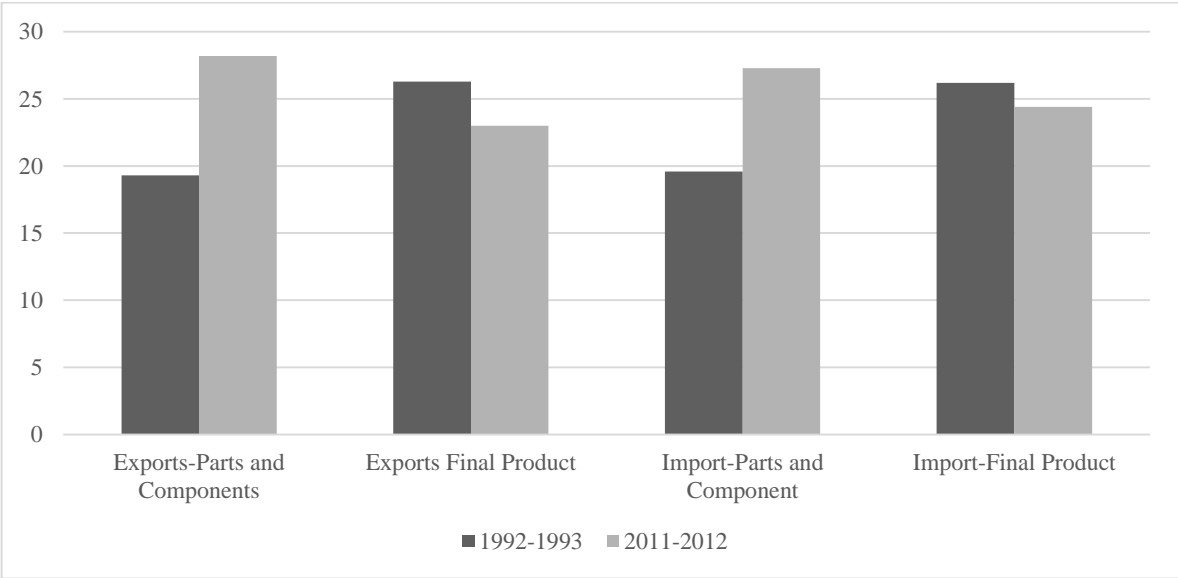
Source: World Development Indicators

IPNs are commonly defined as the fragmentation of production processes into different

production blocks which can be undertaken in different locations. IPNs are well established in various high-growth industries, such as the automotive sector and the electronics sector, linking multinational enterprises (MNEs) and small and medium enterprises (SMEs) as well as developed economies and developing economies. The presence of IPNs has changed the structure of trade, which has been traditionally dominated by final goods to trades in intermediate goods. Based on United Nations (UN) Comtrade statistics, the export share of parts and components has increased from 19.3 percent in 1992-1993 to 28.2 percent in 2009-2010 while the import share of parts and components rose from 19.6 percent in 1992-1993 to 27.3 percent in 2011-2012. On the other hand, export in final assembled goods decreased from 26.3 percent in 1992-1993 to 23.0 percent in 2011-2012; imports slightly declined from 26.2 percent to 24.4 percent.

The development of international production network begins with moving the production processes in low-cost country and re-importing the assembled components for the final assembly. Over time, production networks have spread out to additional countries resulting in multi-border crossing of the parts and components. As the international network of parts/components supply matures, the production of final assembly was relocated from advanced countries to overseas to take advantage of the proximity to the market and source of cheap labor.

**Figure 4. 1 World Trade in Parts and Components**



Source: UN Comtrade(various years)

In the case of East Asia, fragmentation of production processes occurs both within interfirm and intra-firm. Kimura and Ando (2005) developed a framework that would explain the co-existence of inter-firm and intra-firm fragmentation. The framework takes into account the two dimension of fragmentation: geographical distance and the controllability of the firm.

Intra-firm transaction is found to be more costly than the interfirm transaction due to the presence of extra transactions cost like controlling or monitoring. In this case, short-distances can help lower these transaction costs and in turn lead to the agglomeration of the firms. Moreover, inter-firm transactions offers flexibility in setting transfer prices and opportunity to gain larger profits.

This section specifically aims to explain the following:

1. What are the characteristics of the international production networks in East Asia?
2. What are the factors that fostered the development of IPN in East Asia?

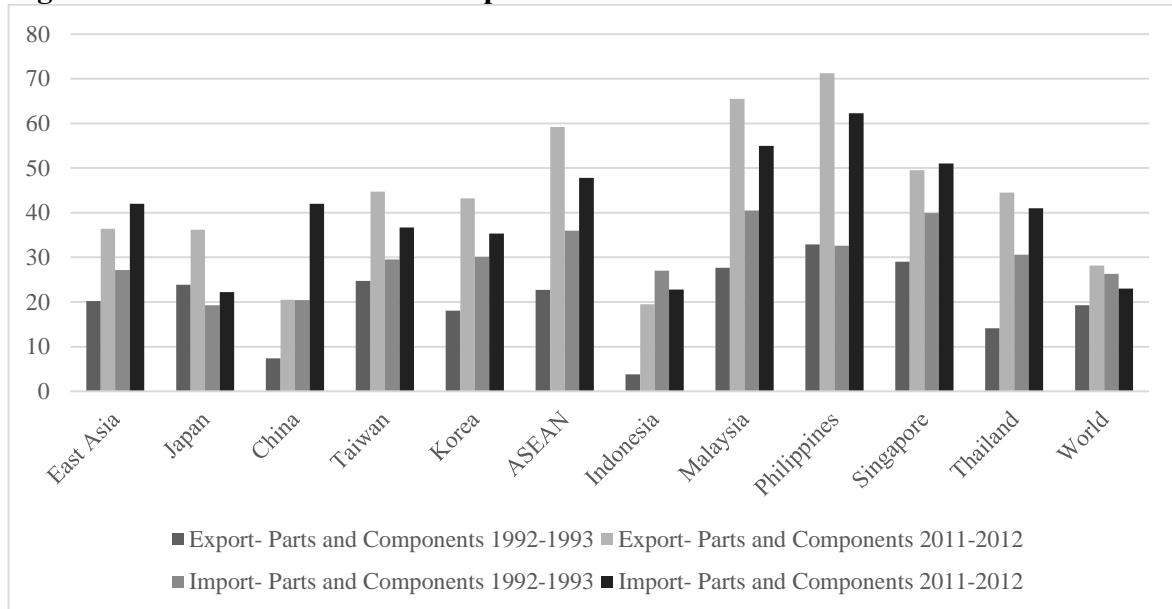
#### **4.1.2 Relevant Statistics on International Production Networks in East Asia**

This section aims to explain the trend and pattern of international production networks in Asia by presenting relevant statistics. There have been various approaches to quantify the magnitude and pattern of global sharing but most analyses include trade statistics in manufacturing, particularly in parts and components and foreign direct investment. Athukorala (2013) identified two approaches in measuring the pattern of international production networks. The first approach is based on outward processing trade (OPT) statistics recorded by OECD member countries. OPT statistics includes data on parts and components exported from source countries and assembled goods received in turn but covers only limited range of products. The second approach uses the individual country trade statistics from the UN Comtrade database. UN Comtrade database covers more parts and components trade from more countries. This study will utilize the UN Comtrade data on manufacturing trade which covers the following product categories: office machines and automatic data processing (SITC 75), telecommunications and sound recording equipment (SITC 76), electrical machinery (SITC 77), road vehicles (SITC 78), professional and scientific equipment (SITC 87), and photographic apparatus (SITC 88).

East Asia experienced an increasing trade in parts and component from 1992-1993 to 2011-2012. The exports share of parts and component expanded from 20.2 percent in 1992-1993 to 36.4 percent in 2011-2012. Meanwhile, the imports share of parts and components also rose from 27.2 percent in 1992-1993 to 42 percent in 2011-2012. The share of parts and components in the manufacturing trade is particularly high in Malaysia and Philippines for both periods. Exports share of parts and components for Malaysia and Philippines is high at 65.5 percent and 71.2 percent respectively in 2011-2012.

Looking at the bilateral trade flows in trade in parts and components would reveal the degree of integration in international production network in East Asia. In 2011-2012, ASEAN is the top source of import in parts and components and at the same time, the top exporter of parts and components for the whole East Asia. Japan, China, Korea, and Taiwan are the biggest trading partners of ASEAN. East Asia accounts for the 55.1 percent share in exports and 68.3 percent share in imports to ASEAN.

**Figure 4.2 Trade in Parts and Components in East Asia**



Source: UN Comtrade(various years)

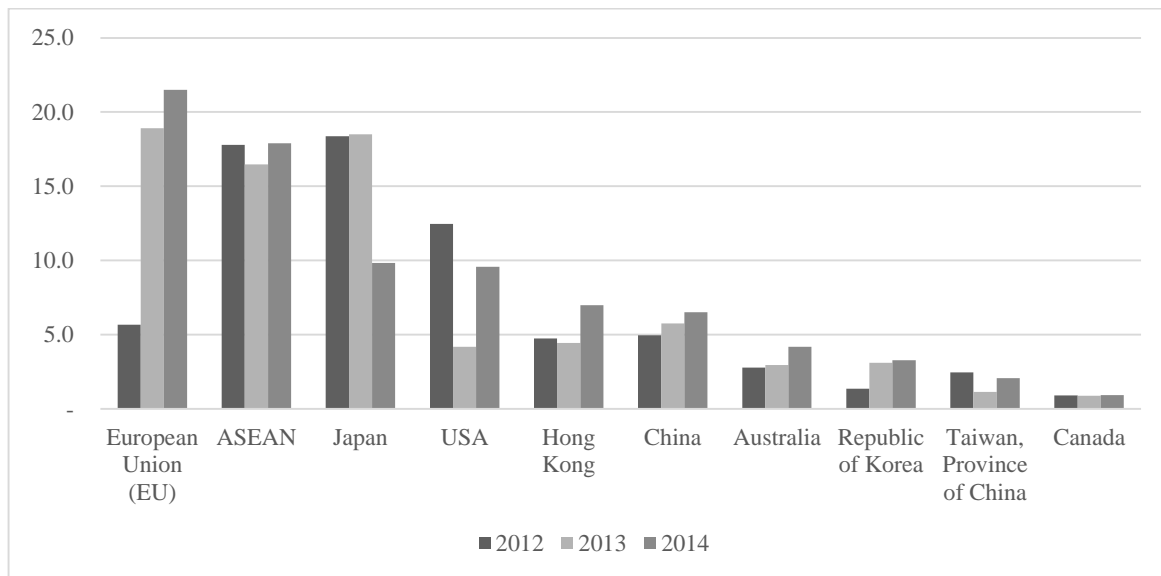
**Table 4.2 Direction of Trade in Parts in Components (Percent Share) 2011-2012**

Country/Region	ASEAN	NAFTA	EU	World
<b>Export</b>				
East Asia	55.5	25.1	24.2	35.1
Japan	47.9	31.5	31	35.1
China	48.7	17.1	16.2	25.5
Korea	63.7	36.6	25.7	43.8
Taiwan	61.2	35	38.2	44.2
ASEAN10	56	32.1	33.8	44.3
<b>Import</b>				
East Asia	68.3	54.7	33.4	42.3
Japan	44.9	41	19.2	20.1
China	74	40.1	31.5	44.2
Korea	55.7	38.9	22.9	31.9
Taiwan	68.8	40.2	28.2	38.6
ASEAN10	66.8	67.5	41.5	48.8

Source: UN Comtrade

Foreign Direct Investments (FDI) also reflects the scale of international production networks. The FDI data for ASEAN reveals that FDI comes primarily from East Asia, specifically from Japan, HongKong, China, and Korea. In 2014, EU is the top source of FDI which account to 21.5 percent, but this is still significantly less than the combined accounts of East Asian countries which is almost half of the FDI inflows at 46.6 percent.

**Figure 4.3 Top Sources of FDI 2012-2014**



Source: ASEAN.org

#### **4.1.3 Development of International Production Network in Asia**

The origins of international production network in Asia can be traced through the establishment of semiconductor devices factory in Singapore by two American companies: National Semiconductors and Texas Instruments (Lee, 2000 cited in Athukorala and Kohpaiboon 2013). By 1970s, more factories were built in Singapore and some them started to relocate in neighboring countries of Malaysia, Thailand, and the Philippines.

On the other hand, US semiconductor producers have also established their assembly plants in Hong Kong, South Area, and Taiwan, and even moving to Singapore (Gundwall and Flamm 1985 cited in Athukorala and Kohpaiboon, 2013). Fairchild established a transistor assembly plant in Hong Kong, but it was Singapore who captured the biggest share of these assembly facilities. The reason behind the spectacular rise of Singapore in semiconductor industry could be accounted to political developments during that time. It was the height of Cultural Revolution in China and investors were quite worried about the political conditions, so they went to Singapore instead of locating to South Korea, Taiwan, and Hong Kong which are geographically closer to China (Goh 1993, cited in Athukorala and Kohpaiboon, 2013).

In 1980s, the hard disk drive assemblers began moving to Singapore, and since then, there have been changes in the composition of electronics industry with hard drive becoming more significant than semiconductor assemblies. Major players like Seagate, Maxtor, Hitachi Metals, Control Data, Applied Magnetic and Corner Peripherals came to Penang and Singapore.

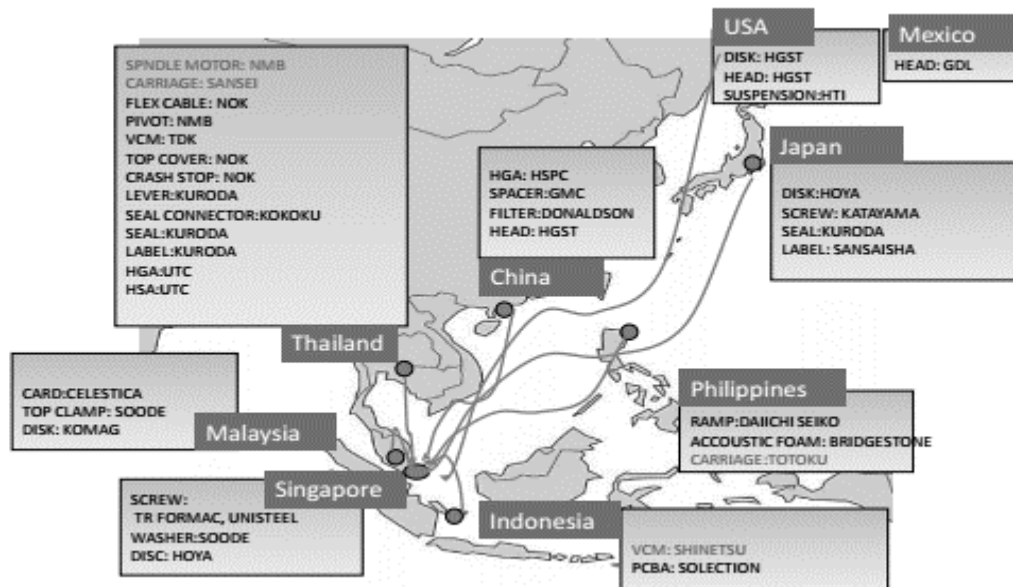
During the 1980s, the prevailing pattern of production was a two-way exchange between home countries and host countries of part and component factories. Parts and components, mostly low-technology and low-skill components, were sent to host countries for assembly, and intermediate goods were exported to the home countries where it would be assembled into final goods. With the further development of networks of parts and components, more firms started to move the final assembly of additional electronics and electrical goods such as computers, cameras, TV sets, and motor cars to Southeast Asian nations. The rapid appreciation of yen after the Plaza Accord<sup>8</sup> in 1985 prompted more companies to relocate their production in cheaper locations such as Southeast Asia. The production processes evolved and countries like Singapore eventually matured as its production shifted from low-skill and low-technology component to production processes which require high technology such design and fabrication.

At present, the production network in South East Asia has become sophisticated and more countries have been integrated. For example, the hard disk drive (HDD) industry can be divided into hierarchical production processes: upstream processes, such as research and development and high-tech wafer processes, and the downstream processes, such as final assembly, and component and parts procurement. Hiratsuka (2011) noted that the hierarchical nature of production provided the HDD industry economies of scale for short-life products, and flexibility to allocate the investments among assemblers, and component suppliers and part suppliers. Various parts and components are sourced from different countries: US, Mexico, Japan, China, Philippines, Indonesia, Malaysia, Thailand, and Singapore. These parts and components were then assembled into final product in two factories located in Thailand and Singapore.

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<sup>8</sup> A 1985 agreement among the G-5 nations (France, Germany, the United States, the United Kingdom and Japan) to manipulate exchange rates by depreciating the U.S. dollar relative to the Japanese yen and the German Deutsche mark. Also known as the Plaza Agreement, the Plaza Accord's intention was to correct trade imbalances between the U.S. and Germany and the U.S. and Japan, but it only corrected the trade balance with the former.

**Figure 4.4 HDD Network in East Asia**



Source: Hiratsuka (2011)

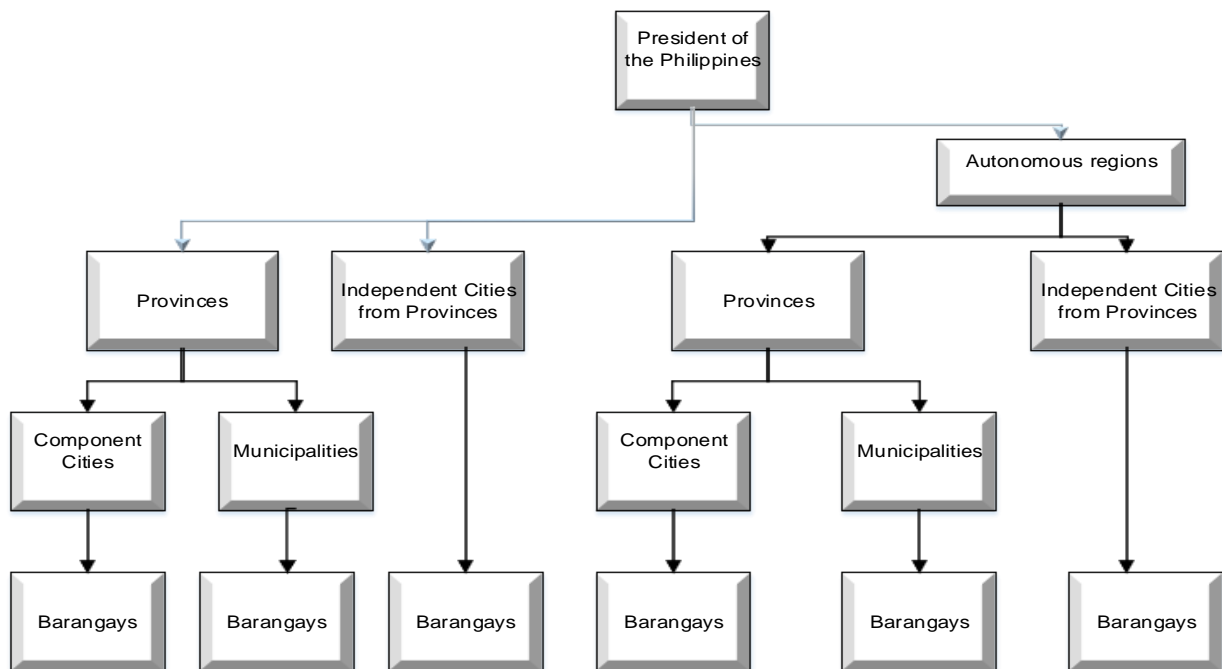
Several studies have explained the factors behind the rapid growth of international production networks (Chia 2012; Kimura, Takahashi, Hayakawa, 2007; Kimura and Obashi, 2011). Chia (2012) enumerated the following factors that has lead the international production network to thrive in East Asia: 1. Diversity in labor supply conditions; 2. Relative factor cost advantage; 3. Agglomeration advantages; 4. Rapid economic growth and structural transformation in several countries. Kimura and Obashi (2011) in their survey of relevant literature regarding production networks identified the following conditions that supported the development of production networks in East Asia. The service link cost is relatively lower in East Asia than in Europe; thus, production network in East Asia has expanded faster (Kimura, Takashashi, and Hayakawa 2007 cited in Kimura and Obashi, 2011). The study by Hayakawa, Ji, and Obashi (2009) about the economic interdependence among East Asian countries in the case of machineries pointed out the positive spatial interdependence. This could mean that regional production networks enabled the simultaneous production expansion and improvement. The presence of differences in location advantages across countries facilitated the international fragmentation of production. Kimura, Takahashi, and Hayakawa (2007) found out that positive correlation between trade flows and income gaps can function as a proxy of location advantages. Meanwhile, Kimura and Ando (2009) argued that presence of Japanese firms also drives the development of international production networks.

## 4.2 Philippines: Introduction and Economic Development Strategies

### 4.2.1 Basic Information about the Philippines

The Philippines is an archipelago located in Southeast Asia. It is composed of 7,107 islands which totals to 300,000 square kilometers, the second biggest archipelagic country in the world. The Philippines is a country with a big population and yet a modest size of the economy. In 2010, the country has 93.26 million making it the 12th largest country in the world in terms of population. Gross Domestic Production (GDP) at current US dollar is valued at 199.59 billion in 2010. Annual growth rate was at 4.4 percent in 2000 but jumped to 7.6 percent in 2006 and continues to gain steady growth in recent years. It is one of the newly-industrializing countries which are transitioning from agricultural-based economy to manufacturing-based and service-based economy. The services sector, fueled by the recent growth in BPO businesses, contributes more than half of the economic output. The manufacturing sector accounts for 30% of the national output.

**Figure 4.5 Administrative Divisions in the Philippines**



Source: Author's own construction

The Philippines is a republic with a presidential form of government. The Philippines is divided into three main islands: Luzon, Visayas, and Mindanao. The country is divided further into 17 regions, 80 provinces, 144 cities, 1,496 municipalities, and 42,025 barangays.



#### **4.2.2 Economic Development during Colonization Period**

The Philippines was captured by foreign powers for more than 400 years. The Spanish conquest lasted from 1521-1898, the American conquest from 1901-1946, and the Japanese occupation from 1942-1945. However, prior to the coming of the Spanish in 1521, the Philippines is composed of independent kingdoms or states, often referred to as *barangays*. These independent states had long-established relations with other kingdoms in China, India, Japan, Vietnam, and Indonesia.

In 1565, Spain had formally colonized the Philippines<sup>9</sup> with the arrival of Miguel Lopez de Legazpi in Cebu<sup>10</sup>. In 1571, Manila was established as the capital of the colonial government. As typical of any colony, the Philippines served primarily as a source of raw materials; thus, there had been rapid cultivation of agricultural lands. The Spanish opened the Manila port to international market in late 16<sup>th</sup> century via the Galleon Trade and it lasted until late 19<sup>th</sup> century. After the short-lived independence in 1898, Spain ceded the Philippines to the United States of America at the Treaty of Paris for US\$20 million. The Philippines has experienced socio-economic progress during this period. The passage of Payne-Aldrich Act which provided for duty-free agreement between the United States and the Philippines resulted in significant expansion of foreign trade, mainly exports of agricultural products. This resulted to the rapid growth of regions which are the source of agricultural products: e.g. rice (Central Luzon), sugar (Central Luzon, Southern Tagalog, and Western Visayas), hemp (Bicol), coconut (Southern Tagalog and Visayas), and tobacco (Ilocos and Cagayan Valley). Mortality rate decreased significantly and education with English as a medium of instruction was provided for all. The Japanese occupation during World War II left the Philippines with extensive damages. Vast agricultural lands were laid to waste and the sprouting factories and industries were destroyed.

#### **4.2.3 Regional Development Policies from Post-Independence to Martial Law Period (1947-1986)**

During the post-war period (1947-1960s), Philippines found itself pursuing import-substitution-industrialization (ISI) in response to balance of payment crisis and the depletion of foreign exchange reserves. Another factor that led the country to adopt ISI strategy is the budding economic nationalism sentiment in the administration, most notable of which is the “Filipino First Policy” of President Carlos P. Garcia, which g preferential treatment to locals over foreigners. The early years of ISI was remarkable and manufacturing sector grew at 13.55 percent from 1949-1955 (Tecson, 2007). ISI favored the capital-intensive industries over the resource-based industries; and as a result, capital-rich regions of Metro Manila and Southern Luzon have significantly prospered (Sicat, 1968, cited in (Mercado, 2002).

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<sup>9</sup> Spain was not successful in subjugating the whole archipelago, particularly the Muslim-areas in Mindanao.

<sup>10</sup> Cebu is located in Region VII (Central Visayas).

However, growth was not sustained, and this led the Philippines to remove all controls and venture on economic liberalization. Various policies were undertaken to facilitate this transition. The Agricultural Land Reform of 1963 was implemented to abolish the shared tenancy system in the hopes of revitalizing the agricultural sectors and addressing the rural-urban gaps. The Republic Act No.5186 or Investment Incentives Act of 1968 was enacted to give incentives and guarantees to investments and to create the Board of Investments (BOI), the lead government agency for promotion of investments. The Republic Act No.6135 or Export Incentives Act of 1970 was ratified to provide fiscal incentives to the export-oriented sectors. The first export processing zone (EPZ) was established in the province of Bataan<sup>11</sup> in 1972. A National Physical Framework Plan which espouses the growth center approach to infrastructure development was conceived in 1970. The government prohibited the establishment of new factories or plants within 50-km radius of Manila in 1973.

Mercado (2002) argued that it was during this period (late 1960s-onwards) that the government started to pay attention to the spatial aspects of development. Improvement of rural areas and dispersion of industries away from the capital surfaced as the one of the main goals of the export-oriented economy. The government installed Regional Development Authorities (RDAs)/ Provincial Development Authorities (PDAs) to manage and improve local development. In addition to these, integrated area development (IAD) projects were implemented as part of regional public investment program. Regional development framework was included for the first time in the National Development Plan of 1978-1982 and each region were guided with the Regional Development Plan of 1978-1982. The Five-Year Development Plan of 1983-1987 continued the efforts in addressing the spatial disparities between rural and urban areas with *Kilusang Kabuhayan at Kaunlaran*<sup>12</sup>(KKK) as the main economic-social development strategy. The KKK program aimed to induce development to least development regions through the livelihood projects owned and managed by the community residents. The program also put forward the national hierarchy of human settlements strategy to disperse the population from congested areas. Significant improvements geared towards incorporation of the local concerns were made on the regional development planning, investment, and budgeting. Prior to these improvements, development planning and budgeting were still decided by the national office although the implementation is undertaken by the regional offices.

The industrial sector grew at an average of 7.9 percent as well GDP with 6 percent from 1970-1980. It should be noted that these developments were pursued under the Martial Law regime which Marcos declared in 1972.

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<sup>11</sup> Bataan is located in Region III (Central Luzon).

<sup>12</sup> Movement for livelihood and progress

#### 4.2.4 Economic Liberalization during Post-EDSA- Present (1986-Present)

Marcos regime was overthrown by EDSA<sup>13</sup> People Power Revolution in 1986 which eventually installed Corazon Aquino<sup>14</sup> as the new President. Agro-industrialization, decentralization and structural reforms were prevailing strategies in this period. In addition to the five existing export processing zones (Baguio, Bataan, Cavite, Mactan and the PHIVIDEC Industrial Estate), 18 Regional Industrial Center (RIC) and People Industrial Enterprise (PIE) in provinces were established. These RICs and PIEs are aimed to develop the agro-industrialization and dispersion of growth. To further discourage industrial location in the Metro Manila, tax holidays and duty-free importation were no longer given for those who were locating in the capital in 1988. Former US military bases were converted into business centers through the Republic Act 7227 or Bases Conversion and Development Act of 1992. The effort towards rural development continued with the enactment of the Comprehensive Agrarian Reform Program (CARP) which aims to achieve equitable distribution and ownership of the land. Two new regions were also created in this period: the Autonomous Region of Muslim Mindanao (ARMM) and Cordillera Administrative Region (CAR). To improve the coordination between central and local government in development planning and budgeting, the Synchronized Planning and Programming and Budgeting System (SPPBS) were adopted. In the physical planning, the National Physical Framework Plan 1990-2000 with the corresponding Regional Physical Framework Plan 1990-2020 for all regions was formulated.

Two decades of Marcos dictatorship and the disappointment over the “trickle-down” development strategy prompted the government to shift power close to the people and allow them greater participation in the development process through the enactment of the Local Government Code (LGC) of 1991. The code devolves functions and responsibilities to the local government units (LGUs), particularly with the delivery of basic services. The code has increased the share of the LGUs in the national taxes or the internal revenue allotment (IRA) from 11 percent to 40 percent.

The Ramos administration continued the economic liberalization under the banner of "Philippines 2000" which aims to achieve Newly-Industrializing Country (NIC) status by the year 2000. Massive economic reforms such as trade liberalization, privatization, deregulation, and build-operate-transfer (BOT) arrangements were pursued. The country experienced series of energy crisis in early 1990s which prompted the government to deregulate the power sector and issued licenses to Independent Power Producers (IPP). Public utilities, such as water and telecommunications sector, were privatized. Improvement of infrastructure was undertaken through BOT scheme. The Philippines has also actively participated in the interregional associations and economic partnerships such as the Asia-Pacific Economic Cooperation (APEC) and Brunei-Indonesia-Malaysia-Philippines-East Asia Growth Area

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<sup>13</sup> Epifanio Delos Santos Avenue (EDSA), one of the major highways in Metro Manila where massive protests against Marcos dictatorship were staged.

<sup>14</sup> wife of former Senator and staunch Marcos opponent, Benigno Aquino Sr.

(BIMP-EAGA). In 1995, the Philippines joined the World Trade Organizations. In the aim of spreading economic activities to other areas of the country, Republic Act 7916 or the Special Economic Zones Act of 1995, which allows the participation of the private sector in the management of industrial estates, was signed in to a law. The same law also created the Philippines Export Processing Zone Authority (PEZA) which is mandated to oversee the development of the economic zones. To address the long-standing problem of poverty, Social Reform Agenda (SRA) was implemented. Series of poverty alleviating projects were implemented at the selected 21 provinces and six urban areas, such as Metro Manila, Baguio City and Cebu City. The Moro National Liberation Front (MNLF), one of secessionist movement in Mindanao, signed a peace agreement in 1996. The Philippines was quite successful in achieving significant growth during this period but the momentum was stopped by the Asian Financial Crisis in 1997.

The transitory Estrada Administration puts poverty as its main priority with its “Erap para sa Mahirap” program. The GMA administration followed the same path of her predecessors regarding trade and industrial policy. For investment and infrastructure planning purposes, the existing regions were clustered into four “Super Regions”: North Luzon as Agribusiness Quadrangle, Metro Luzon Urban Beltway, Central Visayas as Prime Tourism Area, and Mindanao as Southern Agribusiness Area. Moreover, Strong Republic Nautical Highway (SNRH), an integrated network of roads and ports connecting the archipelago, opened in 2003. The network adopted roll-on-roll-off (RORO) system wherein motor vehicles can drive in and out of the cargo ship or ferries. The Philippines Cyber Corridor program aiming to boost the ICT sector was implemented, and in line with this, "next wave cities" or the cities which have the potential to host business processing outsourcing (BPO) industry were identified. The business processing outsourcing (BPO) industry has boomed since 2006 and is now a 9 billion dollar-worth industry. The leading cities of Metro Manila and Cebu have absorbed the majority of these BPO-related investments. The Japan-Philippines Economic Partnership Agreement (JPEPA), which aims to facilitate free trade of goods, services, and capital between Japan<sup>15</sup> and Philippines, was ratified on 2008.

Economic policies of the Aquino’s administration underpin “inclusive growth” strategy. The administration main aims include sustaining the economic growth at 7-8% for the next six years, generating mass employment, and achieving the Millennium Development Goals (MDGs). The Pantawid Pamilyang Pilipino Program (4P) is the centerpiece strategy to alleviate poverty. 4Ps program is a conditional cash transfer program wherein the poor in the poorest areas were given money or incentives in the condition that they will empower themselves. The administration also adopts Industrial Cluster Strategy to promote industrial clusters which take into account the industrial activity and infrastructural facilities of domestic area.

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<sup>15</sup> After the United States of America, Japan is the second-biggest trading partner of the Philippines.

#### **4.2.5 Evolution of Regional Development Policies: From Diffusion to Integration**

The World Development Report 2009: Reshaping Economic Geography identified three dimensions of development and their corresponding policy challenges: density, distance, and division. Density is considered as the most important dimension at the local level and the policy challenge is how to properly establish density and use market forces to stimulate concentration and convergence in living standards between towns and cities. Distance is most significant at the national geographic scale and the policy challenge is mobility of work and reduction of transports costs through infrastructure. Division is the most important at the international level and the policy challenges are the access to world markets, differences in currencies, and regulations. The report also enumerated three categories of policy response to promote economic integration and reduce disparities: Institutions or Spatially-blind, Infrastructure or Spatially-connective, Interventions or Spatially-targeted programs. Institutions or spatially-blind policies should have wide coverage and should include policies related to land, labor, and trade regulations; social services such as education, health, and water. Infrastructure or spatially-connective mainly deals with infrastructure policies that enable the freer movement of goods, services, and people. Interventions or spatially-targeted policies are policies meant for specific sectors, such as slum clearance program, fiscal incentives, and preferential trade access for poor countries. Borrowing the classification of policies from WDR 2009, it would seem that policy-makers and decision-makers in the Philippines are well aware of the complex nature of spatial policies as evident with the mix of development efforts pursued. Post-war efforts were mainly focused on macro-economic policies, and it was not until 1970s that spatial disparity has been given proper notice in policy-making. As mentioned earlier, it was the Five-Year Development Framework 1978-1982 which has the very first Five-Year Regional Development Plan 1978-1982. The theme of spatially-blind policies pursued has varied over the years from export-oriented growth to agro-industrial balanced growth strategy to inclusive growth strategy.

Meanwhile, many spatially-focused policies emerged from late 1970s onwards. These spatially-focused policies also vary greatly with their focus but the trickle-down approaches through development of urban centers were the preferred approach. These urban centers later incorporated its surrounding areas and were organized as metropolitan areas. National Economic Development Authority (NEDA) identifies 12 major metropolitan areas in the Philippines. Metro Manila is the biggest metropolitan areas followed by Metro Cebu and Metro Davao. Seven out of the twelve metropolitan areas are located in the main island of Luzon.

In recognition of the fact that poverty has been synonymous to agriculture, policies dedicated to impoverished region, mainly through agricultural development, have also been pursued. Land redistribution has been the main theme of agricultural reforms and rural development starting from the post-war period. The Agricultural Land Reform of 1963 under the Macapagal administration is one of the landmark pieces of legislation which abolishes the shared tenancy system. The Comprehensive Agrarian Reform Program (CARP) of 1987 under the Aquino administration has been the main basis for land-share and social equity

reforms for more than two decades now.

On the surface, it would seem that the Philippines has well thought out strategies to address spatial disparities, particularly the urban-rural divide. However, many of these spatially-focused policies are “well-intended” but some are “internally-inconsistent” and poorly implemented. In theory, local governments are more knowledgeable about the local conditions and thus in better position to craft development policies. However, there seems to be improper coordination between local government and national government in terms of planning and implementation. Many of the concerns of the local government authorities were not incorporated in the national development planning or vice versa due to some mismatch in priorities. Cariño et al.(2004) argued that many of these investment proposals of the provinces were not implemented when they do not demonstrate “concrete and reliable connections to national sectoral policy concerns and priorities.”

Furthermore, many of these spatially-focused policies were geared towards diffusion of economic activities as evident with the number of airports and seaports, special economic zones, and state universities (Medalla et al. 2007, cited in Human Development Network (2013). These attempts to disperse economic activities across the regions were not successful mainly due to disregard to economies of scale and lack of development significance.

With the discontent in dispersion strategy abound, the focus have shifted to integration strategy. Given the archipelagic nature of the country, special approach is needed to induce connectivity and domestic integration (Asian Development Bank, 2010). As stipulated in WDR 2009, spatially-connective policies are mainly through infrastructure development. Based on the survey, spatially-connective policies through infrastructure development have not been given explicit attention in the development agenda through the years. Infrastructure projects are well-documented to bring development and integrate the lagging areas. In particular, the good quality local roads can induce local growth and development (Llanto, 2007). Unfortunately, the Philippines as a whole, is under-investing in infrastructure and lags significantly behind its East Asian neighbors (Balisacan, Hill, and Piza, 2008). In the recent Global Competitiveness Report 2013, the Philippines fare very poorly in terms of quality ranking 98<sup>th</sup> out of 144 countries. The fact that infrastructure is often tied to votes, especially at the local level, further complicates the infrastructure development. Many local politicians would just deliberately construct projects with no development significance to win the votes. On the other hand, a few bright spots in infrastructure development manifested with the 2003 roll-on-roll-off (RO-RO) policy reforms. RORO system is designed to improve inter-island system of trade and tourism. This has resulted to significant decrease in sea transport costs, enhanced mobility of goods and people, and flourishing domestic tourism. This RORO system was also adopted in some ASEAN countries.

**Table 4.3 Regional Development Policies and Historical Event**

Period	Significant events	Spatially-focused(Intervention)	Spatially-connective(Infrastructure)	Spatially-blind (Institutions)
postwar to late 1960s	Postwar recovery, Filipino First Policy, Exchange Rate Control, Korean War, Protectionism			ISI, Agricultural Land Reform(Macapagal)
1960s to 1970s	Lifting of Controls, Peso Devaluation, birth of ASEAN	Regional Development Authorities(RDA), Mindanao Regional Development Study, Manila Bay Metropolitan Regions Strategy, increased number of regions from 12 to 13	National Physical Framework of 1970	EOI, review of government structures for regionalization and decentralization,
1972-1976	Martial Law Period, Oil Crisis, Structural Adjustment by IMF, Economic Liberalization	Integrated Area Development(IAD), Ban on location of New factories near Manila, Regional Development Fund, Regional Development Council, Establishment of Metro Manila and Metro Manila Commission,		Four-Year Development Plan(1972-1975) mentioned the importance of regional development to economic growth
1976-1982		Five-Year Regional Development Plan, 1978-1982 for each regions, Development of Urban Hierarchy: Metro Manila, Cebu, and Davao and 10 regional Centers, Regional Development Investment Program, Regional Budgeting System,		inclusion of Regional Development Framework in the Five-Year Development Plan, 1978-1982
1983-1987	Martial Law/ Assasination of Ninoy Aquino/People Power Movement/ Constitution Change/ AFTA	National Hierarchy of Human Settlements, Regional Development Paper Series, Regional Programming and Budgeting, Regional Project Monitoring, Integrated Regional Information System, Local Resource Management,		KKK Program to generate employment and income to reduce regional development disparities
1987-1992		RICS, PIEs, Fiscal Incentives for locating outside Manila, CARP, Synchronized Planning and Budgeting(SPPBS), RDC-membership of private sector, Organic Acts of Muslim Mindanao, 1991 Local Government Code	Regional Physical Framework Plans(RPFPS)	Country-side Agri-industrial Development Strategy(CAIDS)

<b>1993-1998</b>	WTO Membership, Asian Crisis, AFTA, APEC	Growth Networks, National Urban Policy Agenda, MMDA	infrastructure improvement via market liberalization, privatization, built-operate-transfer	
<b>1999-2010</b>	Digitalization, 9/11 Terrorist Attacks, Impeachment of Estrada,	Super Regions, Next Wave Cities	Strong Nautical Highway, Philippine Cyber Corridor	Poverty Reduction
<b>2010-present</b>		Priority Industry Clustering(2011-2016), Pantawid Pamilyang Pilipino	PPP for infrastructure project	Inclusive Growth

Source: Author's own construction

### 4.3 Optimal Location within the Philippines: Comparison of Provincial Socio-Economic Characteristics

It is assumed in this section that the Philippines is within the prospective location area of a firm planning to establish a factory in East Asia: the firm will have to select a province from 80 provinces which have different economic and social characteristics. The firm decides the province where the factory will be located by examining the compatibility between the socio-economic characteristics of a province and the requirements of production processes. The first step the firm should take to determine the factory's location is to scrutinize the economic and social condition of each provinces in Philippines. Based on the provinces characteristics, the firm can select a province in which its factory locates.

#### 4.3.1 Socio-Economic Data of the Philippines

The primary sources of data in this study are the Countryside in Figures published by National Statistical Coordination Board (NSCB) and National Statistical Office (NSO). The study used the latest available data for each indicator. However, as the schedule of the survey varies, reference year is not uniform.

**Table 4.4 List of Indicators**

<b>Categories</b>	<b>Indicators</b>	<b>Year</b>
	Land Area	2007
	Population	2010
Demography	Population density	2010
	Real per capita income	2009
	Wage Rate Non-Agriculture	2012
	Wage Rate Agriculture	2012
	Total number of banks	2012
	Total bank deposits (millions)	2012
	Number of Micro Small Medium Enterprise(MSME)	2011
	Employment in MSME	2011
	Employment Rate	2012
Economy	Poverty Incidence among Population (%)	2012
	Mean Years of Schooling	2008
Education	Literacy rate (simple literacy)	2000



	Net Enrolment Ratio (NER) in Primary Education	
	Completion Rate in Primary Education	
	Net Enrolment Rate (NER) in Secondary Education	2006-
	Completion Rate in Secondary Education	2007
	Number of Higher Education Institution(HEI)	2010
		2011-
	Enrollment in HEI(SUC)	2012
		2010-
	Graduates in HEI(SUC)	2011
	Crime Incidence (Crime per Population)	2012
	Crime Solution Efficiency	2012
	Traffic Accident (Traffic Accident Per Population)	2012
	Weather and Climate-related risks	2010
Security	Geophysical risk	2010
	Paved Road Length KMs(Road Density)	2012
	Permanents Bridges Linear Meters(Bridge Density)	2013
	Total Number of Airports	2010
	Total Number of Ports	2012
	Energized Barangay (%)	2012
	Number of Telephone Lines	2012
Infrastructure	Number of Special Economic Zones	2012
	Life expectancy at birth (years)	2009
	Number of Household with Access to Safe Water	2011
	Number of Household with Access to Sanitary Toilet	2011
	Total Health Workers	2011
	Number of Government Doctors	2011
Health	Ratio of Barangay Health Station	2011
	Good Governance Index	2012
	State of Performance	2010
	Internal Revenue Allotment	2011
	Total Local Sources(tax and non-tax)	2011
	IRA Dependency	2012
Governance	Basic Social Welfare Spending	2013

#### 4.3.2 Estimation of Socio-Economic Index of the Provinces

There are various statistics and indices that assess the performance of provinces in the Philippines. The Human Development Network (HDN) produces human development index of the provinces, which is estimated using health, education, and income indicators. The NSCB publishes the Countryside in Figures annually and provides ranking of provinces in specific category. The NSCB also develops the good governance index (GGI) to measure the performance of local government units (LGU). The GGI covers three main areas: political, economic, and administrative indicators. The LGU including provincial-level, the self-assessment report through the Local Productivity and Performance Measurement System (LPPMS) and Local Governance Performance Management System (LGPMS). This study aims to provide a more holistic approach in the assessing the conditions of the provinces by introducing additional variables in the analysis such as higher education indicators, traffic accidents, geophysical risk, ports and airport, special economic zones, and number of government doctors.

Socio-economic index is computed using various variables that falls into six categories: economic condition, education, security, infrastructure, health, and governance. These variables are standardized using equation (4-1),

$$S_{IvP} = \frac{(X_{Iv} - AVE_{Iv})}{ST_{Iv}} \quad (4-1)$$

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

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.

Score of the indicator I was obtained using equation (4-2),

$$S_{Iv} = (1/n) \sum_{I=vP}^{I_n} S_{IvP} \quad (4-2)$$

The socio-economic index was computed based on equation (3),

$$PD_p = (1/6) \sum_{I=a}^e S_{Iv} \quad (4-3)$$

### 4.3.3 Comparison of Socio-Economic Index

High socio-economic index would mean vibrant local economy, highly-educated citizens, relatively safe and secure neighborhood, presence of physical infrastructure, good health and welfare support, and efficient local administration. The top provinces that have the highest computed socio-economic index are the following: Metro Manila<sup>16</sup>(3.433), Cebu (0.610), Laguna(0.588), Cavite(0.521), Bulacan(0.487), Rizal(0.490), Batangas(0.474), Pangasinan(0.351), Negros Occidental(0.331), and Isabela(0.339). Except for Cebu, Pangasinan, and Negros Occidental, the rest of the top provinces are located within regions that are adjacent to Metro Manila. On the lowest end of the ranking are the following provinces: Maguindanao (-0.895), Sulu(-0.816), Basilan(-0.744), Tawi-tawi (-0.600), Lanao del Sur(-0.524), Camiguin (-0.497), Saranggani (-0.402), Ifugao (-0.397), Masbate(-0.376), and Northern Samar(-0.364). Except for Ifugao, Masbate, and Northern Samar, the lowest ranking provinces are located in Mindanao, primarily in Autonomous Region of Muslim Mindanao (ARMM). In the Figure 4.6, the provinces with darker shades indicate comparatively higher socio-economic index, while provinces with lighter shades signify lower provincial dynamism scores.

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<sup>16</sup> For comparison purpose, Metro Manila is considered as a province in this study.

In terms of economic scores, except for Cebu, Batanes, and Quezon, the provinces which rank the highest are located within the peripheries of Metro Manila: Laguna, Cavite, Rizal, Batangas. On the other hand, provinces with lowest economic scores are located mostly in ARMM: Lanao del Sur, Tawi-tawi and Maguindanao. In terms of education, except for Batanes, the provinces with the highest scores are again situated near the capital: Cavite, Rizal, Laguna, and Bulacan. Notice that in both economic and education scores, no provinces from Mindanao have made it to the top. In terms of security, the provinces that are considered to be relatively safe are the following: Apayao, Sultan Kudarat, North Cotabato, Cagayan, Siquijor, Abra, Iloilo, Palawan, Isabela, and Marinduque. Meanwhile, provinces with the lowest score in security are the following: Albay, Davao Oriental, Pampanga, Aurora, Zambales, Basilan, Misamis Oriental, Ifugao, Camiguin, and Benguet.

**Table 4.5 Ranking of the Provinces**

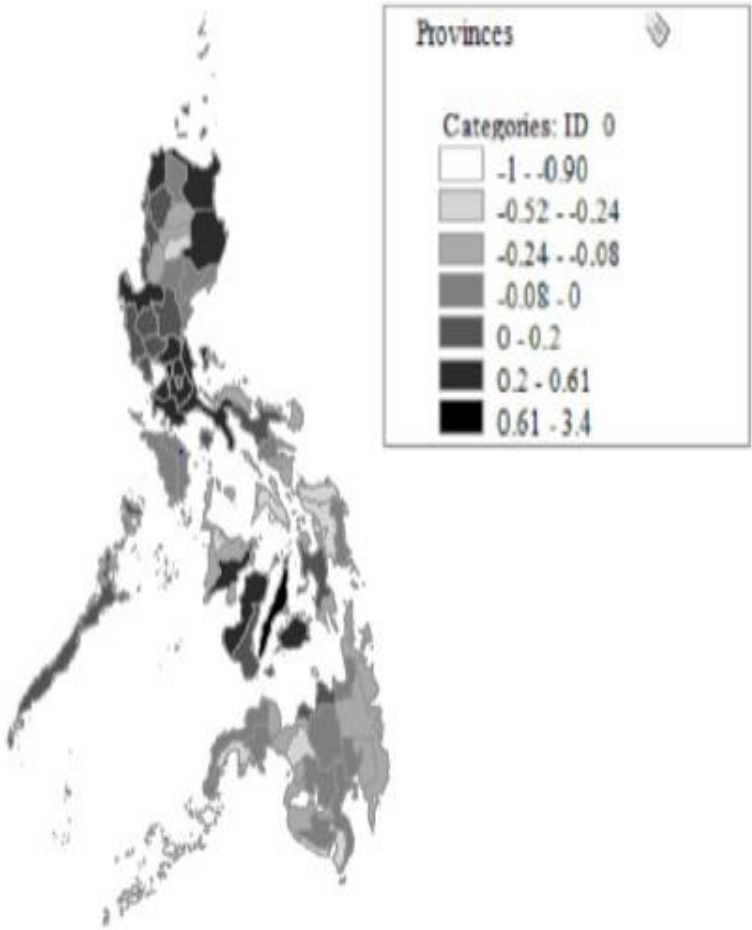
Ranking	Socio-						
	Economic Index	Economic	Education	Security	Infrastructure	Health	Governance
<b>Top 10</b>							
1	Metro Manila	Metro Manila	Metro Manila	Apayao	Metro Manila	Metro Manila	Metro Manila
2	Cebu	Laguna	Cavite	Sultan Kudarat	Leyte	Cebu	Rizal
3	Laguna	Cavite	Rizal	North Cotabato	Cebu	Isabela	Laguna
4	Cavite	Rizal	Laguna	Cagayan	Palawan	Cavite	Pangasinan
5	Rizal	Batangas	Bulacan	Siquijor	Negros Occidental	Bulacan	Bulacan
6	Bulacan	Quezon	Batanes	Abra	Pangasinan	Batangas	Negros Oriental
7	Batangas	Bulacan	Batangas	Iloilo	Batangas	Negros Occidental	Benguet
8	Pangasinan	Cebu	Pangasinan	Palawan	Bohol	Bohol	Cavite
9	Isabela	Batanes	Tarlac	Isabela	Zamboanga del Norte	Pangasinan	Cebu
10	Negros Occidental	Pampanga	Pampanga	Marinduque	Occidental Mindoro	Quezon	Tarlac
<b>Bottom 10</b>							
71	Northern Samar	Basilan	North Cotabato	Albay	Kalinga	Capiz	Sorsogon

72	Masbate	Surigao del Norte	Zamboanga del Norte	Davao Oriental	Mt. Province	Apayao	Southern Leyte
73	Ifugao	Camarines Norte	Sultan Kudarat	Pampanga	Bukidnon	Antique	Zamboanga del Sur
74	Sarangani	Western Samar	Davao del Sur	Aurora	Abra	Aklan	Sarangani
75	Camiguin	Aklan	Davao Oriental	Zambales	Ifugao	Maguindanao	Occidental Mindoro
76	Lanao del Sur	Sulu	Tawi-Tawi	Basilan	Apayao	Lanao del Sur	Lanao del Sur
77	Tawi-Tawi	Tawi-Tawi	Sarangani	Misamis Oriental	Sultan Kudarat	Basilan	Romblon
78	Basilan	Lanao del Sur	Basilan	Ifugao	Basilan	Northern Samar	Masbate
79	Sulu	Sorsogon	Sulu	Camiguin	Maguindanao	Tawi-Tawi	Surigao del Sur
80	Maguindanao	Maguindanao	Maguindanao	Benguet	Camiguin	Sulu	Maguindanao

Source: Author's own construction

In terms of infrastructure, the provinces which have the highest score are the following: Metro Manila, Leyte, Cebu, Palawan, Negros Occidental, Pangasinan, Batangas, Bohol, Zamboanga del Norte, and Occidental Mindoro. On the other hand, the provinces which rank poorly in the infrastructure category are Kalinga, Mt. Province, Bukidnon, Abra, Ifugao, Davao del Sur, Sulu, Basilan, Camiguin, and Benguet. These provinces are either located in Mindanao (Bukidnon, Davao del Sur, Sulu, Basilan, and Camiguin) or in the mountainous region of Northern Luzon (Kalinga, Mt. Province, Abra, and Ifugao). In terms of health, provinces with favorable health conditions are the following: Metro Manila, Cebu, Isabela, Cavite, Bulacan, Batangas, Negros Occidental, Bohol, Pangasinan, and Quezon. On the other hand, provinces with relatively poor health conditions are: Capiz, Apayao, Antique, Aklan, Maguindanao, Lanao del Sur, Basilan, Northern Samar, Tawi-Tawi, Sulu. In terms of governance score, the provinces which rank the highest are the following: Metro Manila, Rizal, Laguna, Pangasinan, Bulacan, Negros Oriental, Benguet, Cavite, Cebu, and Tarlac. Meanwhile, the provinces which fared poorly in the governance scores are the following: Sorsogon, Southern Leyte, Zamboanga del Sur, Sarangani, Occidental Mindoro, Lanao del Sur, Romblon, Masbate, Surigao del Sur, and Maguindanao. This analysis highlights the diversity of the provinces in the Philippines in which firms could utilize when deciding to locate in the Philippines.

Figure 4.6 Map of Socio-economic Indices



Source: Author's own construction

#### 4.3.4 Results of principal component analysis (PCA)

PCA is a tool used for exploratory data analysis. PCA is a technique that is used to discern the similarities or difference in the set of variables and plot these variables into two-dimensional scale. PCA is developed by Karl Pearson in 1901 and was further refined by Harold Hotelling in 1930s. Mathematically speaking, PCA creates uncorrelated indices or component from the initial set of correlated variables. These components are linear weighted combination of the initial variables. The eigenvectors of the correlation matrix define the weights of each principal component. The first principal component (PC1) denotes the largest possible amount of variation in the original data, given that the sum of the squared weights is equal to one. The second principal component (PC2) and subsequent component explain additional variance but less than the first component and also completely uncorrelated with the first component. The fewer components mean that there is a high degree of correlation among the original variables.

This study applies Bartlett test of sphericity and the Kaiser-Meyer-Olkin(KMO) measure of sampling adequacy to assess the appropriateness of PCA.. The Bartlett test of sphericity assess whether the values of the correlation matrix equal zero (small significance would mean that there are real correlations between variables). The KMO measure of sampling adequacy evaluates whether the partial correlation is high. The accepted level of KMO measure should be at least 0.6 and communalities should be at least 0.3. The table below gives the results of PCA appropriateness test. The supposition by Bartlett's test that there is no correlation significantly different from 0 between variables is rejected as the computed value is lower than significance level at  $\alpha=0.5$ . Meanwhile, the KMO measure is significantly high at 0.820. Therefore, the preconditions for PCA appropriateness have been fulfilled sufficiently.

**Table 4.6 Barlett's Test and KMO**

Barlett's test of sphericity	
Chi-square (Observed value)	317.615
p-value	<0.0001
KMO	0.820

Source: Author's own construction

The study uses the computed values of the 6 indicators (economic, education, security, infrastructure, health, and governance). The data matrix contains 6 data set that belongs to 80 provinces has dimensions of 6X80. The first principal component (PC) accounts for 62.482 percent of the total variance with Eigenvalue of 3.749 and the second principal component accounts for 17.465 percent of the total value with Eigenvalue of 1.048. Eigenvalues specify how sufficient the principal components to explain the deviation of all the variables. They must be at least 1.00 to be included in the analysis so in this case only the first PC is included in the analysis. The first PC alone accounts for 62.482 percent of the total variance of the variables and the second PC accounts for 17.47 percent of the total variance. The table below shows the principal component loading matrix. The column indicates the weight of the

variable on principal components and also specifies the direction of these weights. The positive sign indicates relation in the same direction and the negative sign indicates relation in opposite direction. Factor loadings should be at least 0.3 to be included in the analysis. The economic, education, infrastructure, health, and governance have significant loadings for the first PC. The variables under the first PC can be categorized as economic indications. While, security and health have significant loadings for the second PC and these two variables can be categorized as security indicators.

**Table 4.7 Factor Loadings**

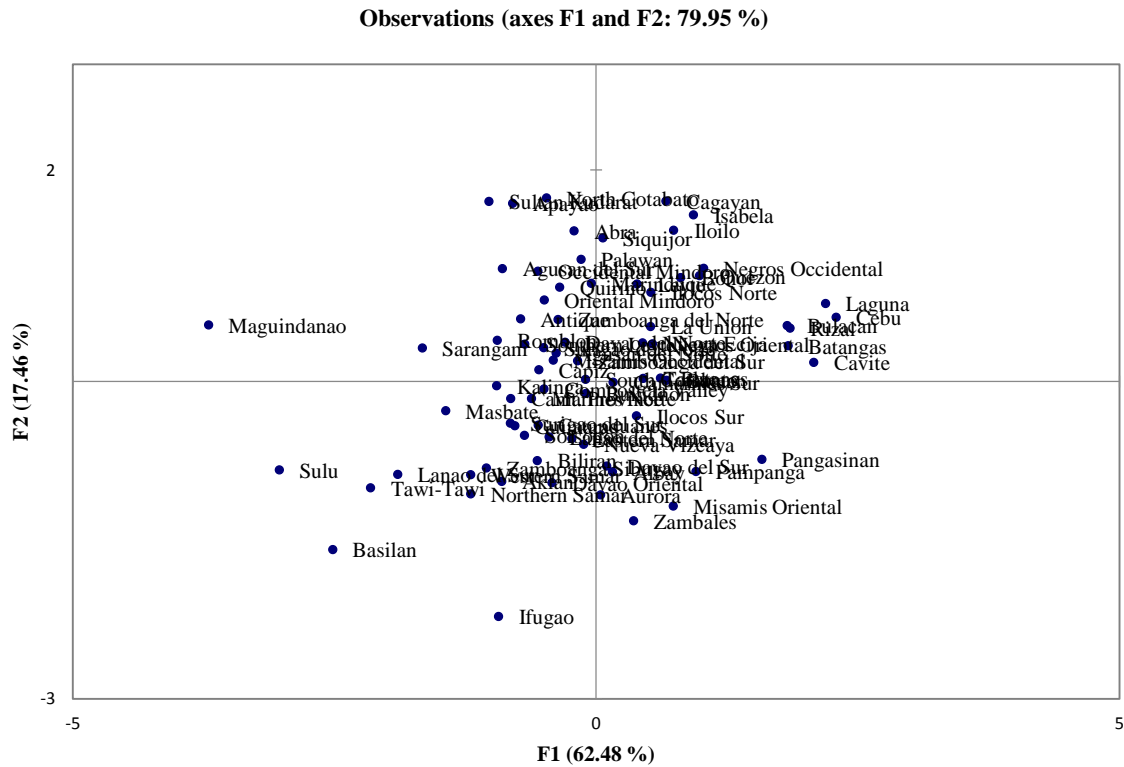
	F1	F2
Economic	0.932	-0.080
Education	0.857	-0.002
Security	0.107	0.969
Infrastructure	0.865	-0.027
Health	0.756	0.243
Governance	0.903	-0.207

Source: Author's own construction

The result of the principal component analysis makes it possible to identify a homogenous grouping of provinces with similar characteristics. The provinces with relatively good economic and stability indicators are located in Quadrant I or North East Corner. Meanwhile, the provinces with good economic condition but relatively not favorable stability situation are located in Quadrant II or South East corner. The provinces with relatively good security indicators but relatively unfavorable economic conditions are found in the Quadrant III or Northwest corner. The provinces with both poor economic and security situation are located in the Quadrant IV or the Southwest corners. Metro Manila is considered as an outlier as it is located in the far corner of the Quadrant II which means that it has very good economic situation but relatively unfavorable security condition.

This representation allows easy identification of the characteristics and comparative competitiveness of the provinces in the Philippines. This is particularly useful for the firms who are planning to locate in the Philippines. For instance, firms that conduct high-technology processes and research and development (R&D) can select the provinces with high education-level, or firms that handles assembly or logistics can choose to locate in the provinces with relatively well-built infrastructure. Furthermore, this representation can also be helpful to policymakers and local administrators who are aiming to revitalize local economy and improve social conditions.

**Figure 4.7 Principal component analyses of the provinces in the Philippines**



Source: Author's own construction

#### 4.4 The Urban System Structure in the Philippines

This section discusses the development of cities in the Philippines, identifies spatial pattern of cities, and analyzes the relation between the dynamism index and urban system index.

##### 4.4.1 Definition of Cities

The 144 cities in the Philippines are classified into three categories: highly-urbanized cities, independent component cities and component cities. There are 34 highly-urbanized, 5 independent component cities, and the rest are component cities of their respective provinces and are defined as follows:

*Highly Urbanized Cities* - Cities with a minimum population of two hundred thousand (200,000) inhabitants and with the latest annual income of at least 500 million pesos based on 2008 constant prices. Highly-urbanized cities are autonomous from provinces.



*Independent Component Cities* - Cities that are independent from the provinces and as such their charters ban residents from voting for provincial elective officials (although some are allowed to participate). These cities have a minimum population of 150,000 and earns at least 350 million pesos based on 2008 constant prices

*Component Cities* - Cities which do not meet the preceding requirements are deemed part of the province in which they are geographically located. If a component city is located along the boundaries of two (2) or more provinces, it shall be considered part of the province of which it used to be a municipality.

The definition of cities in the Philippines varies significantly with the definition of cities in other countries. As the urban system in every country is different, there is no standardized international definition of a city.

**Table 4.8 Definition of Cities in Selected Countries**

<b>Countries</b>	<b>Definition</b>
United	Places of 2,500 or more inhabitants and urbanized areas
Japan	50,000 or more inhabitants with 60 per cent or more of the house located in the main built-up areas and 60 per cent or more of the population engaged in urban type of business
India	having 5,000 or more inhabitants, a density of not 1,000 persons per square mile, and at least three fourths of the adult male population employed in pursuits other than agriculture
Mexico	localities of 2,500 or more inhabitants
France	communes containing an agglomeration of more than 2,000 inhabitants living in contiguous houses
Spain	localities of 2,000 or more inhabitants
Canada	places of 1,000 or more inhabitants, having population density of 400 or more per square kilometer

Source: Department of Economic and Social Affairs, 2003, Demographic Yearbook 2001, New York: United Nations cited in Chen(2008)

**Table 4.9 City Income Class**

<b>Class</b>	<b>Average Annual Income</b>
First	P 400 M or more
Second	P 320 M or more but less than P 400 M
Third	P 240 M or more but less than P 320 M
Fourth	P 160 M or more but less than P 240 M
Fifth	P 80 M or more but less than P 160 M
Sixth	Below P 80 M

Source: National Statistical Coordination Board(NSCB)

The cities are also categorized according to their average annual income. There are six classes of cities in the Philippines as shown in table above. In order for a municipality to be converted into a city, the municipality must satisfy the following requirements:

- Locally generated income of at least 100 million pesos (based on constant prices in the year 2000) for the last two consecutive years, AND
- Population of 150,000 or more, as certified by the (NSO); OR a contiguous territory of 100 square kilometers

#### 4.4.2 Spatial Pattern of Cities in the Philippines

Half of the highly-urbanized cities are located within the National Capital Region (NCR), while the rest are scattered across different regions. Region 4A (Calabarzon) has the most number of cities with 18 cities; 2 highly-urbanized and 16 component cities. Region 6 (Western Visayas) and Region 7 (Central Visayas) are also home to the many cities with 16 cities each. Cordillera Administrative Region (CAR) and Autonomous Region of Muslim Mindanao (ARMM), both regions which are located far from the capital have 2 cities.

**Table 4.10 City Status**

<b>Region</b>	<b>Highly-urbanized</b>	<b>Independent Component</b>	<b>Component</b>
NCR	16	0	0
CAR	1		1
Region 1- Ilocos		1	8
Region 2-Cagayan Valley		2	2
Region 3- Central Luzon	2		12
Region 4A- Calabarzon	2		16
Region 4B-MIMAROPA	1		1
Region 5-Bicol		1	6
Region 6-Western Visayas	2		14
Region 7-Central Visayas	3		13
Region 8- Eastern Visayas	1	1	5
Region 9- Zamboanga Region	1		4
Region 10-Northern Mindanao	2		7
Region 11- Davao Region	1		6
Region 12- SOCCKSARGEN	1	1	3
Region 13-CARAGA	1		5
ARMM			2

Source: NSCB

National Economic Development Authority (NEDA) identifies 12 major metropolitan areas in Philippines. These metropolitan areas are composed of different component cities and have different policy and management structure. Metro Manila is the biggest metropolitan areas followed by Metro Cebu and Metro Davao. Seven out of the twelve metropolitan areas are

located in the main island of Luzon.

**Table 4.11 Metropolitan Areas in the Philippines**

Rank	Description	Island Group	Component cities/municipalities
1	Metro Manila	Luzon	Manila, Caloocan, Las Piñas, Makati, Malabon, Mandaluyong, Marikina, Muntinlupa, Navotas, Parañaque, Pasay, Pasig, Pateros, Quezon City, San Juan, Taguig, Valenzuela
2	Metro Cebu	Visayas	Cebu City, Carcar, Compostela, Consolacion, Cordova, Danao, Lapu-Lapu, Liloan, Mandaue, Minglanilla, Naga, San Fernando, Talisay
3	Metro Davao	Mindanao	Davao City, Digos, Panabo, Samal, Santa Cruz, Carmen, Tagum
4	Metro Cagayan de Oro	Mindanao	Cagayan de Oro, Alubijid, Claveria, El Salvador City, Gitagum, Jasaan, Laguindingan, Opol, Tagoloan, Villanueva, ]
5	Metro Angeles	Luzon	Angeles, Bacolor, Mabalacat, Porac, San Fernando
6	Metro Bacolod	Visayas	Bacolod, Bago, Murcia, Silay, Talisay
7	Metro Iloilo-Guimaras	Visayas	Iloilo City, Guimaras Province, Leganes, Oton, Pavia, San Miguel, Santa Barbara
8	Metro Naga	Luzon	Naga, Bombon, Bula, Calabanga, Camaligan, Canaman, Gainza, Magarao, Milaor, Minalabac, Ocampo, Pamplona, Pasacao, Pili, San Fernando
9	Metro Baguio (BLIST)	Luzon	Baguio, La Trinidad, Itogon, Sablan, Tuba
10	Metro Batangas	Luzon	Batangas City, Bauan, San Pascual
11	Metro Dagupan (CAMADA)	Luzon	Calasiao, Mangaldan, Dagupan
12	Metro Olongapo	Luzon	Olongapo, Subic

Source: NEDA

As some cities were created before the enactment of Local Government Code, some of them did not satisfy the population requirement. For the purpose of comparison, cities were grouped according to population size: small (less than 150,000), medium (151,000- 200,000), and large (201,000 and above). Based on the graph below, large cities are concentrated within three adjacent regions of National Capital Region (NCR), Region 3 (Central Luzon), and Region 4A (Calabarzon). Many small cities are located in Region 6 (Western Visayas) and Region 7 (Central Visayas).

**Table 4.12 Regions and City Sizes**

Regions	Land Area	GRDP (%)	GRDP Per capita	City Size			Total
				Small	Medium	Large	
NCR	636	35.73	183.75	1		15	16
CAR	84	2.2	73.57	1		1	
R1-Ilocos	12,840	3.07	39.81	7	2		9
R3-Central Luzon	21,470	9.21	55.07	5	1	8	14
R4A-Calabarzon	16,229	17.39	82.39	4	1	13	18
R5-Bicol	17,632	1.97	22.31	3	3		
R6-Western Visayas	20,223	4.11	35.56	10	4	2	16
R7-Central Visayas	14,891	6.3	56.51	11	1	4	16
R8-Eastern Visayas	21,432	2.29	34.31	4	2	1	7
R9-Zamboanga Region	15,997	2.09	37.28	3	1	1	5
R10- Northern Mindanao	14,056	3.8	53.63	5	2	2	9
R11-Davao Region	27,141	3.84	52.2	3	1	2	6
R12-SOCCKSARGEN	14,373	2.73	40.04	2	1	2	5
CARAGA	18,847	1.23	30.95	5	0	1	6
ARMM	11,608	0.76	14.32	2			

\* Land Area(sq.kms.), Population(2007) in thousand, GRDP(2012), GRDP per capita(2012) in thousand pesos

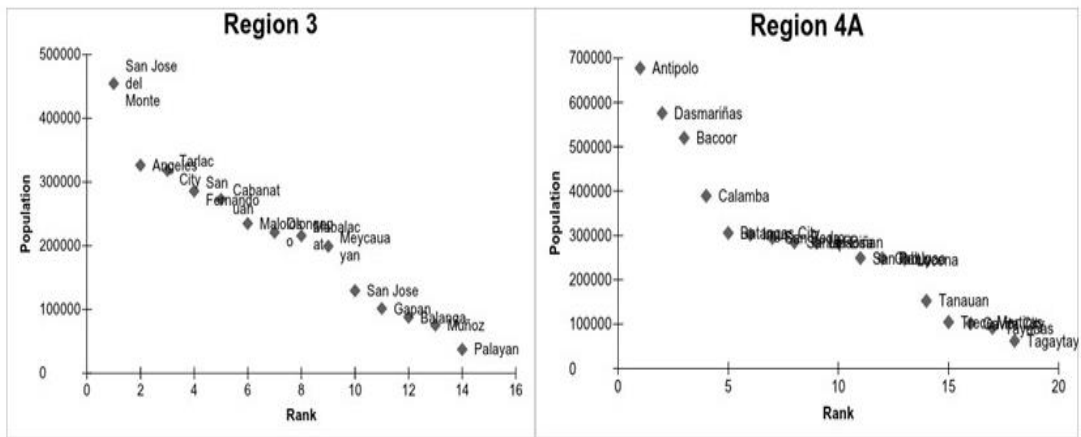
Source: National Statistical Office(NSO)

There are four distinct patterns that can be observed based on the classification of cities according to size: Big cities regions, Small cities regions, and Primary cities regions. All of the 16 cities in NCR, except San Juan, are considered large with Quezon City as the biggest city with 2.8 million populations. Majority of the cities in Region 3 and Region 4A are comparatively larger than other regions in the country. San Jose del Monte is the biggest in terms of population with 454,553 residents in Region 3, and other hand, Palayan City in Nueva Ecija is the smallest with 37,219 residents (this figure is smaller than the present population requirement for cityhood). Antipolo is the biggest with 677,741 residents in Region 4, while Tagaytay is the smallest with only 62,030 residents. While these two regions have similar city system pattern, their economic structure is slightly different. These regions are second and third largest regional economy. Region 4A relies primarily on the industry sector, while Region 3 is mainly based on both industry and services and still sources 16.8 percent of its regional output from agriculture.

Region 6 and Region 7 are considered as small-cities regions with majority of the cities

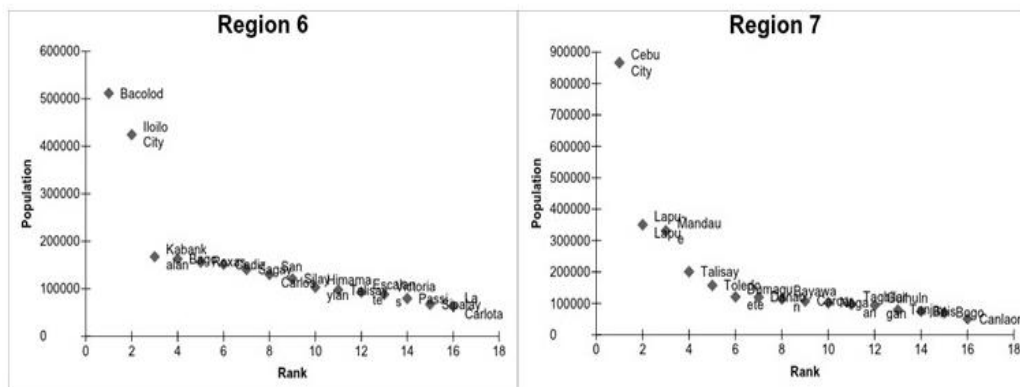
having a population of less than 150,000. Bacolod and Iloilo are the only two large cities in Region 6 while the rest are small with Carlota as smallest with 63, 852 inhabitants. On other hand, Region 7 has four large cities and all of which are located in Cebu Province: Cebu City, Lapu-Lapu, Mandaue, and Talisay. However, 10 out of 16 cities have a population smaller than 150,000 with Canlaon as the smallest with 50,627 inhabitants. In terms of economic structure, these two regions are quite different. Region 6 is 5<sup>th</sup> biggest economy and Region 7 is the 4<sup>th</sup> largest economy. While both regions are primarily based on the services sector, Region 7 source 37 percent of its output from the industry sector, more than double compared with 18 percent of Region 6.

**Figure 4.8 Big Cities Regions**



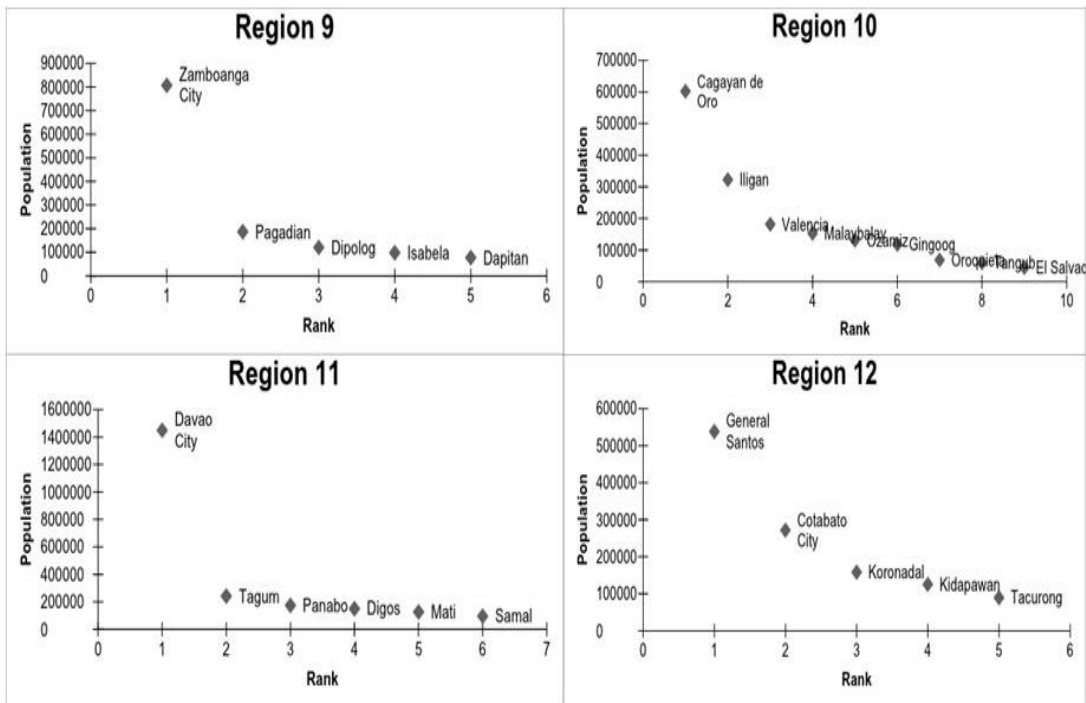
Source: Author's own construction

**Figure 4.9 Small Cities Region**



Source: Author's own construction

**Figure 4.10 Primary City Regions**



Source: Author's own construction

Meanwhile, a number of regions fall under the category of primary cities wherein one or two cities are considerably larger than the rest of the cities within the region: Zamboanga city in Region 9, Cagayan de Oro in Region 10, Davao city in Region 11, General Santos in Region 12. Interestingly, these regions also exhibited similar economic structure. Services sector accounts for 39-45 percent of total regional output, and industry sector contributes 28-39 percent. Region 11 is the only region with more than 50% of its output coming from the services sector.

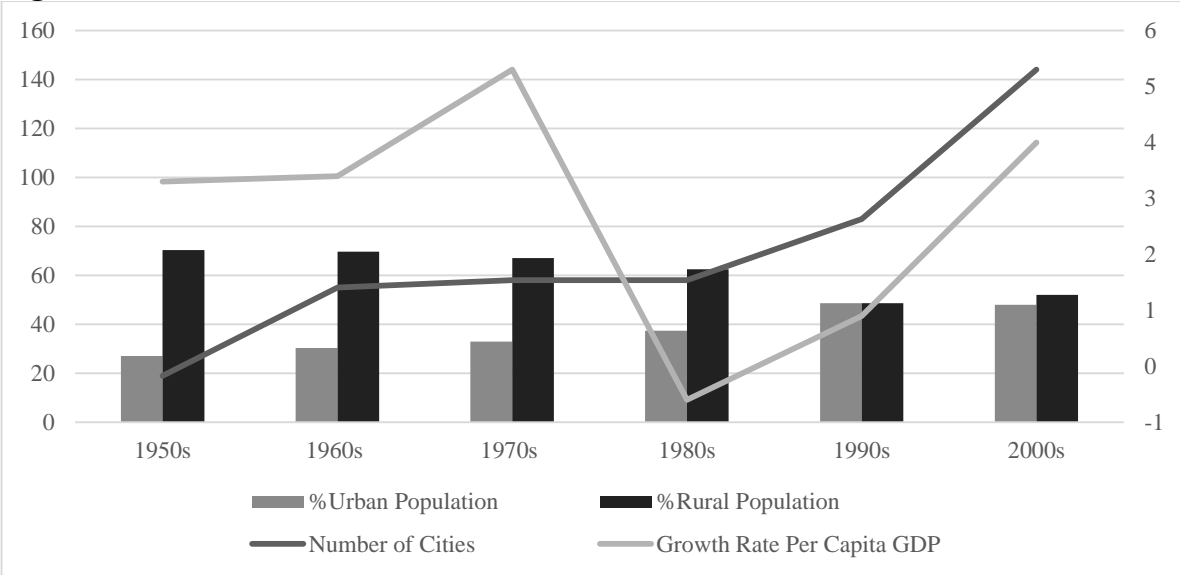
#### 4.4.3 Historical Development of Cities

The Philippines was under occupation by foreign power for more than 400 years. However, during the pre-colonization period, independent kingdoms or states exist. During pre-colonial period, the settlements are largely concentrated along coastal areas with access to external trade. Manila was instituted as the capital city of the Spanish colonial government in 1571. The urban clusters during Spanish period were established not only as trading centers but also defensive post from which control of indigenous population is possible. The Philippines was a rich source of raw materials for the Spanish colonial government, thus the economic activities were largely concentrated within traditional agricultural regions of Visayas, Bicol

and Ilocos (Pernia, 1982). Doepper (1972) cited in Antipolo (2010) identified the hierarchy of settlements during the Spanish era: 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. This uneven distribution in urban center will persist over the next centuries.

During the post war period in the 1950s, there were only 18 cities in the country and almost 70 percent of the population still lives in the rural areas. During this period, the Philippines was faced with serious balance of payment and foreign exchange crisis, thus import-substitution-industrialization (ISI). Moreover, the incumbent administration has heavily favored economic nationalism through the Filipino First Policy. As discussed earlier, this ISI policies left a substantial effect on the spatial development as it allowed the capital-intensive industries located in Metro Manila and Southern Luzon to grow rapidly as compared to resource-based industries (Sicat, 1968, cited in (Mercado, 2002). The shift of population and economic activity in this period from the traditional agriculture regions to Metro Manila left a huge imprint in the spatial structure of the urban areas.

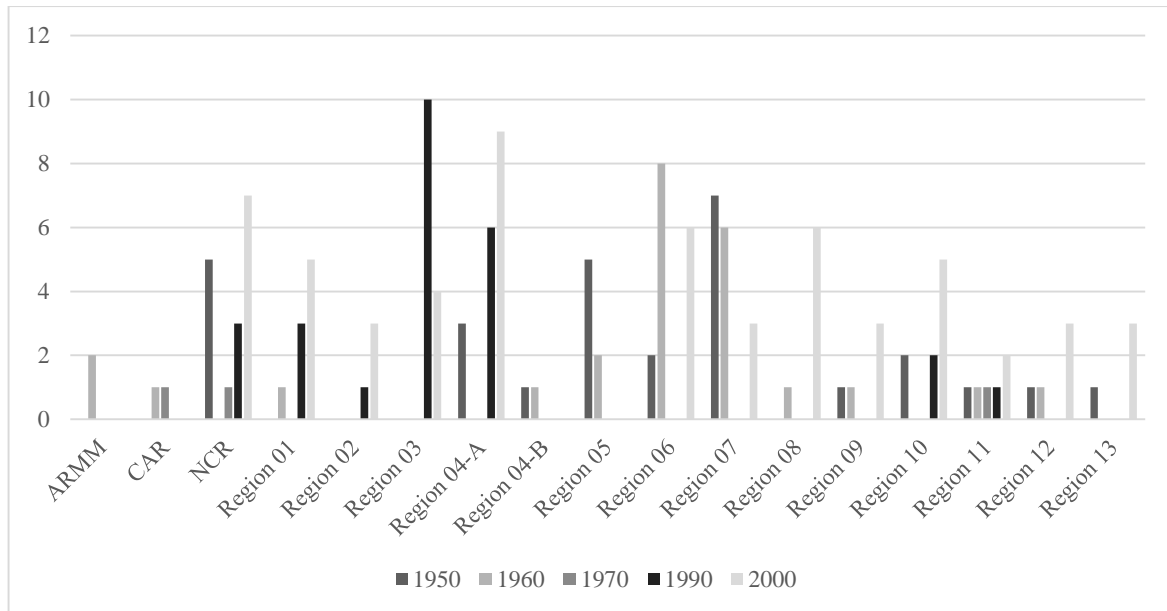
**Figure 4. 11 Cities, Urbanization, and Economic Growth**



Source: NSCB

The momentum of urban growth continues until 1960s wherein 36 new cities were created but later slowed down in 1970s-1980 wherein only 3 new cities were established. As the growth gained during the ISI was not sustained, the policies have shifted to economic liberalization in late 1960s.

**Figure 4.12 Location of Cities Created from 1950s-2000s**



Source: NSCB

The significant growth in the number of cities that have occurred from 1990s coincides with the remarkable increase in population. There were 91 new cities that were ratified and almost half of the population is now living in the urban areas. The enactment of Local Government Code (LGC) of 1991 has triggered the rapid conversion into new cities. The local government units (LGU), particularly, the cities have larger share in the national taxes in the form of Internal Revenue Allotment (IRA).

#### 4.4.4 Derivation of Urban System Index

Capello (2004) argued that urban size affects locations costs and benefits. Furthermore, the influence of urban size should be look at based on the efficient city size, which is in relation to what the city produces, how it produces, and the way in which it is embedded within the urban system. Ishikawa (2015) argued that city system is an important location factor for the firms, and it reflects the socio and economic performance of a particular location. City system is also important for local administrators in policy-making process. This section will analyze the characteristics of city system in the Philippines.

To examine the spatial structure of the city system in the Philippine, this study utilizes Ishikawa (2015) city system index (CSI). 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.

Coefficient of Divergence (CD) which denotes the characteristics of 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 population in the region.

$$1 = \sum_{r=1}^N p_r \quad (4-4)$$

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 (4-5) with regards to the equation (4-4).

$$H = - \sum_{r=1}^N p_r L_N(p_r) \quad (4-5)$$

Since there is apriori 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 then summing up these values and finally dividing it by  $N$ .

$$CD = \left(\frac{1}{N}\right) \sum_{r=1}^N p_r L_N(r) \quad (4-6)$$

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

$$CD = N^{-2} \sum_{r=1}^N L_N(r) \quad (4-7)$$

The lower value of CD indicates that the urban population tends to diverge towards the largest city of the city system.

Spatial Convergence (SC) which denotes the spatial characteristic of the city system is derived as follows:

Assuming that there are  $N_i$  ( $i=1,2,3,\dots,N$ ) 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 cities and then the average least distance is derived as below.

$$AD = \left(\frac{1}{N}\right) \sum_{i=1}^N d_i \quad (4-8)$$

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 located closer to each other.

$$SC=AD/2\left(\frac{N}{M}\right)^{0.5} \quad (4-9)$$

The values of CD and SC are then combined to construct the urban system index (USI). USI is expressed in the equation below.

$$USI=((\alpha CD)^2+(\beta SC)^2)^{0.5} \quad (4-10)$$

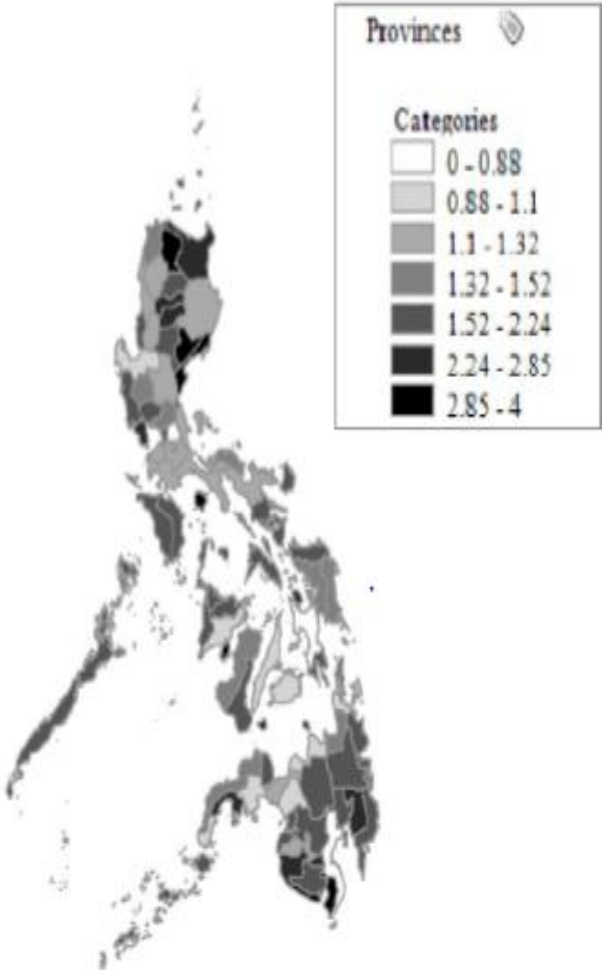
Where  $\alpha$  and  $\beta$  are both positive parameter. The lower value of USI indicates that the structure of the urban system is converging in terms of population distribution and location of cities. The higher value of USI denotes that the structure of urban system has characteristics of leveling in term of population distribution and location of cities.

This study has calculated the urban system index of the provinces of the Philippines. The population and nearest distances of 144 cities and 1496 municipalities were calculated using excel VBA and R software. The parameters in equation 7 is assumed at  $\alpha=20$ , and  $\beta=0.5$ .

#### **4.4.5 Urban System Index in the Philippines**

Figure 4.13 presents a map of the computed urban system index. Provinces with darker shade have higher computed USI, while provinces with lighter shade have relatively lower computed USI. The value of USI ranges from 3.226 (highest) – 0.603 (lowest). The provinces with the highest USI values or those with urban system characterized as relatively uniform in terms of population and spatial distribution of cities are as follows: Guimaras, Marinduque, Apayao, Sarangani, and Quirino. Meanwhile, the provinces with lowest USI values or those with urban system characterized by the relative concentration of population and cities to the primary city are as follows: Leyte, Rizal, Davao del Sur, Cebu, and Misamis Oriental.

**Figure 4.13 Map of Urban System Index in the Philippines**



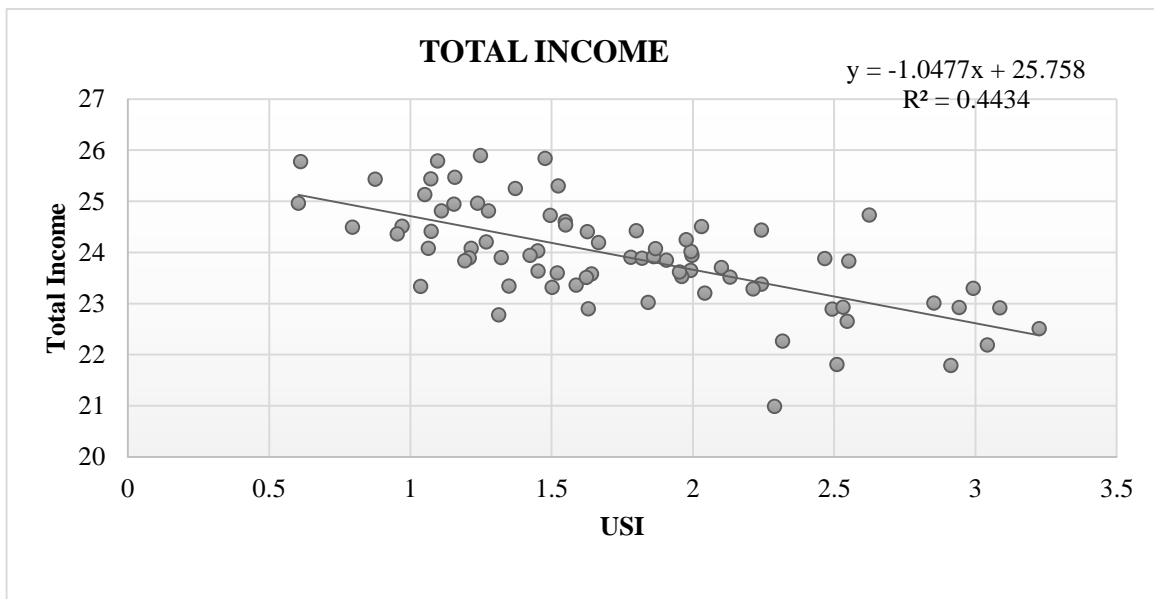
Source: Author's own construction

#### 4.4.6 Urban System Index and Provincial Socio-economic Performance

This section analyzes the relation between the USI and the provincial socio-economic performance presented in the previous sections. Ishikawa (2015) found out that lower values of USI or urban system that is characterized by convergence in terms of population and city distribution tend to have higher socio- economic performance.

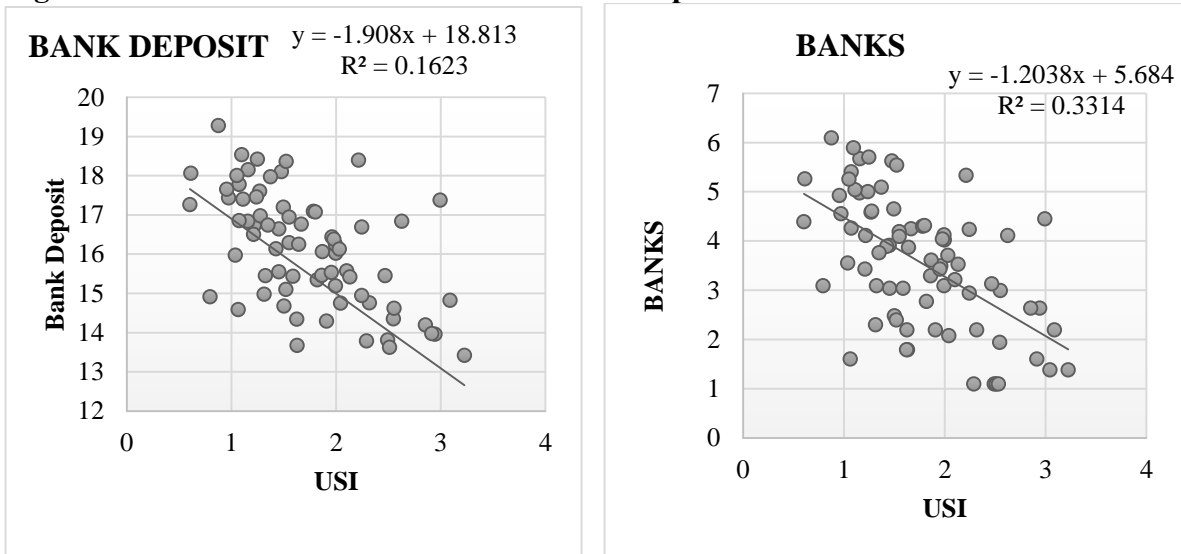
The inverse linear relationship between lower USI and higher socio-economic indicators is also observed in the case of the Philippines. The following socio-economic indicators tend to be high in provinces where there is convergence of population and city distribution towards the primary city. Total Income, Bank Deposit, Number of Banks, Number of MSME, Number of College Graduates and Higher Education Institution, Road Density, Number of Telephone lines, Number of Government Health Workers, Number of Doctors, Number of Barangay Health Stations, and Local Finance.

**Figure 4.14 Total Income**



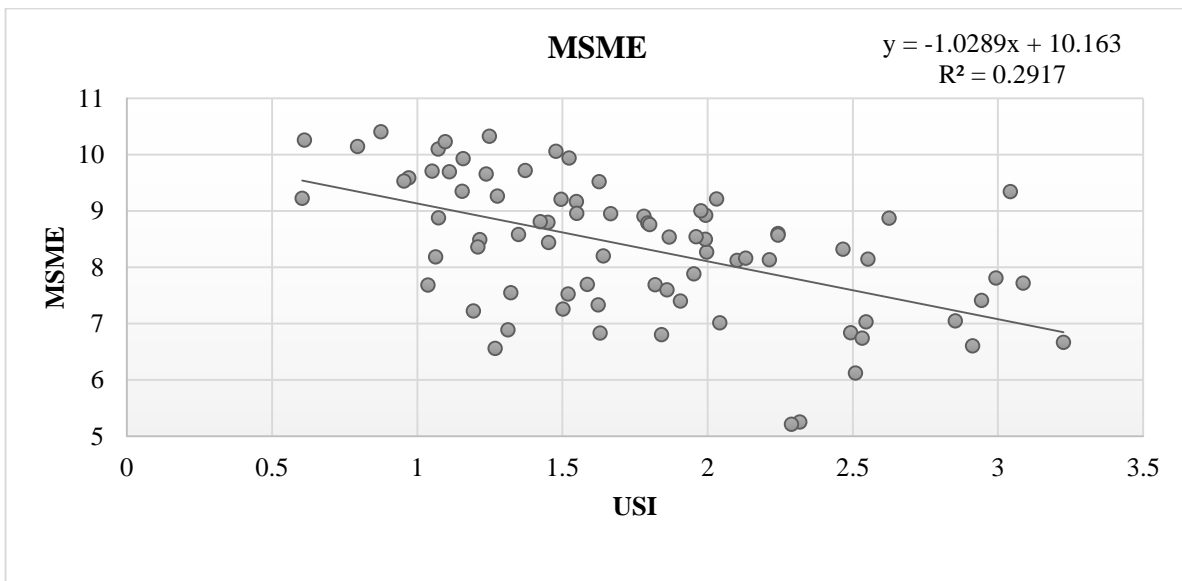
Source: Author's own construction

**Figure 4.15 Number of Banks and Total Bank Deposit**



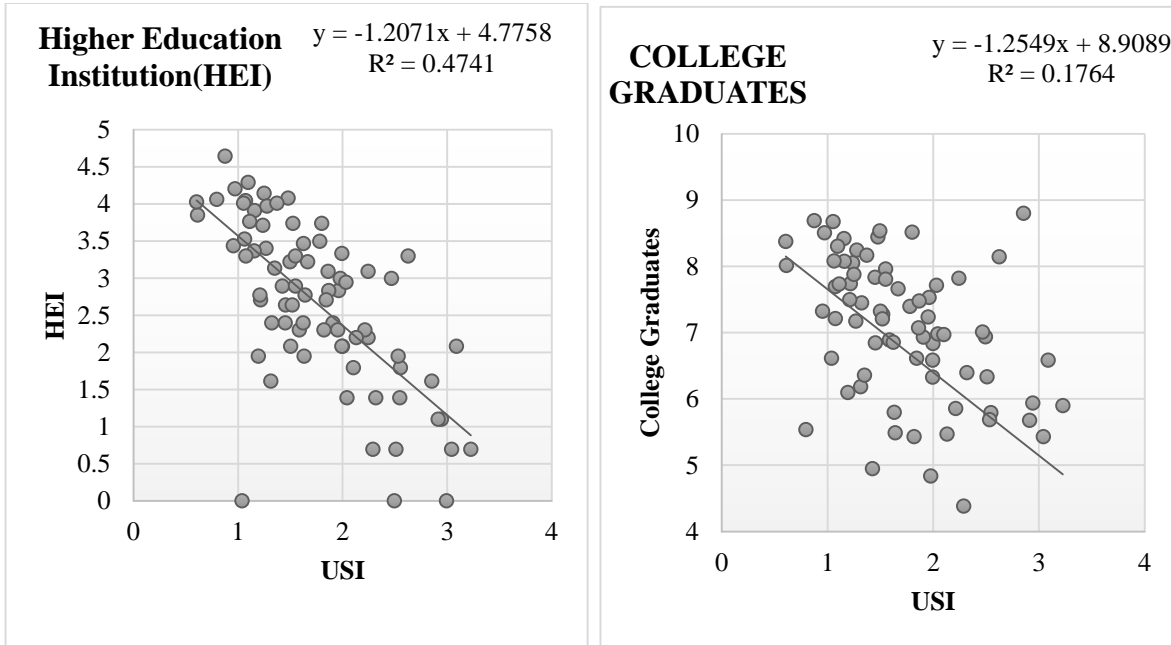
Source: Author's own construction

**Figure 4.16 Number of MSMEs**



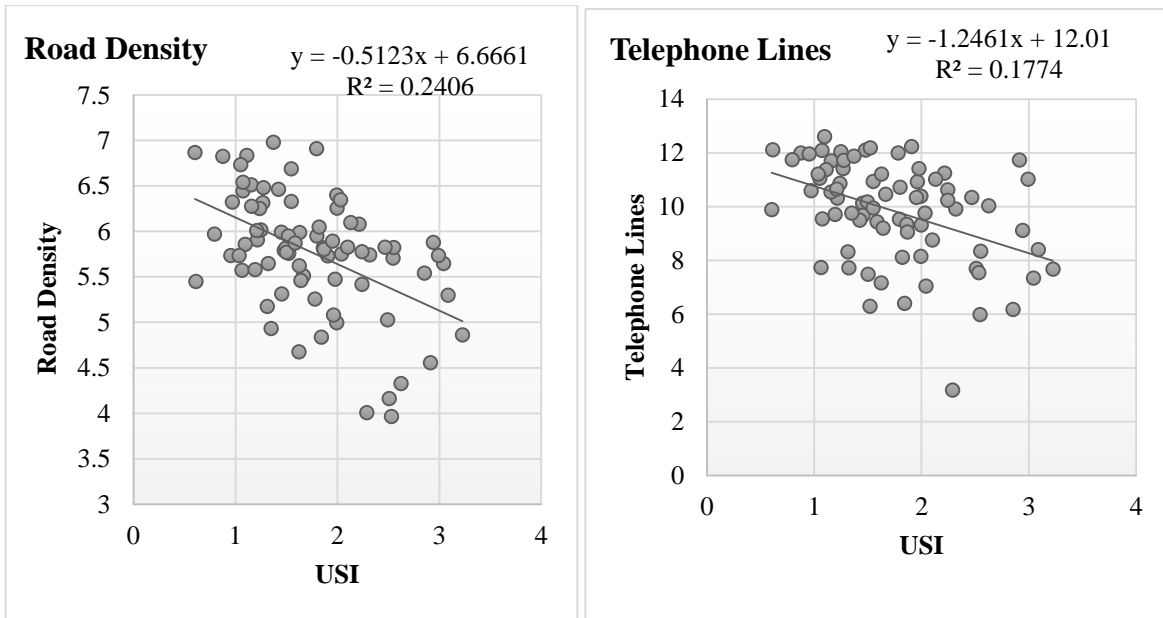
Source: Author's own construction

**Figure 4.17 Number of Higher Education Institutions and Number of College Graduates**



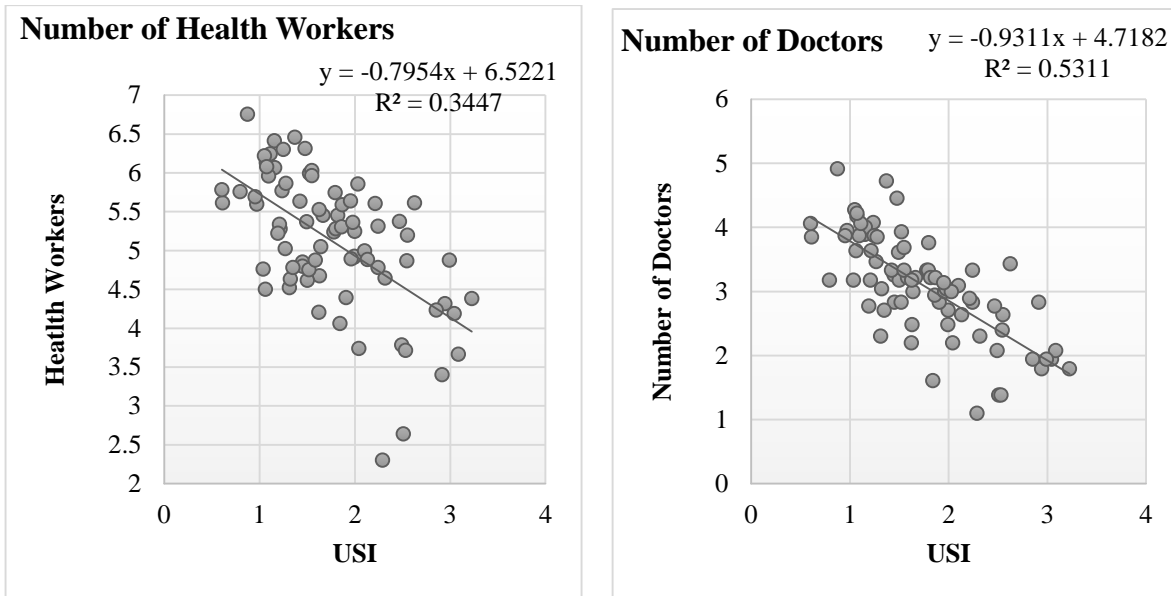
Source: Author's own construction

**Figure 4.18 Road Density and Number of Telephone Lines**



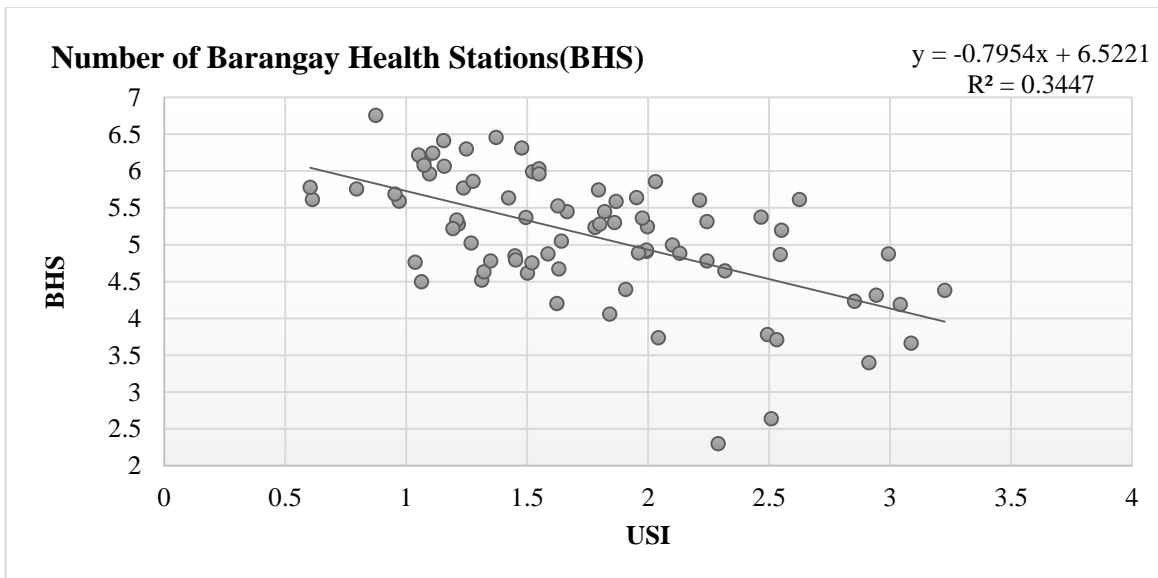
Source: Author's own construction

**Figure 4.19 Number of Government Health Workers and Doctors**



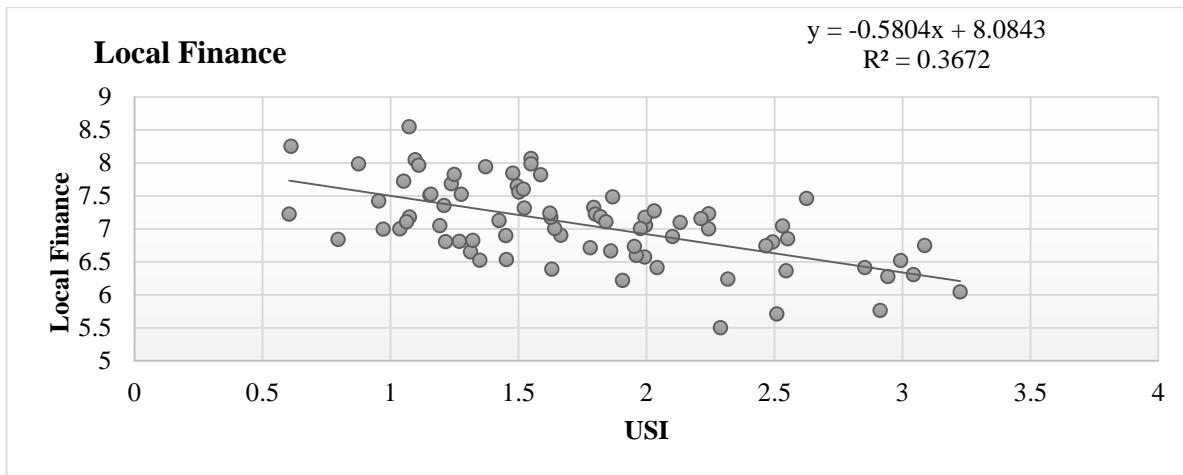
Source: Author's own construction

**Figure 4.20 Number of Barangay Health Stations**



Source: Author's own construction

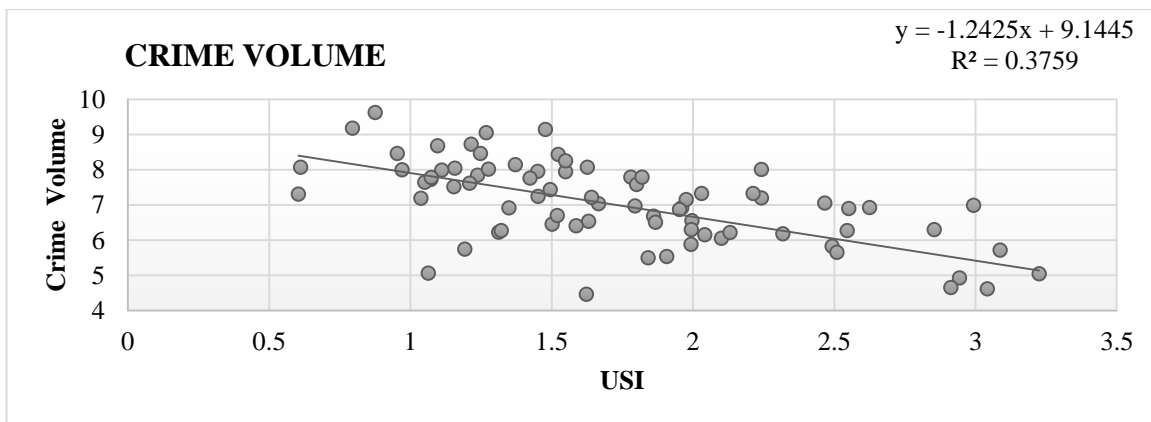
**Figure 4.21 Local Finance (Total Local Financial Resources)**



Source: Author's own construction

Meanwhile, in the study by Ishikawa (2012) some indicators are found to have positive relationship with USI values, particularly social welfare. Contrary to the findings of Ishikawa (2012), in the case of the Philippines, the social welfare condition as represented by the number of government health workers, number of doctors, and number of barangay health station is relatively better in provinces with urban system converging towards the primary city. On the other hand, in terms of safety, it can be inferred that provinces with lower USI values or those with level urban system are less dangerous as evidenced in the higher volume of crimes recorded among provinces with higher USI. This is in line with many studies that support how urbanized cities are likely to have more crimes which could possibly be a “disagglomeration” factor for both firms and people.

**Figure 4.22 Crime Volume**



Source: Author's own construction



Based on the result of the analysis above, it can be deduced that if a firm is seeking for production efficiency, it makes sense to locate in provinces with urban system that has convergence. On the other hand, if the particular production process requires relatively stable and safer environment, it should locate in provinces with level urban system. If the firm is seeking the balance between production efficiency and safety, it can move to provinces with the average USI value. The findings of the study is also useful for the local administrators as it can guide them on which particular socio-economic component should they enhance or maintain in order to attract firms.

#### **4.5 Industrial System and Local Economic Development: Economic Zones in the Philippines**

This section discusses the economic zones in the Philippines and takes a closer look at the provinces where they are located.

##### **4.5.1 History of Economic Zones in the Philippines**

The shift to export promotion strategies in late 1960s led to the creation of the Bataan Export Processing Zone (BEPZ) in 1969, the first export processing zone in the Philippines. Four additional state-run export processing zones have been created in 1980s: Phividec Industrial Estate (PIE) in 1974, Baguio City Export Processing Zone (BCEPZ) in 1980, Cavite Export Processing Zone (CEPZ) in 1980, and the Mactan Export Processing Zone in 1986. These first generation economic zones are considered “enclaves” as the products were mainly for export and their intermediate and capital inputs are tariff-free (Manasan, 2013). Many studies have noted that poor performance of first general special economic zone, particularly BEPZ. Warr (1989) pointed out that these types of economic zones are costly relative to its benefit due to its remote location. Massive funding has been poured on to public infrastructure, such as road and housing and government-subsidized utilities. However, it still fails to attract potential locator firms and this reflects the ineffectiveness of incentives to influence the investment pattern and disperse industries into lagging areas.

The Philippines was driven to massive economic liberalization during the Ramos administration. At the forefront of the economic liberalization are the special economic zones (SEZs). SEZs are a significant economic strategy to attract foreign investments, boost export, and create employment. The SEZs veer away from the traditional state-run industrial zones as it allow the private participation in the development and management of the economic zones with minimum government interference. Furthermore, the limit on this type of industries and market orientation was lifted to attract more firms. Previously, incentives were only given to export-oriented firms who belong to the identified priority industries.

##### **4.5.2 Definition and Incentives of Economic Zones**

The enactment of the Republic Act 7916 or Special Economic Zones Act of 1995 allows the

participation of the private sector in the management of industrial estates. The same law also created the Philippines Export Processing Zone Authority (PEZA) which is mandated to oversee the development of the economic zones. These economic zones were further categorized into the following: industrial estates (IE), export processing zones (EPZ), free trade zone, tourism ecozones, and IT Parts/IT Buildings. The Special Economic Zones of 1995 were defined as:

“Special Economic Zones (SEZ)”- or ECOZONES, are selected, are highly developed or have the potential to be developed into agro-industrial, industrial tourist/recreation, commercial, banking, investment, and financial centers.

“Industrial Estate (IE)”- refers to a tracts of land developed for the use of industries. They have basic infrastructure such as road, water and sewage systems, pre-built factory building, and residential housing.

“Export Processing Zones (EPZ)”- are special IEs whose locator companies are mainly export-oriented. EPZ incentives include tax-and- duty free importation of capital equipment, raw materials, and spare parts.

“Free Trade Zones”- are areas in nearby ports of entry, such as seaports and airports. Imported goods maybe unloaded, repacked, sorted, and manipulated without being subject to import duties. However, if these goods are move into a non-free trade zone, they will be subjected to customs duties.

“Tourism Ecozones” - refers to tourism development zone/tourism estate declared as special economic zone suitable for development into an integrated resort complex with prescribed carrying capacities of tourist facilities and activities, such as, but not limited to, sports and recreation centers, accommodations, convention and cultural facilities, food and beverage outlets, commercial establishments and other special interest and attraction activities/ establishments, and provided with the necessary infrastructure.

“IT Parks/IT Buildings” are special economic zones for IT projects and services. An IT Park or an IT Building, the whole or part of which has been developed into a complex capable of providing infrastructures and other support facilities required by IT Enterprises, including amenities required by professionals and workers involved in IT Enterprises.

The following are the categories of enterprises qualified to location in the ecozone:

- Export Enterprise- manufactures assembles, or processes products which are 100% exported, unless a lower percentage is approved by PEZA.
- Free Trade Zone Enterprise- imports and markets tax and duty-free gods within the free trade area in the ecozone. Goods bought outside the free trade area will be subject to customs and tariff duties.
- Service Enterprise- conducts in any one of a combination of the following activities:

customs brokerage, trucking/forwarding, janitorial, security, insurance and/or banking, consulting, or any such service approved by PEZA.

- Domestic Market Enterprise- manufactures, assembles, processes goods which continually fails to export at least 50% of its total output for a period of three years if majority-owned by Filipinos and at least 70% if majority-owned by foreign nationals
- Pioneer enterprise- falls under any of the following conditions:
  - Manufactures, processes, or produces goods not produced in a commercial scale in the country.
  - Uses a design, formula, scheme, method, or process which is new and untried in the Philippines
  - Produces nonconventional fuels or manufactures equipment that utilizes nonconventional sources of energy
  - Develops areas for agri-export processing development
  - Given such status under the annual IPP<sup>17</sup> approved by the president
- Utilities enterprise- provides light and power, water supply and distribution, communications, and transportation system in the ecozone.
- Facilities enterprise- builds and maintains necessary infrastructure such as warehouse, buildings, road networks, ports, sewerage and drainage systems, and other facilities considered as necessary by PEZA in the development and operations of the ecozone.
- Tourism enterprise- operates sports and recreation center, accommodations, convention and cultural facilities, and other special interest and attraction activities/establishments with foreign tourist as primary clientele.
- Ecozone Developer/Operator- develops, operates, and maintains the ecozone, all component sectors (i.e., IEs, EPZs, Free Trade Zones, and Tourist Ecozones) and all related infrastructure (roads, light and power systems, drainage facilities, etc.)
- IT Enterprise-provides or operates IT services. IT is the collective term for the various technologies involved in processing and transmitting information, which include computing, multimedia, telecommunications, microelectronics, and their interdependences. Also called “informatics” or telematics,” the term now often refers to the convergence of various information-based, broadcast, and mass media communication technologies.

Firms choosing to locate within the ecozones are entitled to the following benefits:

- Tax and duty-free importation of capital equipment, raw materials, spare parts, suppliers, breeding stocks, and genetic materials
- Income Tax Holiday of four years for nonpioneer projects or six years for pioneer projects
- A special tax rate of 5% of modified gross income in lieu of all national and local taxes after Income Tax Holiday

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<sup>17</sup> Investment Priority Program(IPP)

- Tax credit for import substitution
- Exemption from wharfage dues, export tax, and import fees.
- Tax credit on domestic capital equipment, breeding stocks, and genetic materials
- Additional deduction for incremental labor expenses and training expenses
- Unrestricted use of consigned equipment
- Permanent resident status for foreign investors and immediate family
- Employment of foreign nationals
- Remittance of earnings without prior approval from the BSP<sup>18</sup>
- Exemption from local business taxes
- Exemption from Branch Profit Remittance Tax (BPRT) in the case of Philippines branches under 5% modified gross income

#### **4.5.3 Location of Economic Zones**

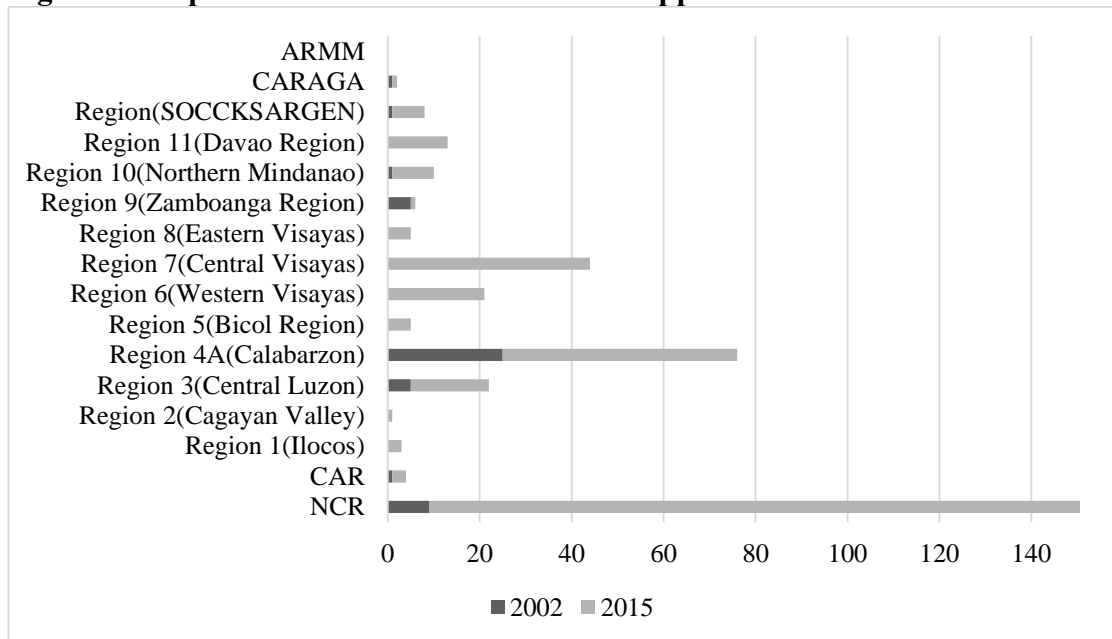
There are 326 economic zones operating in the Philippines as of May 2015. PEZA also manages four public ecozones; Bagiuo City Economic Zone, Cavite Economic Zone, Mactan Economic Zones, and Pampanga Economic Zones. In addition to ecozones under the supervision of PEZA, the Bases Conversion and Development Authority (BCDA)<sup>19</sup> manages four ecozones: Clark Freeport and Special Economic Zone, Poro Point Freeport Zone, and Bataan Technology Park. The Subic Bay Metropolitan Authority (SMBA) manages the Subic Bay Freeport Zone. The other ecozones were operated by government entities specifically tasked to operate them: Freeport Area of Bataan (formerly the Bataan Export Processing Zone), Cagayan Special Economic Zone and Freeport (CSEZF) Aurora Pacific Economic Zone and Freeport, and the Zamboanga City Special Economic Zone.

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<sup>18</sup> Bangko Sentral ng Pilipinas (BSP), the country's central bank.

<sup>19</sup> BCDA, is a government entity mandated to transform former US military bases into alternative productive civilian use, BCDA remains as a major force in creating economic opportunities in the country through its establishment of integrated developments, dynamic business centers and vibrant communities.

**Figure 4.23 Special Economic Zones in the Philippines**

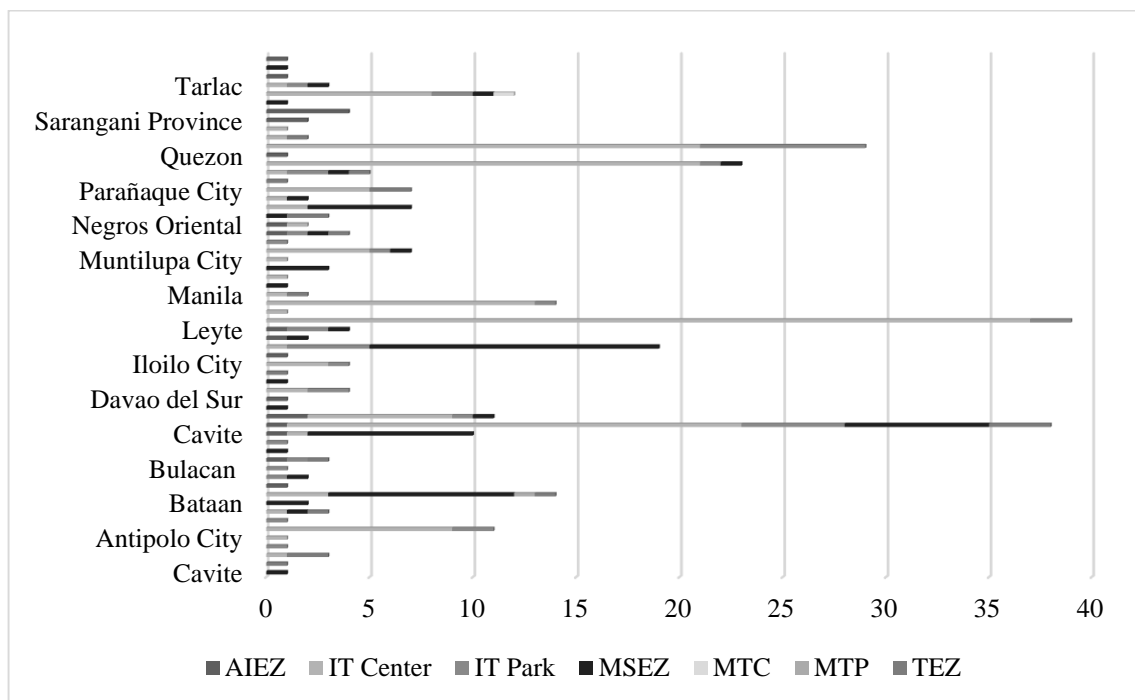


Source: PEZA

A huge number of special economic zones are located in NCR and its neighboring region of CALABARZON. However, looking at the categories of the special economic zones, majority of these special economic zones are IT Centers and IT Parks.

Out of 80 provinces, there are only 21 provinces hosting manufacturing economic zones which are mix of first generation economic zones like Bataan and second generation economic zones such as Davao City. Laguna is hosting the most number of manufacturing special economic zones with 14, followed by Batangas and Cavite, with 7 and 8 ecozones respectively. Table 4.12 lists down the number of manufacturing economic zones, socio-economic index and USI. Most provinces hosting manufacturing ecozones have relatively high socio-economic index, particularly provinces that are near Metro Manila such as Laguna, Batangas, and Cavite. Meanwhile, the urban system structure of provinces hosting manufacturing economic zones differs with provinces with almost uniform urban structure such as Bataan and Metro-Manila to highly-dense urban structure of Cebu, Leyte, and Davao Del Sur.

**Figure 4.24 Economic Zones in Provinces by Type**



Source: PEZA

**Table 4.13 Location of Manufacturing Economic Zones, Socio-Economic Index, and USI**

Provinces	Manufacturing Economic Zones	Socio-economic Index	USI
Laguna	14	0.588	1.096
Batangas	9	0.474	1.158
Cavite	8	0.521	1.248
Cebu	7	0.610	0.875
Pampanga	5	0.176	1.523
Misamis Oriental	3	0.103	0.954
Bataan	2	0.171	2.243
Baguio City(Benguet)	1	-0.210	1.268
Bulacan	1	0.487	1.477
Davao City(Davao del Sur)	1	-0.042	0.795
Davao Del Norte	1	0.060	1.977
General Santos City(South Cotabato)	1	-0.027	1.626
Lanao del Norte	1	-0.152	1.209
Leyte	1	0.174	0.603
Negros Occidental	1	0.331	1.371
Palawan	1	0.056	1.794

Pangasinan	1	0.351	1.073
Surigao del Norte	1	-0.094	1.037
Tarlac	1	0.114	1.495
Zambales	1	-0.002	1.781
Metro Manila	6	3.433	2.008

Source: Author's own construction

#### 4.6 Policy Implications

In recent years, the Philippines has become one of the fastest-rising economies in the world, primarily driven by the stellar growth of BPO (business process outsourcing) industry. The BPO industry generates around 15 billion dollars, employs around 900,000 Filipinos, and accounts for the 4-5% of the GDP. The Philippines has overtaken India as the world's BPO capital in 2010. The BPO industry has also paved the way for the development of new wave cities to accommodate the growing industry demand and decongest operation in Metro Manila. These new wave cities are Cebu, Clark, Bacolod, Baguio, Dumaguete, Iloilo, Lipa, Metro Bulacan, Metro Cavite, Metro Laguna, Metro Naga, and Metro Rizal. The highly-educated and English-speaking labor force, infrastructure and government support, and strong industry associations are often cited as the main driver behind the expansion of the BPO industry.

On the other hand, while the manufacturing sector has also grown in recent years with 8.1% in 2014, it still fails to generate new jobs and unemployment rate remains high at around 7% from 2006-2010. In terms of participation in the global value chain or international production networks, the Philippines has one of the total highest total participation indexes among Asia Pacific economies (Serafica, 2015). The participation index is estimated using the percentage of gross exports, the share of foreign inputs (backward participation), and domestically produced inputs in other countries' export (forward participation). The Philippines has been heavily involved in the electrical and electronics sector. However, while the participation rate in international production networks is high, this involvement is limited to labor-intensive, high-capital logistics, assembly, and testing and shipping (Aldaba, 2015).

The results of the analysis of the interplay among corporate taxation system, transfer pricing system, agglomeration economies in industrial park, local socio-economic performance, and urban system structure is valuable for both the manufacturing and service industry. As shown in the theoretical simulations, firms would likely to locate in particular countries with lower corporate taxation rate and offer agglomeration benefit in industrial parks. The Philippines offer various tax incentives if the firms chose to locate within the special economic zones within a specified period. However, current corporate tax rate of 30% is one of highest among the ASEAN economies. A significant review of corporate taxation system and incentives is needed.

As the empirical analysis has shown, there is a strong relationship between urban system structure and socio-economic performance. Firms who are after the economies of scale would

often be attracted to highly-densed cities. However, unabated expansion of big cities could lead to disagglomeration, such as the congestion that is happening now in Metro Manila. Thus, a better management of large urban areas is necessary to invite potential firms and ensure that firms who choose to locate will stay. Meanwhile, small urban system also stands to benefit from the fragmented production system where the firms have flexibility to move their production processes to appropriate locations. Thus, further development of the niche capabilities and maintenance of its comparative advantage (which in this case is peace order) is essential.



## **5. Summary and Conclusions**

### **5.1 Summary**

The flow of the study has proceeded in the following manner:

Chapter 1 provided an outline of the research, background of the research, research problem, significance of the research, overview of the methodology, and delimitations of the research were explained.

Chapter 2 presented selected location theories such as Marshall's Industrial District, Weber's Theory of Industrial Location, New Economic Geography, Scott's Industrial Space, Pontes and Parr's Agglomeration Economies and Shi and Yang Theory of Industrialization. The study refers to these previous researches in the construction of the analytical model

Chapter 3 explained the theoretical model and the results of the theoretical simulations incorporating corporate taxation system, transfer pricing, and agglomeration in industrial parks.

Chapter 4 introduced general overview of the international production networks in East Asia and basic information about the Philippines. The comparison of provincial dynamism index and analysis of the link between socio-economic performance and provincial dynamism were also conducted.

### **5.2 Conclusions**

To analyze the link between optimal location and local characteristics, the study has carried out theoretical and empirical analysis. The study adopts the model of the firm with two factories located in different location point as analytical framework to guide the inquiry. The study also uses the proposed two-step decision-making process in selecting potential location: international level and local level. To analyze the selection of optimal location at the international level, this study has performed theoretical simulations to analyze the impact of the selected factors, namely, corporate taxation system, transfer pricing system, and agglomeration economies within industrial park on the determination of potential location of factories. The study has conceived different scenarios to understand how the aforementioned factors impact the selection of the potential location. The results of the simulation shows a chaotic phenomenon which blurs out a specific location point, but nevertheless, presents a range of potential location. This range of prospective location guarantees the firm of achieving target profit as long as the firm decides to locate their factories within the range. The study also demonstrates that corporate tax rate affects the overall profit of the firm and also could dictate the possible location of the factories. In the scenario where there is difference in tax rate between two countries, the firm will not move the location of intermediate goods factory to the same location of final good factory as this setup will reduce the total profit of the firm. Meanwhile, the firms refers to corporate tax rate in order to determine the appropriate transfer price. Consequently, transfer price serves a guide in

allocating resources and determining the overall profit of the firm. The study also shows that agglomeration economies in industrial park encourages the firm to disperse their factories into two different locations, in particular if transports and tax rate is relatively low.

As the results of the theoretical simulations shows a wide range of potential location, the study infers that the Philippines is included within the range of potential location and conducts an examination of the socio-economic characteristics as well as the urban system structure of the provinces. To aid in the discussion of international production network narrative, the study have also briefly surveys the development of IPNs in East Asia. Many studies have noted the remarkable scale of IPNs in East Asia and some authors argued that the differences in terms of development and economic structure has contributed to the expansion and sophistication of international production networks. The study also provides and brief introduction about the Philippine and reviews the relevant economic policies and regional development strategies that has been pursued by the Philippines government. The review of the government policies and strategies shows that the Philippines have undertook significant regional or spatial development policies over the past years but most efforts were focus on dispersion of economic activities. The result of the constructed socio-economic index reveals a wide diversity of socio-economic characteristics among the provinces in the Philippines. Metro Manila and its neighboring provinces have consistently scored high in across different indicators (economic, education, security, infrastructure, and governance). On the other hand, provinces in Mindanao have fared poorly across different indicators. The result of principal component analysis classifies the provinces into four groups based on the similar characteristics: good economic condition and stable provinces; good economic condition but relatively unstable provinces; highly-stable but unfavorable economic situation; and poor economic and security condition provinces. The study also finds out that there is strong relationship between urban system structure and socio-economic performance. Urban system structure characterized by converging toward the primary city tends to perform better in socio-economic indices, except for the peace and safety component. In parallel to the development of IPN in Asia, this variability could be useful in a fragmented production system wherein firms can locate to provinces which match their production requirements.

### **5.3 Opportunities for Further Research**

This study opens up new avenues for further research and among those are the following research topic: cross-country comparison using the same analytical framework in determining the optimal location of the firms; time-series analysis of socio-economic characteristics and urban system structure of the provinces in the Philippines; and determination of the optimal location of the firms within the service industry.

As discussed earlier, the theoretical simulation shows a chaotic phenomenon that signifies a wide range of potential location instead of a specific location point. Therefore, it is highly-recommended to perform a cross-country comparison using the same framework where the subnational socio-economic characteristics and urban system structure has to be examined.

The study utilizes the latest version of the relevant statistics to ascertain local socio-economic conditions and urban system structure but it would also be useful to look at the transformation over the past years by conducting a time-series analysis. This analysis is potentially valuable in forecasting the trajectory of the provinces and recommending development policies.

The focus of this study is on the manufacturing firms but it is also noteworthy to undertake the analysis on the determination of the optimal location for the firms in the services-related industry, specifically looking at the similarities and differences between manufacturing-related firms and services-related firms. This particular topic is relevant in the case of the Philippines as it is currently the biggest destination for BPO investment and the government is gearing the secondary cities to host the additional BPO-related firms.

## 6. Appendix

The table below shows the computed socio-economic indices of the provinces in the Philippines.

**Table 6.1 Socio-Economic Index of the Provinces**

<b>Region/ Province</b>	<b>Economic</b>	<b>Education</b>	<b>Security</b>	<b>Infrastructure</b>	<b>Health</b>	<b>Governance</b>	<b>Socio- Economic Index</b>
Metro Manila	4.707	3.518	0.012	5.346	2.248	4.768	3.433
Abra	-0.078	0.318	0.702	-0.429	-0.098	-0.126	0.048
Apayao	0.027	-0.253	0.938	-0.454	-0.649	-0.120	-0.085
Benguet	-0.078	0.343	-1.695	-0.112	-0.077	0.357	-0.210
Ifugao	0.189	-0.619	-1.032	-0.441	-0.485	0.004	-0.397
Kalinga	-0.219	-0.406	0.076	-0.404	-0.583	0.095	-0.240
Mt. Province	-0.025	-0.263	-0.017	-0.415	-0.357	0.067	-0.168
Ilocos Norte	-0.314	0.510	0.375	0.060	0.361	0.203	0.199
Ilocos Sur	-0.096	0.481	-0.203	-0.082	0.268	0.106	0.079
La Union	-0.246	0.513	0.157	-0.088	0.586	0.112	0.172
Pangasinan	-0.008	0.651	-0.416	0.466	0.832	0.580	0.351
Batanes	0.378	0.876	0.064	-0.019	-0.239	-0.113	0.158
Cagayan	0.021	0.231	0.774	0.066	0.552	0.066	0.285
Isabela	0.131	0.452	0.553	0.158	1.087	-0.344	0.339
Nueva Vizcaya	0.092	0.043	-0.311	-0.240	0.017	-0.047	-0.074
Quirino	0.131	-0.087	0.478	-0.374	-0.238	-0.090	-0.030
Aurora	0.105	0.179	-0.518	-0.114	-0.076	0.038	-0.064
Bataan	0.231	0.594	0.034	0.086	0.006	0.076	0.171
Bulacan	0.480	0.918	0.185	-0.090	1.005	0.425	0.487
Nueva Ecija	0.310	0.494	0.124	-0.264	0.278	-0.150	0.132
Pampanga	0.334	0.595	-0.517	0.052	0.601	-0.008	0.176
Tarlac	0.319	0.645	0.122	-0.310	-0.314	0.224	0.114
Zambales	0.288	0.512	-0.628	0.055	-0.164	-0.072	-0.002
Batangas	0.654	0.673	0.047	0.432	1.000	0.038	0.474
Cavite	0.807	1.061	0.013	-0.128	1.027	0.349	0.521
Laguna	0.899	1.023	0.423	-0.101	0.632	0.655	0.588
Quezon	0.545	0.173	0.425	0.043	0.641	0.003	0.305
Rizal	0.729	1.059	0.314	-0.324	0.503	0.661	0.490
Marinduque	-0.018	0.101	0.535	-0.085	-0.303	0.102	0.055
Occidental Mindoro	-0.243	-0.224	0.465	0.301	-0.174	-0.492	-0.061
Oriental Mindoro	-0.309	-0.061	0.475	0.103	-0.579	0.002	-0.062
Palawan	-0.244	0.087	0.589	0.685	-0.400	-0.380	0.056
Romblon	-0.239	0.054	0.144	-0.223	-0.371	-0.590	-0.204
Albay	-0.351	0.453	-0.476	0.147	0.156	0.018	-0.009
Camarines Norte	-0.431	0.160	-0.105	-0.156	-0.357	-0.341	-0.205

Camarines Sur	-0.244	0.201	-0.129	0.022	0.517	-0.101	0.044
Catanduanes	-0.203	0.232	-0.157	-0.075	-0.551	-0.198	-0.159
Masbate	-0.273	-0.431	-0.178	-0.198	-0.519	-0.658	-0.376
Sorsogon	-0.570	0.000	-0.372	0.064	0.084	-0.383	-0.196
Aklan	-0.492	0.065	-0.413	-0.014	-0.669	-0.145	-0.278
Antique	-0.201	-0.296	0.384	0.063	-0.650	-0.110	-0.135
Capiz	-0.089	-0.096	0.173	-0.178	-0.644	0.075	-0.126
Guimaras	-0.139	0.070	-0.203	-0.307	-0.427	-0.315	-0.220
Iloilo	-0.030	0.436	0.628	0.203	0.511	-0.020	0.288
Negros Occidental	-0.079	0.017	0.399	0.487	0.975	0.189	0.331
Bohol	-0.031	0.061	0.346	0.334	0.878	0.029	0.270
Cebu	0.444	0.476	0.119	0.888	1.505	0.232	0.610
Negros Oriental	0.155	-0.442	0.179	0.152	0.451	0.416	0.152
Siquijor	-0.108	0.219	0.727	-0.058	-0.190	0.101	0.115
Biliran	-0.373	0.021	-0.322	-0.105	-0.395	0.070	-0.184
Eastern Samar	-0.237	0.126	-0.212	0.152	-0.381	0.031	-0.087
Leyte	-0.341	0.020	0.363	0.976	0.296	-0.272	0.174
Northern Samar	-0.333	-0.334	-0.309	0.022	-1.314	0.086	-0.364
Southern Leyte	-0.396	-0.114	0.109	0.113	-0.131	-0.409	-0.138
Western Samar	-0.477	-0.421	-0.379	-0.193	-0.609	-0.046	-0.354
Zamboanga del Norte	-0.273	-0.626	0.191	0.334	0.301	-0.227	-0.050
Zamboanga del Sur	-0.024	-0.073	-0.012	0.153	0.213	-0.440	-0.031
Zamboanga Sibugay	-0.243	-0.585	-0.380	-0.220	-0.393	-0.095	-0.319
Bukidnon	0.072	-0.334	-0.150	-0.425	0.532	0.051	-0.042
Camiguin	-0.005	0.181	-1.608	-1.282	-0.418	0.150	-0.497
Lanao del Norte	-0.079	-0.607	-0.266	0.020	-0.006	0.023	-0.152
Misamis Occidental	-0.244	-0.172	-0.005	-0.107	0.255	-0.250	-0.087
Misamis Oriental	0.066	0.346	-0.658	0.245	0.506	0.116	0.103
Davao del Norte	0.286	-0.410	0.197	-0.395	-0.019	-0.019	-0.060
Davao del Sur	0.236	-0.736	-0.470	0.300	0.446	-0.028	-0.042
Davao Oriental	0.062	-0.775	-0.500	-0.125	0.166	0.082	-0.182
Compostela Valley	-0.067	-0.611	-0.024	-0.390	0.057	0.216	-0.136
North Cotabato	-0.112	-0.620	0.777	-0.402	0.391	-0.072	-0.006

Sarangani	-0.275	-1.241	0.080	-0.398	-0.129	-0.449	-0.402
South Cotabato	-0.092	-0.313	-0.052	0.012	0.298	-0.011	-0.027
Sultan Kudarat	-0.146	-0.694	0.803	-0.463	-0.073	-0.294	-0.145
Agusan del Norte	-0.194	-0.039	0.153	-0.097	-0.222	-0.038	-0.073
Agusan del Sur	-0.171	-0.490	0.476	-0.388	-0.047	-0.303	-0.154
Surigao del Norte	-0.417	-0.151	0.195	0.085	-0.309	0.032	-0.094
Surigao del Sur	-0.289	-0.104	-0.376	0.023	0.156	-0.782	-0.229
Basilan	-0.399	-1.559	-0.641	-0.501	-1.233	-0.131	-0.744
Lanao del Sur	-0.563	-0.383	-0.361	-0.188	-1.149	-0.498	-0.524
Maguindanao	-0.609	-1.851	0.166	-0.756	-0.977	-1.345	-0.895
Sulu	-0.538	-1.791	-0.203	-0.343	-1.731	-0.287	-0.816
Tawi-Tawi	-0.543	-0.979	-0.240	-0.191	-1.685	0.035	-0.600

The table below show the computed coefficient of divergence and spatial convergence values of the provinces in the Philippines.

**Table 6.2 Urban System Index in the Philippines**

<b>Province</b>	<b>CD</b>	<b>SC</b>	<b>USI</b>
Metro Manila	0.099	1.865	2.008
Abra	0.063	1.875	1.313
Apayao	0.151	2.136	3.042
Benguet	0.060	2.169	1.268
Ifugao	0.125	2.310	2.546
Kalinga	0.079	1.837	1.630
Mt. Province	0.114	1.954	2.318
Ilocos Norte	0.070	2.023	1.450
Ilocos Sur	0.058	1.664	1.215
La Union	0.080	2.172	1.666
Pangasinan	0.050	2.021	1.073
Batanes	0.103	4.920	2.289
Cagayan	0.129	2.324	2.625
Isabela	0.055	1.729	1.154
Nueva Vizcaya	0.097	2.263	1.997
Quirino	0.147	1.142	2.943
Aurora	0.139	3.027	2.853
Bataan	0.111	1.865	2.243
Bulacan	0.072	1.737	1.477
Nueva Ecija	0.059	1.843	1.237
Pampanga	0.074	1.909	1.523

Tarlac	0.072	1.864	1.495
Zambales	0.086	2.393	1.781
Batangas	0.055	1.900	1.158
Cavite	0.060	1.667	1.248
Laguna	0.052	1.858	1.096
Quezon	0.050	2.456	1.110
Rizal	0.027	1.454	0.612
Marinduque	0.152	2.447	3.087
Occidental Mindoro	0.097	2.463	1.993
Oriental Mindoro	0.098	1.812	1.994
Palawan	0.064	6.273	1.794
Romblon	0.088	3.704	1.907
Albay	0.087	2.354	1.800
Camarines Norte	0.070	1.761	1.452
Camarines Sur	0.058	2.633	1.276
Catanduanes	0.100	2.100	2.042
Masbate	0.085	3.233	1.820
Sorsogon	0.090	2.486	1.861
Aklan	0.096	1.938	1.961
Antique	0.100	3.123	2.101
Capiz	0.091	2.153	1.868
Guimaras	0.159	2.904	3.226
Iloilo	0.048	2.170	1.051
Negros Occidental	0.065	2.097	1.371
Bohol	0.050	1.948	1.073
Cebu	0.035	2.674	0.875
Negros Oriental	0.075	1.854	1.549
Siquijor	0.144	2.031	2.913
Biliran	0.122	2.641	2.493
Eastern Samar	0.072	2.109	1.502
Leyte	0.023	1.935	0.603
Northern Samar	0.072	2.331	1.520
Southern Leyte	0.078	1.294	1.586
Western Samar	0.056	3.433	1.322
Zamboanga del Norte	0.069	1.934	1.424
Zamboanga del Sur	0.040	2.775	0.971
Zamboanga Sibugay	0.108	2.891	2.243
Bukidnon	0.076	1.650	1.549
Camiguin	0.123	2.332	2.510
Lanao del Norte	0.057	2.123	1.209
Misamis Occidental	0.079	2.355	1.641
Misamis Oriental	0.044	1.937	0.954
Davao del Norte	0.097	2.132	1.977

Davao del Sur	0.038	1.199	0.795
Davao Oriental	0.109	2.033	2.213
Compostela Valley	0.126	2.011	2.552
North Cotabato	0.100	1.617	2.031
Sarangani	0.147	2.792	2.993
South Cotabato	0.078	2.172	1.626
Sultan Kudarat	0.122	2.081	2.466
Agusan del Norte	0.066	1.399	1.349
Agusan del Sur	0.106	1.375	2.131
Surigao del Norte	0.045	2.616	1.037
Surigao del Sur	0.096	1.826	1.953
Basilan	0.090	1.801	1.842
Lanao del Sur	0.051	1.504	1.063
Maguindanao	0.059	1.055	1.193
Sulu	0.080	1.231	1.623
Tawi-Tawi	0.114	5.511	2.532

The preceding the tables and figures shows the results of the Principal Component Analysis  
**Table 6. 3 Summary Statistics**

Variable	Observations	Obs. with missing data	Obs. without missing data	Minimum	Maximum	Mean	Std. deviation
Economic	80	0	80	-0.609	4.707	0.001	0.623
Education	80	0	80	-1.851	3.518	0.000	0.707
Security	80	0	80	-1.695	0.938	0.001	0.481
Infrastructure	80	0	80	-1.282	5.346	0.000	0.692
Health	80	0	80	-1.731	2.248	0.000	0.668
Governance	80	0	80	-1.345	4.768	0.001	0.621

**Table 6. 4 Correlation matrix(Pearson n)**

Variables	Economic	Education	Security	Infrastructure	Health	Governance
Economic	<b>1</b>	<b>0.732</b>	0.054	<b>0.766</b>	<b>0.616</b>	<b>0.887</b>
Education	<b>0.732</b>	<b>1</b>	0.063	<b>0.624</b>	<b>0.656</b>	<b>0.697</b>
Security	0.054	0.063	<b>1</b>	0.097	0.187	-0.039



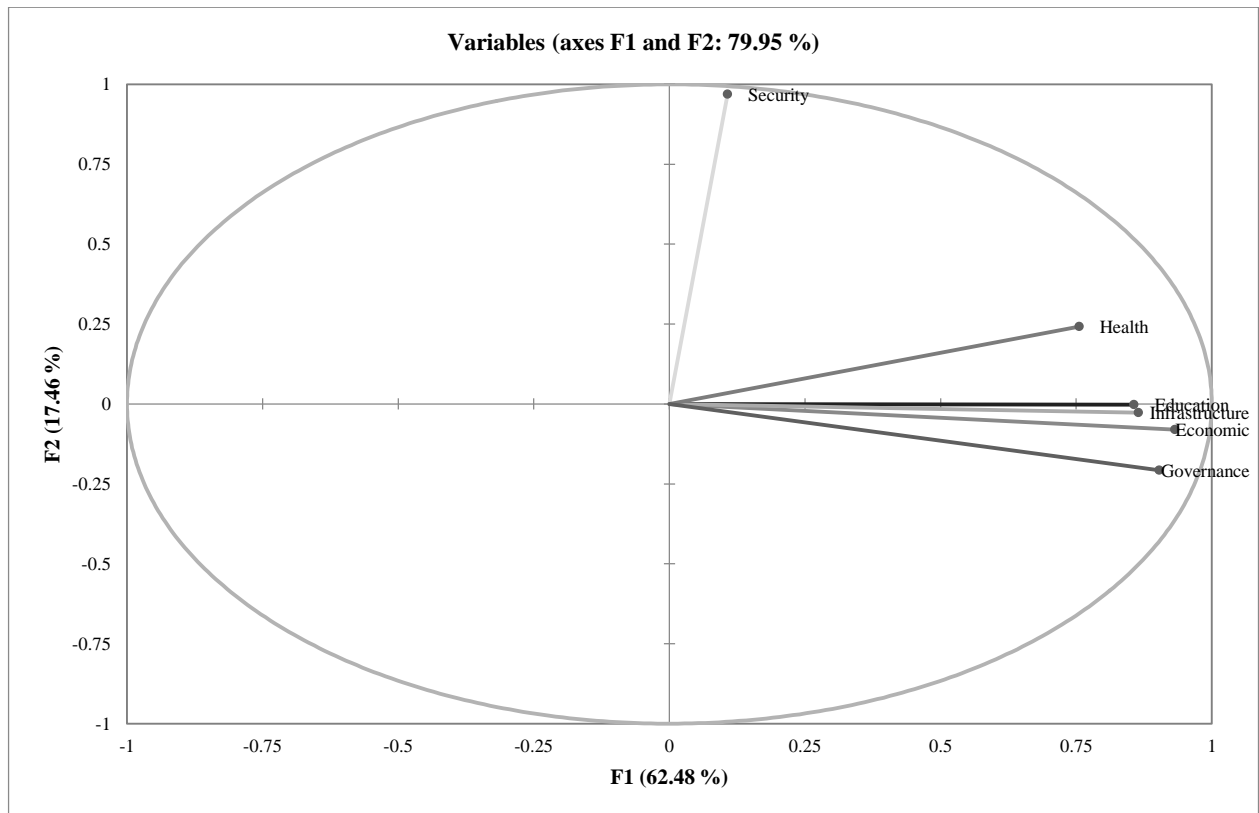
Infrastructure	<b>0.766</b>	<b>0.624</b>	0.097	<b>1</b>	<b>0.537</b>	<b>0.788</b>
Health	<b>0.616</b>	<b>0.656</b>	0.187	<b>0.537</b>	<b>1</b>	<b>0.504</b>
Governance	<b>0.887</b>	<b>0.697</b>	-0.039	<b>0.788</b>	<b>0.504</b>	<b>1</b>

Values in bold are different from 0 with a significance level  $\alpha=0.05$

**Table 6.5 Eigenvalues**

	F1	F2	F3	F4	F5	F6
Eigenvalue	3.749	1.048	0.559	0.316	0.233	0.096
Variability (%)	62.482	17.465	9.318	5.262	3.876	1.597
Cumulative %	62.482	79.947	89.265	94.527	98.403	100.000

**Figure 6.1 Variables Axes**



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