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碩士論文
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可近性是否會影響雇用率? 檢視菲律賓的空間錯置假說
Does Accessibility Affect Employment Levels? Examining the Spatial Mismatch Hypothesis in the Philippines

Student: Ma. Claudine Agnes O. Alvarez
Advisor: Prof. Tsoyu Calvin Lin

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研究生：雷瑞思　　Student: Ma. Claudine Agnes Alvarez

指導教授： 林左裕　　Advisor: Prof. Tsoyu Calvin Lin

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ABSTRACT

The spatial mismatch hypothesis states that low access to potential employers or firms is associated with lower employment levels in a region, and that the distribution of these potential jobs and employment levels are not evenly distributed across space. This study aims to test this hypothesis in the context of the Philippines, where a trend of unbalanced regional development is becoming more and more apparent. The results reveal that access to firms has a positive significant effect on employment levels even when controlling for other location and working-age population characteristics. Moreover, the results also show that high-employment and high-access communities are significantly clustered in Manila, to the disadvantage of its neighboring provinces. These findings suggest that access to potential employers is a significant contributor to a region's employment levels and that initiatives aimed at solving the unemployment problem should give more focus on job creation near underserved workers' locations.

Keywords: spatial mismatch, job access, employment, regional development, Philippines

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I dedicate this thesis to the memory of my two angels, Freya and Ellie.

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I. INTRODUCTION

1.1. Background of the study

In the Philippines, there is a noticeable regional imbalance in terms of economic and social development. Metro Manila, the main administrative region and the seat of government in the Philippines, is home to almost 13 million people and contributes 36.6% to the Philippines' GDP (Bersales, 2017). It also boasts the highest per capita income and regional GDP in the country, along with the lowest levels of unemployment among all the 17 regions in the country.

The development of Metro Manila has had spillover effects on its neighboring provinces since adjacent regions also engage in trade with the metropolitan area; however, there is still a marked difference between Metro Manila and other regions in the Philippines especially in terms of economic growth and generation of jobs, with both decreasing as the proximity to Metro Manila decreases (Pernia & Lazatin, 2016). In a separate study on firm locations conducted by the Philippine Statistics Authority (Bersales, 2018), it is apparent that the imbalance in the development of the two regions still persists to this day: the study states that the National Capital Region accommodates 20% of the country's business establishments and generates more than 36% of jobs in the country. In contrast, only 15% of the country's businesses are situated in the provinces of Cavite, Laguna, and Rizal, and the region only generates around 16% of jobs in the country.

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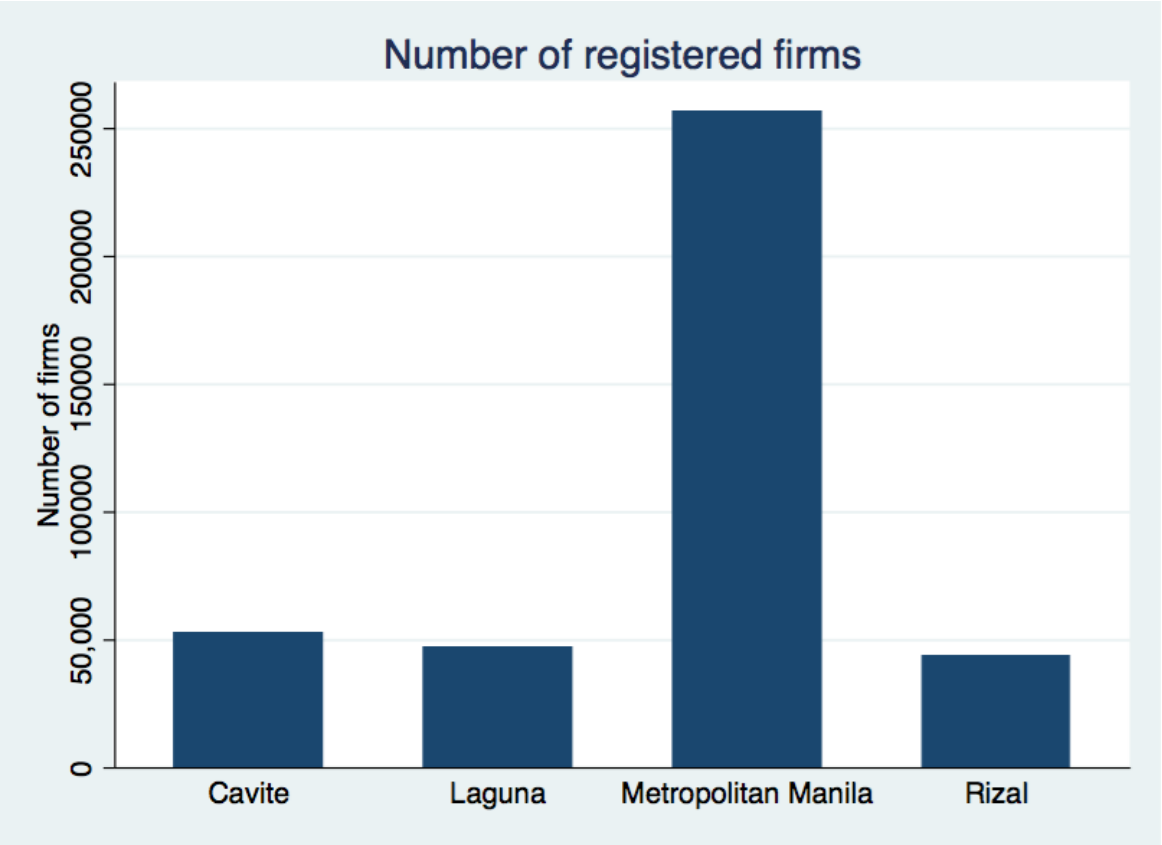

Figure 1. *Number of registered firms for Metro Manila and its adjacent provinces.*

Due to the region's strong economic performance and the concentration of firms in the region, living in or migrating to Metro Manila is considered as an ideal solution to increase access to employment opportunities or get higher wages, especially for rural migrants. However, the region's high population density is starting to create problems for its local governments, which are struggling to provide adequate housing and other public services such as employment and livelihood assistance to its residents.

Despite the risk of unemployment brought about by fierce competition for metropolitan jobs and the risk of living in informal settlements due to the capital region's high standard of living and lack of affordable housing, this does not change the perception that there are far more job opportunities in Metro Manila than in the provinces and that there

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is still a good chance of securing employment in the metropolis. Thus, workers from adjacent provinces still prefer to work in Metro Manila and commute from their provincial residences despite the costs of commuting and time wasted due to traffic jams in the metropolis' thoroughfares. This indicates that there is still a noticeable discrepancy between the location of firms and the location of workers' residences, which appear to be unevenly distributed. This phenomenon is known as spatial mismatch: the mismatch between the location of job opportunities and workers' access to these opportunities from their residential locations.

1.2. Statement of the problem

This study aims to test the spatial mismatch hypothesis in the context of Metro Manila and its adjacent provinces by investigating the relationship between a region's access to firms and its employment levels. The hypothesis as formulated and developed in existing literature has three different components: It implies that 1) better access to employment opportunities leads to higher employment levels; 2) communities farther from the job core have lower access to employment opportunities or firms that could be potential employers; and 3) communities with low access to employment opportunities are also likely to have lower employment levels. With that said, this thesis seeks to answer the following main questions in order to address each component:

1. *How does the presence of accessible job opportunities impact neighborhood employment levels?*
2. *Do communities outside Metro Manila have significantly lower access to job opportunities compared to communities in the metropolitan area?*
3. *Do communities outside Metro Manila have significantly lower employment levels compared to communities in the metropolitan area?*

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1.3. Objectives of the study

In order to answer the research questions and test the spatial mismatch hypothesis, this thesis aims to address the following objectives:

- To determine the spatial distribution of accessible firms and employment levels
- To determine the impact of accessible firms on employment levels
- To compare the degree of access to firms for communities inside and outside Metro Manila
- To compare the degree of employment levels between communities inside and outside Metro Manila

1.4. Hypotheses of the study

This study presents the following hypotheses corresponding to the components of the spatial mismatch hypothesis as stated in the previous section: First, the study hypothesizes that the presence of accessible firms has a positive impact on community development levels. Spatial mismatch indicates that there is a direct relationship between accessibility and employment; that is, improved access to jobs also translates to higher employment, so the presence of a positive relationship between these two variables indicates that there is spatial mismatch in the study area.

Second, the study hypothesizes that communities in Metro Manila have both higher access to firms and higher employment levels compared to communities outside Metro Manila. The presence of these factors indicates that spatial mismatch exists in this area because spatial mismatch is characterized by an unequal distribution of firms and employment levels, with communities near the job center experiencing higher levels of both access to firms and employment levels.

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1.5. Significance of the study

Spatial mismatch is an important issue worth exploring in the Philippines because inequality in job access is a potential problem for the capital region and its neighboring areas. The uneven development of Metro Manila and its neighboring areas means that a large number of businesses are situated in Metro Manila, and that the region sees a steady influx of job seekers and workers from neighboring provinces who commute to the metropolitan area for work from their provincial residences (Liu, 2018) despite the high commuting costs. Studies and reports regarding inequality in the Philippines are mostly concerned about household income (Balisacan & Piza, 2003; Balisacan & Fuwa, 2004) or poverty levels. Other research on employment have also focused on skills and educational mismatch (Mesa, 2007; Gacott, et.al., 2017), while research regarding inequality of job access has been limited, if any. In particular, the phenomenon of spatial mismatch has not yet been studied in the Philippine context despite the importance of the issue and presence of numerous examples and cases that demonstrate the phenomenon in action.

Not only does this thesis hope to contribute to the spatial mismatch literature by exploring a Southeast Asian context, it also aims to shed light on the distribution of jobs and employment in the Philippines and whether inequality or mismatch exists. If it can be shown that the heavy concentration of jobs in the capital region severely disadvantages the people who live outside its borders, then regional development as it currently stands can be said to be inequitable and people who cannot afford to move out to find the jobs in the metropolitan area will continue to be disadvantaged due to the constraint brought about by their residential location. Not only will daily travel be inefficient in the long run for those who are commuting to Metro Manila jobs due to the high costs of transportation and time wasted due to traffic, this locational disadvantage would also lead to less opportunities and continued adverse employment outcomes for those who cannot afford

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to travel beyond their respective communities or regions, leaving the capital region to grow even larger while other regions are lagging behind.

Confirming whether there is a spatial mismatch will help in identifying which areas need more resources to overcome or reduce it. The findings and recommendations of this research would help government officials and private sector partners plan accordingly for future development projects by identifying which areas suffer from low job access or low employment, or both. With this information, they will be able to determine which areas are in need of livelihood assistance or investment. Not only that, they will also be able to pinpoint the most ideal areas for establishing businesses or attracting industries where most people could get access to them.

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II. REVIEW OF RELATED THEORIES AND LITERATURE

This chapter first reviews theories related to the spatial mismatch hypothesis. The next section talks about the origins of the hypothesis in the United States and reviews relevant studies related to the investigation of the hypothesis. These discussions will compare differing viewpoints regarding the significance of the hypothesis in empirical literature, especially since there is still no consensus in the field regarding the significance of job access in determining employment levels.

Finally, the chapter discusses gaps in existing literature that the study would address, and will describe a research framework building on the aforementioned theories, the strengths of previous literature, and the research gaps.

2.1. Theoretical basis

The spatial mismatch hypothesis was a controversial topic from the time it was published not only because of its origins of investigating African-American employment levels in the United States, but also because studies concerning the topic has different outcomes: a number of studies support the hypothesis that location has a significant effect on employment levels, while some dismiss the effect of accessibility from workers' residential locations and state that population characteristics are more significant determinants of employment levels.

There are numerous theories offering explanations or factors that affect employment. Some of them are related to human capital qualities such as levels of education and skill, while some also depend on a place's attributes that makes it viable for generating jobs. For investigating the spatial mismatch hypothesis, the most important theory is related to the relationship between access to jobs and employment levels.

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The relationship between job access and employment levels is mainly based on the spatial search-matching theory as provided by Gobillon, et. al (2007). Based on this spatial extension, job search efficiency also deteriorates with the distance between a job searcher's residence and the prospective center of employment, so the number of employment matches - that is, the number of people employed - also depends on workers' search efficiency from their residential location. In effect, this theory implies that individuals who are experiencing spatial disconnection from job opportunities are having more difficulty getting matched with a job because of limited options around their neighborhood, effectively limiting their search intensities and efficiency. In contrast, those who live in proximity to opportunity-rich areas have more choices when it comes to potential employers, so it is easier for them to search intensively and find a good match given the wealth of options they have access to.

On the other hand, the human capital theory states that individual attributes such as skills and educational levels are important determinants of employment and even contribute to the development of a nation. In particular, education makes a person more eligible for a wider range of job opportunities because unlike uneducated workers who are productive only in a limited range of jobs, educated workers are productive in more diverse types of jobs (McKenna, 1996). Studies that reject the spatial mismatch hypothesis subscribe to this theory, stating that instead of access to jobs from a certain location, the characteristics of the working age population are more important determinants of local employment levels or individual employment outcomes.

Location-based attributes are also deemed to be important in attracting firms and development according to the New Economic Geography theory (Krugman, 1991). With more firms being developed and set up in these regions, more jobs are also being created and the region becomes developed, thus also driving employment levels up and bringing about economic development (Daunfeldt, Elert & Johansson, n.d.).

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The next section will discuss the application of these theories in existing spatial mismatch literature.

2.2. The spatial mismatch hypothesis

The spatial mismatch hypothesis originated from Kain (1968)'s paper on housing segregation and employment of African-American workers in the United States. This paper was written in the context of racial discrimination in the United States during the 1960s, when African-Americans faced constraints on residential choices that limited their freedom to move to places with better job access. The hypothesis argues that the poor labor outcomes of African American inner-city residents stems from their distance and disconnection from employment opportunities, which have moved away from inner-city locations to suburban neighborhoods. On the other hand, African-American workers were forced to stay in the inner city and thus had limited residential choices due to segregation and discrimination. Running a regression model using data from the Chicago and Detroit metropolitan areas, Kain concluded that African-American employment levels decreased as the distance from residential locations increased. Since racial discrimination was one of the primary factors that motivated housing segregation in the United States, it follows that race is one of the most significant components in the hypothesis as formulated by Kain. This factor was further used to emphasize that the differences in the degrees of racial segregation between Detroit and Chicago also contributed to the magnitude of decrease in employment levels.

In the following years since the publication of Kain's original study, numerous scholars have sought to investigate the spatial mismatch hypothesis and have generated mixed results, with some supporting (Ihlanfeldt & Sjoquist, 1990; Kasarda, 1991; Leonard, 1987; Jin & Paulsen, 2018) and some rejecting (Ellwood, 1986; Hu & Giuliano, 2017) the hypothesis.

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Dissenting studies rejecting the spatial mismatch hypothesis state that location does not have any significant impact on employment outcomes; instead, social factors and individual characteristics are more significant determinants of employment, thus applying more of the human capital theory than the spatial search-matching theory as implied by Kain's original study. As a result, a large number of spatial mismatch studies control for other variables besides location or access to jobs in order to compare the impacts of these factors. Among the most common control variables used in spatial mismatch studies are age, educational attainment, share of married females, and share of African-Americans or other minorities. Ellwood (1986) is one of the most prominent critics of the hypothesis, and his study states that distance and travel time to jobs do not have much effect on employment participation among disadvantaged groups. Furthermore, Ellwood's study suggests that while African-Americans do tend to reside in places farther from jobs compared to whites, African-Americans who live in neighborhoods with better job access only have a slight advantage when it comes to employment outcomes. Moreover, he emphasizes that African-Americans who live in mixed-race neighborhoods still experience adverse employment outcomes compared to whites, which leads to the conclusion that low employment levels are brought about primarily by racial discrimination and other worker characteristics such as educational attainment and skills. This has given rise to Ellwood's aphorism that it is "race, not space" that dictates minority labor market outcomes, setting the stage for more studies to give emphasis on racial factors or variables as opposed to location when investigating the hypothesis.

Besides racial discrimination, Hu & Giuliano (2017) also argue that the high concentration of poverty in certain areas also plays a huge part in determining labor market outcomes, and that the positive effects of job accessibility on widening the job search area is reduced in neighborhoods with a high poverty rate. However, the authors' choice to include poverty rate as an independent variable in their model raises some

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questions, especially because using poverty concentration as a variable to predict employment outcomes may give rise to a causality problem: poverty concentration may affect employment levels because it promotes the culture of poverty in a neighborhood (Lewis, 1963) by giving rise to less-skilled workers and getting less access to information on jobs (Wilson, 1987). But it is also highly possible that employment also has an impact on poverty concentration - the less people who have jobs in a community, the higher poverty concentration will be. This causality problem has not been addressed in the study's methodology.

On the other hand, numerous studies agree with Kain's conclusion that the residential location of workers has a significant effect on employment. In his review, Kasarda (1991) confirms the significance of location as a contributing factor to employment levels; although race remains to be a huge component of the phenomenon of spatial mismatch in the United States, space and location cannot be dismissed as contributing factors due to their high impact. Moreover, Immergluck (1998) assesses the impact of nearby jobs on neighborhood employment rates. Immergluck's study concludes that access to nearby jobs has a positive and significant impact on employment rates, though its effects are lessened when controlling for the working age population's characteristics such as race, educational attainment, and other skill-related variables. Despite the larger impacts of the population attributes, the effect of nearby jobs could not be discounted and that access to employment opportunities still contribute significantly to employment levels.

Further studies confirm that access to potential employers plays a significant role in determining employment outcomes: In investigating Chicago and Los Angeles data, Leonard (1987) found that distance from the main ghetto is one of the most significant determinants of African-American employment, and that the distance of an establishment from the ghetto determines the number of African-Americans it employs, with establishments farther from the ghetto hiring less African-American workers. A study on

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youth employment by Ihlanfeldt & Sjoquist (1990) states that although race plays a huge part in the differences between employment levels of neighborhood youth, their location also contributes a large part to their employment outcomes, with those living farther from jobs experiencing lower employment levels.

2.3. Spatial mismatch outside the United States

Though most of the literature on the spatial mismatch hypothesis focused on cities in the United States, studies influenced by the spatial mismatch hypothesis have also been generated in countries outside the US such as China and Singapore. However, there are striking differences in the mechanisms of spatial mismatch between different countries.

While the mechanisms of spatial mismatch in the United States mostly highlight race and residential segregation as main components, Asian perspectives on spatial mismatch generally do not dwell on race, focusing instead on economic and institutional factors that bring about or promote the mismatch. For instance, Xu, et. al (2014) present the mechanisms of spatial mismatch in Beijing and emphasize that the mismatch had more to do with the forced movement of low-income households to the urban peripheries as a result of economic reforms and the development of the inner city area as the commercial center. The geographical disconnection between residential location and employment opportunities is further exacerbated by poor transit linkages between the urban fringes and city center, and the lower capability of the disadvantaged population to move closer to employment centers in the urban region. This is confirmed by Zhang and Man (2015), whose study states that taking public transport takes twice as much time as driving, which indicates that there is a gap in job accessibility between those who own a car and those who take public transport, and that lower-income groups are being driven further into more disadvantaged locations far from the central city.

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In Singapore, similar mechanisms that promote spatial mismatch are in place. The development of the central city area into a financial center and the displacement of less-privileged residents to the urban peripheries also promoted spatial mismatch in the country. Unlike China, where there are poor transport networks connecting the urban fringes to the commercial centers, Singapore provides linkages from the suburbs to the central city through public transport infrastructure. However, the mismatch is still compounded by unaffordable transportation costs, effectively limiting the poor residents' job search and employment options to those located in the new towns, and in turn resulting in a shortage of job opportunities (Lau, 2011).

The examples of China and Singapore highlight how spatial mismatch can still occur in other regions even without racial discrimination and thus brings forward the importance of investigating the hypothesis by focusing on a certain residential location's relationship with the location of the job center.

2.4. Testing and quantifying spatial mismatch

Houston (2005) and O'Regan & Quigley (1991) contend that the lack of a clear definition of spatial mismatch and the excessive focus on race in existing spatial mismatch studies are some of the primary reasons for the mixed and contradictory results in studies concerning the topic. This lack of clarity is evident in the wide variety of measures being used to quantify spatial mismatch: for instance, Kain's 1968 paper used airline distance from the ghetto as a measurement of the extent of spatial mismatch, which was also used by Leonard. Segregation was also used as a measurement of the extent of spatial mismatch (Masters, 1975); however, it is not an appropriate measure because it is more concerned with racial factors than the spatial relationship between residential location and the location of jobs. In addition, Ihlanfeldt & Scafidi (2002) emphasize that some individuals may choose to self-segregate due to personal preferences to live with their own groups, and not because they have been forced to live farther away from the job

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center. Commuting distance is also a possible measure of the spatial disconnection between residential locations and jobs, but it was also deemed to be an inappropriate measure of spatial mismatch by Houston because greater commuting distance may simply mean increased mobility, which is enjoyed by highly-paid workers because of car ownership. Also, a shorter commuting time may mean that the phenomenon of constrained opportunity has occurred - that is, residents could not find jobs in areas far from their neighborhoods due to lack of access to public transport or natural barriers in their respective locations, so their choices are limited to the jobs near their residential locations, thus shortening commuting time.

Out of all the methods reviewed in Houston's paper, using a job-access measure is deemed the best way to test the spatial mismatch hypothesis because it accounts for both the location of jobs and the location of workers, thus addressing the main components of the hypothesis. Several measures of job accessibility are in place in existing studies such as distance from the ghetto to the job center (Kain, 1968; Leonard, 1987), job-to-worker ratio (Ellwood, 1986; Immergluck, 1998), distance decay (Shen, 1998), and number of jobs around a neighborhood (Hanson, Kominiak, & Carlin, 1997).

Besides the methods presented, Houston's paper differentiates between the extent and effect of spatial mismatch and warns that a study measuring the extent of spatial mismatch does not necessarily mean that it also tests the hypothesis. Indeed, despite the presence of numerous studies measuring the accessibility of a neighborhood to jobs, these studies only provide the extent of spatial mismatch and do not test the relationship between the extent of the mismatch and employment levels. Testing the spatial mismatch hypothesis calls for the investigation of the effects of spatial separation on employment levels and determining whether the degree of separation does have a negative impact; thus, merely finding out the extent of the mismatch through accessibility scores or other

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approaches and using these as the sole basis for assessing spatial mismatch is not sufficient as a test of the hypothesis itself (Shen, 1998).

However, despite the wealth of studies exploring the spatial mismatch hypothesis and measuring accessibility to jobs and its relationship with employment, the use of Geographic Information Systems (GIS) remains to be non-prevalent given the periods in which these studies were completed. If any, GIS use was only limited to computing accessibility measures, but no paper in this review has used GIS tools to detect clusters in job locations, which would have been helpful in assessing whether mismatch exists in their respective study areas and where this mismatch is most observable. Regression can only determine the magnitude of job accessibility's impact on employment outcomes, but visualizing the distribution of a neighborhood's attributes is also an important method in identifying the presence of a mismatch. Addressing this missing factor in subsequent research is valuable.

2.5. Research gap

The previous studies show that when applied to the spatial mismatch hypothesis, the search-matching theory offers an explanation for how job accessibility leads to high unemployment: that is, if workers cannot find a job within their threshold area due to spatial disconnection or isolation, they will stop searching even further than their threshold and will not be able to work, thus remaining unemployed and contributing to low employment within a community. Dissenting studies also take the side of the human capital theory by showing that if employers cannot find a worker with the required skills or characteristics, the position will remain unfilled.

Following the intuition of the spatial search-matching and human capital theory as the theoretical basis and the spatial mismatch hypothesis as the conceptual basis for the study, job accessibility can be expected to have a positive relationship with employment

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levels because better proximity to jobs offers more options for workers, thus enabling them to participate in the labor market by widening their search area and increasing their search efficiency.

Building on this previous body of knowledge, as well as the shortcomings of the studies in the existing literature, this paper will address gaps in academic knowledge about spatial mismatch in the Asian setting, particularly by presenting a Southeast Asian perspective where the mechanisms of spatial mismatch greatly differ from those presented in Western and other Asian literature. For instance, some mechanisms of spatial mismatch in the Philippines such as the forcing out of lower-income individuals from the job center may resemble those given in existing literature; however, the continuing prevalence of jobs in the urban areas as opposed to suburbs and the lack of racial factors in labor market and housing interactions means that the job suburbanization and racial aspect of the United States spatial mismatch literature are not applicable.

A large number of studies in spatial mismatch literature also do not adequately measure the spatial aspects of the mismatch such as the location of jobs relative to the residential location of workers, and instead dwell more on social aspects such as race and segregation. While these variables are important components in explaining spatial mismatch in the United States, the excessive focus on these elements turns away the focus on the effects of location and spatial characteristics, which the hypothesis tries to address in the first place. Thus, this paper's approach on investigating the spatial mismatch hypothesis in context of the Philippines will focus on accessibility to job opportunities and its impact on employment levels in a neighborhood, as opposed to race, which is the focal point for spatial mismatch hypothesis studies in the United States.

In addition, as opposed to previous studies, this research will use both GIS and spatial regression to give both a visual and quantitative aspect in testing the spatial mismatch

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hypothesis, which has not been widely done in previous studies. At most, GIS was only used to derive a measurement for job accessibility; however, there have not been many studies where tools like hot spot analysis were used to detect clusters. In spite of the fact that spatial mismatch is a geographical phenomenon, many studies in the field do not use GIS tools to investigate the hypothesis due to the absence of the technology at the time the studies were conducted. Nowadays, the technology for investigating the hypothesis using GIS is readily available and this research will make use of these tools not only to measure accessibility but also to determine patterns in the spatial distribution of neighborhood attributes using spatial statistics and visualize these using maps. Moreover, the use of GIS and spatial regression methods will also help in accounting for the confounding spatial factors that might influence an area's employment levels, especially because neighboring values have greater influence on each other compared to distant values. Taking note of this will give more accurate results when inspecting spatial phenomena. Focusing on spatial factors, using GIS, implementing spatial regression methods, and directly examining the effects of job accessibility from a certain location on employment levels will also help in addressing the inconclusive results in the field.

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III. METHODOLOGY

3.1. Research design

This research uses spatial cross-sectional data and employs a quantitative approach in order to determine the impact of the number of accessible firms on employment levels in the study area neighborhoods. In this type of study, the outcome of interest – defined in this study as employment level – is measured for each community. The quantitative approach is suitable for this study because it is not only geared towards the testing of theories and hypotheses, but it also aids in comparing the effects of job access on employment in relation to other variables. The quantitative approach is also useful for determining the direction of an effect, which makes them applicable for finding out whether accessibility does have a significant influence employment levels and establishing whether it has a positive or negative effect.

Besides using traditional econometric approaches to investigate the relationship between access to nearby jobs and employment levels, this research will also conduct an exploratory spatial data analysis (ESDA) through the use of hot spot analysis in GIS software to identify patterns in the spatial distribution of high employment and job access in the study area. This method is useful for determining whether high job access and employment levels are clustered in a specific area, and in turn it can be determined whether there is a significant difference between neighborhoods inside and outside Metro Manila when it comes to job access and employment levels. Using this approach would also aid in checking whether there is a dependence or spatial autocorrelation between each community's values, the presence of which would warrant the use of spatial regression models instead of the classical linear regression model. Finally, using spatial data analysis methods can validate the regression results by visualizing whether clusters of high employment are actually located in communities that exhibit high access to nearby jobs.

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3.2. Study area

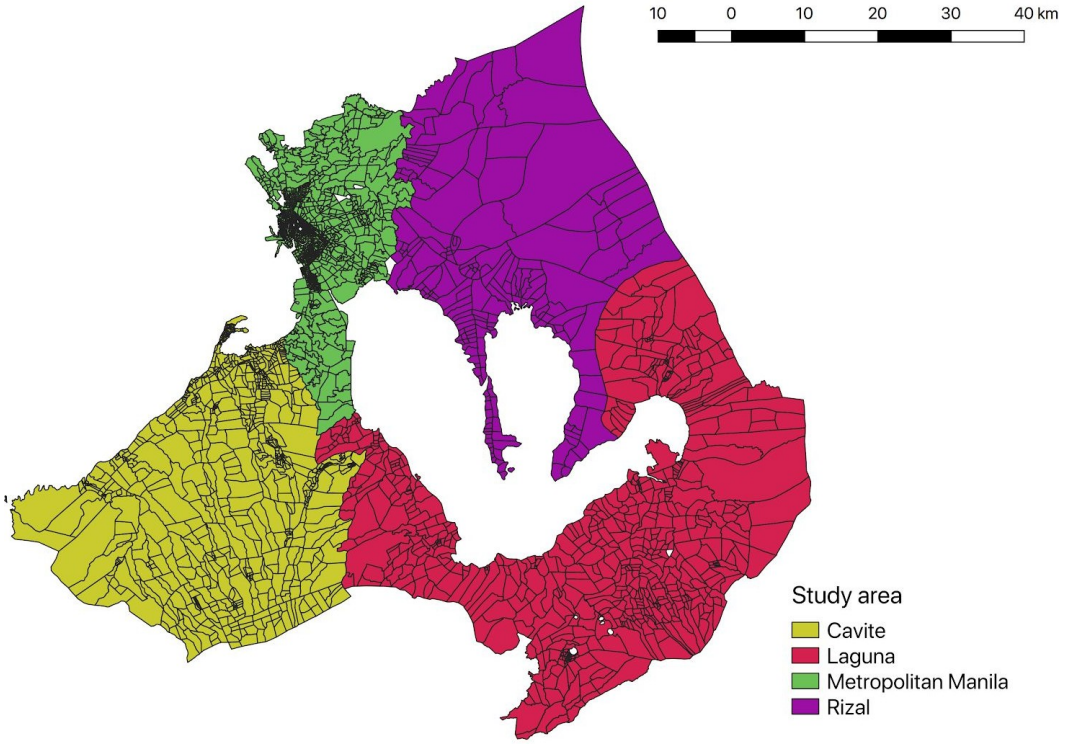

Figure 2. *Map of the study area. This research examines spatial mismatch in the context of Metro Manila and its neighboring provinces of Cavite, Laguna, and Rizal.*

This thesis will investigate the spatial distribution of employment and accessibility, as well as the impact of accessible job opportunities on community employment levels in the National Capital Region (NCR) and its adjacent provinces of Cavite, Laguna, and Rizal. Analysis will be conducted in the *barangay* (village/community) level, the smallest administrative unit in the Philippines. The *barangay* level was chosen in order to observe the differences between each community; for instance, some villages may be more isolated than others or may have lower access to firms because they are surrounded by

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purely or predominantly residential areas. On the other hand, neighborhood composition can be very different between each village, despite being located in the same city or municipality. These differences will not be properly accounted for if the analysis is done with a larger unit such as the city or municipality level.

The National Capital Region (NCR), also known as Metro Manila, is the capital region of the Philippines composed of 17 cities and 1 municipality, broken down into a total of 1,706 *barangays* or villages. It is the most densely populated region in the country with a population of almost 13 million, and it also has the largest contribution to the country's GDP, with a contribution of more than 30% of GDP. Besides being the seat of government and center of public services, the region is also the central economic hub of the country. 7 out of the top 10 wealthiest cities (Quezon City, Makati, Manila, Pasig, Taguig, Pasay, and Caloocan) in the country are also located in Metro Manila, and the region is home to several central business districts located in different parts of the metropolitan area.

The adjacent provinces of Cavite, Laguna, and Rizal belong to Region IV-A (CALABARZON) and are sometimes referred to as part of Greater Manila Area, the parts outside Metro Manila that are continuously expanding and urbanizing. Because of its proximity to the metropolitan area, the region is a growing hub for investments by the Philippine Economic Zone Authority (PEZA), with economic zones in this region accounting for 15% of all economic zones in the country (NEDA, n.d.). These provinces are considered commuter towns to Metro Manila since these are the most accessible provinces to the capital region, and a large number of workers reside in these provinces but continue to commute to parts of Metro Manila for work.

These locations were selected as the study area because spatial mismatch is a potential problem in these regions. Although investments on provinces outside Metro Manila are

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steadily rising, it is still evident that jobs and industries are still heavily concentrated in Metro Manila (Punongbayan, 2013), making it the location of choice in terms of employment opportunities. Including both the metropolitan area and the adjacent provinces will enable comparison of employment levels and job access from each location, which can then be used to assess whether spatial mismatch exists in the study area.

3.3. Model variable selection

To address the research objectives, the study will use one dependent variable and eight independent variables for testing the relationship between access to employment opportunities and employment levels. Spatial mismatch is characterized by decreased employment levels due to low accessibility to job opportunities from workers' residential locations, so the amount of accessible firms will be the model's main independent variable of interest to account for workers' access to potential employers. On the other hand, employment levels will be incorporated in the model as the dependent variable and will be measured using the employment-to-population rate, which is the percentage of the *barangay*'s working age population currently employed.

However, as discussed in the previous chapter, dissenting spatial mismatch studies state that the labor market outcomes in a certain community can also be affected by other population characteristics other than the amount of accessible jobs. In order to address this argument, population and location characteristics will also be included in the model as control variables to assess the effect and significance of accessibility compared to qualifications or place-specific characteristics that might affect employment levels. Besides the educational and skills composition of the community, other demographic factors pertaining to the characteristics of the working age population such as the presence of individuals who are likely to drop out of labor force participation may also affect the employment-to-population ratio since they are still counted in the measurement

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even though they are not participating in the labor force, and thus should be controlled for to avoid negative bias in the model. Moreover, individuals with these characteristics have been determined by previous empirical studies to be disadvantaged in the labor market (Jin & Paulsen, 2018; Immergluck, 1997; Ellwood, 1986). Finally, dummy variables regarding location characteristics were included because the employment level of a region not only depends on the qualities of the population; it may also be affected by the place's characteristics or reputation, which could make it conducive for job search and employment or make it more attractive to firms to set up operations there.

The selection of variables and their measurements are as follows:

(l) **Job accessibility** is defined in this study as the amount of accessible firms or potential employers around a *barangay*. In generating this, a model for measuring the number of firms was developed based on Hanson, Kominiak & Carlin (1997)'s work. In this model, the amount of accessible firms from a community will be obtained by getting the sum of both the community's firms and its neighboring areas' firms. The number of firms in neighboring areas was considered in generating this measure because workers are not limited to searching for jobs in their village; instead, they can travel to surrounding areas to look for jobs if they cannot find a suitable job in their own village. Communities and surrounding areas that generate higher firm counts will be considered as more opportunity-rich compared to neighborhoods with lower firm counts since having more firms around an area would mean that there are more potential employers for job-seekers living in that area. Then, the generated firm counts will be converted into percentage format, so the variable could be interpreted as the percentage of total firms that can be accessed from a specified community.

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This variable is expected to have a positive relationship with the employment-to-population ratio because having more potential employers around an area gives more options and more employment opportunities for residents.

(2) **Educational attainment** is represented in the model as the percentage of the *barangay* population with at least a high school diploma. This variable is included in the model because employers often look at credentials and qualifications of workers before hiring them, and educational attainment is one of the most common bases not only of a worker's qualifications, but also of his personal attributes and abilities to complete certain tasks (Eurostat, 2016). High school was chosen as the basis for educational attainment since this is the minimum educational attainment for a large number of entry-level jobs.

This variable is expected to have a positive relationship with employment levels because a higher educational attainment would make residents eligible for a greater variety of jobs (Danziger, et. al, 2000), increasing their probability of being employed, and thus contributing positively to the *barangay*'s employment-to-population rate.

(3) **Skills training** is represented in the model as the percentage of the resettlement site's population with technical-vocational skills training. Just like educational attainment, employers often perceive a worker's skills training as an indicator of experience and qualifications especially for jobs with specialized skills requirements, which makes it a potential determinant of employment levels in the model.

This variable is expected to have a positive relationship with employment level because for some employers or industries, having technical skills training or experience is an advantage during the hiring process. Participation in skills training programs makes an individual prepared for specific types of occupations or jobs that require specialized

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skills. Participation in these programs also implies that a person has more practical experience about a certain job or industry, which increases his chances of employment.

(4) **The percentage of individuals under age 25** in the working age population is included as a control variable. This variable is expected to have a negative impact on the employment-to-population ratio because these individuals are still included in the working age population although a considerable number are not participating in the labor force due to studies. These individuals usually choose to delay labor force participation until after graduation.

(5) The **percentage share of married females** in the *barangay* will also be controlled for in the model because just like individuals under 25, this demographic group is also likely to drop out of participation in the labor force, and yet they are counted in the employment-to-population ratio.

A larger share of married females in the working age population is expected to have a negative impact on employment levels. In the Philippines, married women are less likely to work because they are typically responsible for childcare and household management. Just like the previous variable on school-aged individuals, it is necessary to control for these variables because they are still counted in the community's working age population despite their non-participation in the labor force. Failing to control for this variable would negatively bias the results.

(6) A **dummy variable for economic zone** was included, with 1 signifying that a village is an economic zone and 0 signifying that it is not. This was included in the model because because being designated as an economic zone could drive employment levels up (Zeng, 2010) because of increased investments on the region brought about by the designation. The increased investment that comes with the designation of an economic

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zone may even have the possibility of positively affecting the employment levels of nearby communities. For this same reason, this dummy variable has a positive expected sign.

(7) A **dummy variable for urban and rural area** is included in the model as a control variable, with 1 signifying that a village is an urban area and 0 signifying that it is a rural area. Highly-urbanized areas generally experience higher employment levels than rural areas since the structure of cities facilitates knowledge spillovers, social opportunities, and learning opportunities (O'Sullivan, 2012). This in turn attracts firms and people to these areas and gives way to more efficient job-matching because of the concentration of workers and firms that could be matched to each other. Because of this, the variable is expected to have a positive sign.

(8) A **dummy variable for protected area** will also be controlled for in the model, with 1 indicating that the area is protected and 0 if it is not. The Philippines is an environmentally-diverse country and thus, the government places a high importance on preserving the natural features of certain areas that are important to the country's ecosystem. These regions do not experience industrialization and urbanization because of a government policy that designates these regions as protected areas. Despite this, protected areas still have the potential to develop because of eco-tourism, which generates jobs for people despite the absence of heavy industrialization. For this reason, this variable has a positive expected sign.

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Table 1.

Variables selected for the regression models

Dependent variable	Spatial unit		Variable Specification/Description
Employment level	*Barangay*		The percentage of the spatial unit's total working age population currently employed.
Independent variable	**Spatial unit**	**Expected sign**	**Variable Specification/Description**
% Accessible firms	*Barangay*	(+)	The percentage of accessible firms or employers around a neighborhood, with a higher value indicating that the area is more opportunity-rich.
Educational attainment	*Barangay*	(+)	The percentage of the spatial unit's working age population with at least a high school diploma.
% with skills training	*Barangay*	(+)	The percentage of the spatial unit's working age population with technical-vocational skills training.
% of married females	*Barangay*	(-)	The percentage of married females in the spatial unit's working age population.
% under 25	*Barangay*	(-)	The percentage of individuals aged 15 to 24 in the spatial unit's working age population.
Economic Zone	*Barangay*	(+)	A dummy variable indicating whether a certain village has been designated as an economic zone (1) or not (0).
Classification	*Barangay*	(+)	A dummy variable indicating whether a certain village is an urban area (1) or not (0).
Protected Area	*Barangay*	(+)	A dummy variable indicating whether a certain village has been designated as a protected area (1) or not (0).

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3.4. Data description and collection method

This study mainly deals with spatial, cross-sectional data in *barangay* level to facilitate analysis in GIS software and to enable the implementation of spatial regression methods. The aggregated *barangay*-level data were obtained from two main data sources: Raw demographic data such as educational attainment, number of working age population, marital status, and gender were aggregated into *barangay*-level variables from the Philippine Statistics Authority (PSA)'s population census public use file, which records information on the aforementioned characteristics at the individual level. On the other hand, data on the number of registered business establishments per *barangay* were obtained from each local government unit's Business Permits and Licensing Office (BPLO). Each local government unit's list contains basic information regarding individual business establishments such as the business name and business location. Business locations, specifically the *barangay* where each establishment is registered, were converted into *barangay*-level counts.

Finally, information on government policy designations such as village classification, economic zones and protected areas were obtained from the Philippine Economic Zone Authority (PEZA) and the Philippines' Department of Environment and Natural Resources (DENR).

In order to facilitate data analysis using GIS software, the aggregated data were mapped into the administrative boundaries file after collection.

3.5. Methodological limitations

Although the research emphasizes accessibility to jobs as the main predictor of community employment levels, it will not be able to compute job access measures for

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different modes of transportation due to unavailability of data regarding transport networks. In addition, this research only investigates employment levels and job access in general, and thus does not examine these factors for each industry or occupational level, nor will it be able to tell whether the accessible job opportunities will match the workers' occupational levels.

Due to data limitations, some variations in the measurement of key variables had to be done. First, labor force data is only available at the provincial level so employment levels could not be represented using the employment rate. However, the census does provide individual-level data on the whole study area population, so it was still possible to obtain the number of working age and employed individuals in the each of the study area's villages, which were then used to compute the local employment-to-population ratio. Although slightly different from the employment rate, the employment-to-population ratio is still a suitable measure of employment levels because it measures not only the share of the employed in the working age population, but also the ability of the government to create jobs relative to the growth of its working age population (Department of Labor and Employment, 2011). It must be noted that an inherent problem in this measure is that it includes all working age individuals in a given spatial unit regardless of their participation in the labor force, but this is addressed in the regression model by controlling for the percentage of individuals who are likely to opt out of labor force participation, thus removing negative bias in the model.

It was also necessary to use an alternative for the measurement of accessible job opportunities due to inconsistencies in the data regarding the number of job vacancies. Ideally, when measuring job accessibility, existing literature recommends that job vacancies be used instead of simply using jobs or number of establishments. With that said, using the number of accessible firms as an indicator of job availability in a location will still suffice given the context of the study because this measure still gives a rough

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idea on the presence of jobs around an area. Having a large number of establishments around a community implies that the villages and its surrounding area is developed (Birch, 1981; Fritsch, 2013), which in turn implies that there are more opportunities for employment. Thus, using the number of establishments as a measure of job availability lets readers see whether the surrounding area has an abundance of potential employers and in turn would be able to show whether there are many opportunities for employment within the vicinity.

3.6. Data analysis methods

This study employs the measures of job proximity approach in testing the spatial mismatch hypothesis. The job-access variable is a direct measure of the degree of spatial mismatch between two locations: in this case, the location of the workers and the location of job opportunities (Houston, 2005). Thus, this approach is the best method to use for testing whether employment levels are affected by a place's accessibility to job opportunities.

The model of local employment levels in relation to the level of access to firms is estimated using Ordinary Least Squares (OLS), spatial lag, and spatial error regression. The econometric approaches in this study are complemented by hot spot analysis through GIS software. Using weighted features in a map, hot spot analysis enables the identification of statistically significant clusters of attributes with high values and low values, called hot spots and cold spots respectively. This type of analysis aids in identifying patterns in the spatial distribution of employment levels and job access; that is, whether high values are clustered in one area. This method will be useful for determining whether there is a clustering of high job access and high employment levels in Metro Manila and whether there is a significant difference between employment levels and job access inside and outside Metro Manila.

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3.6.1. Hot spot analysis

Hot spot analysis is utilized in this study to identify areas with the highest and lowest concentration of employment levels. This is different from simply using spatial distribution maps to visualize the spread of employment levels since statistically significant clusters cannot be distinguished simply by looking at the density of attributes as presented in spatial distribution maps. Hot spot analysis considers an area's feature in relation to its neighboring areas' features and generates a Getis-Ord-Gi* statistic to determine the statistical significance of the feature. A place must have a high value for an attribute and must also be surrounded by neighboring areas with high attributes in order to be considered a hot spot. The cluster is statistically significant if the local sum of features in this area is significantly higher than the study area average and if the difference is too large to be the result of a random occurrence.

When applied to the study, the hot spot analysis identifies places where there is a higher or lower than average employment level or access to firms. If a statistically significant cluster of high employment or access to firms is found in Metro Manila, then it means that higher values for these attributes are actually concentrated in Metro Manila and that the distribution of employment and accessibility is not equitable, thus providing a basis for supporting the spatial mismatch hypothesis.

3.6.2. Ordinary Least Squares (OLS) regression

OLS is a global linear model used to estimate the relationship between a dependent variable and several independent variables, and one of the most common models for estimating relationships between variables in cross-sectional studies. OLS results generate coefficients which allow the estimation of the effect of changes in one variable on the outcome variable, holding all other variables constant.

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An OLS model has three basic assumptions that must be met in order for the coefficients to be the best linear unbiased estimators (Stock & Watson, 2015):

(1) No multicollinearity: This assumption means that there should be no linear relationship between the independent variables. When the independent variables are highly correlated with each other, this means that these independent variables are redundant and could lead to imprecise estimates. This occurs when a model includes two or more independent variables that measure the same attribute.

(2) Homoscedasticity: This means that the variance of the error terms are constant and that the error terms do not depend on the independent variables. Heteroskedasticity does not bias the estimates; however, the confidence interval of the model will be too narrow or too wide, making it difficult to trust the standard errors of the estimators and in turn making it difficult to draw accurate conclusions from the hypothesis testing.

(3) No autocorrelation: Autocorrelation means that observations are correlated with each other. This is highly likely in time-series data, where the values of the present period are highly dependent on the values of the previous period. Spatial data also tends to exhibit this kind of property since nearby observations tend to have similar characteristics and therefore features would also tend to be related to one another. If autocorrelation is present, the estimators will not be reliable since they will tend to be over- or under-estimated.

The OLS regression model for examining the effect of the independent variables on the employment level is expressed in the following equation:

$$\textit{Barangay}\ \text{employment-to-population ratio} = \beta_0 + \beta_1\,\text{ACCESSIBLEFIRMS} + \beta_2\,\text{HSGRAD} + \beta_3\,\text{SKILLSTRAIN} + \beta_4\,\text{MARRIEDFEMALE} + \beta_5\,\text{UNDER25} + \beta_6\,\text{ECONOMICZONE} + \beta_7\,\text{CLASSIFICATION} + \beta_8\,\text{PROTECTEDAREA} + \varepsilon \quad (2)$$

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where:

ACCESSIBLEFIRMS = percent of accessible firms from the *barangay*

HSGRAD = percentage of working age population with at least high school diploma

SKILLSTRAIN = percentage of working age population with technical-vocational training

MARRIEDFEMALE = percentage of working age population who are married females

UNDER25 = percentage of working age population who are under 25

ECONOMICZONE = dummy indicator whether *barangay* is a designated economic zone

CLASSIFICATION = dummy indicator whether *barangay* is urban area or not

PROTECTEDAREA = dummy indicator whether *barangay* is a protected area or not

ε = error term

3.6.3. Spatial regression

Since the study deals with spatial data, there is a possibility that nearby areas or terms are likely to share some similarities, violating the assumption that each observation is independent of the others. When spatial autocorrelation is present, the coefficients of variables would be under- or over-estimated, making the estimates unreliable. Thus, besides implementing the classical regression model, spatial regression models must also be applied in order to solve these issues.

The spatial lag and the spatial error model will be used in this study to correct the OLS model's spatial autocorrelation, but there are differences between the two: The spatial lag model is more appropriate when the dependent variable of a place is spatially correlated to the values of the neighboring areas because this model considers the attributes of other neighboring places as an independent variable. On the other hand, the spatial error model isolates the effects of unobserved geographic characteristics on employment levels, so

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this is more applicable for cases when error terms across space are spatially correlated with each other.

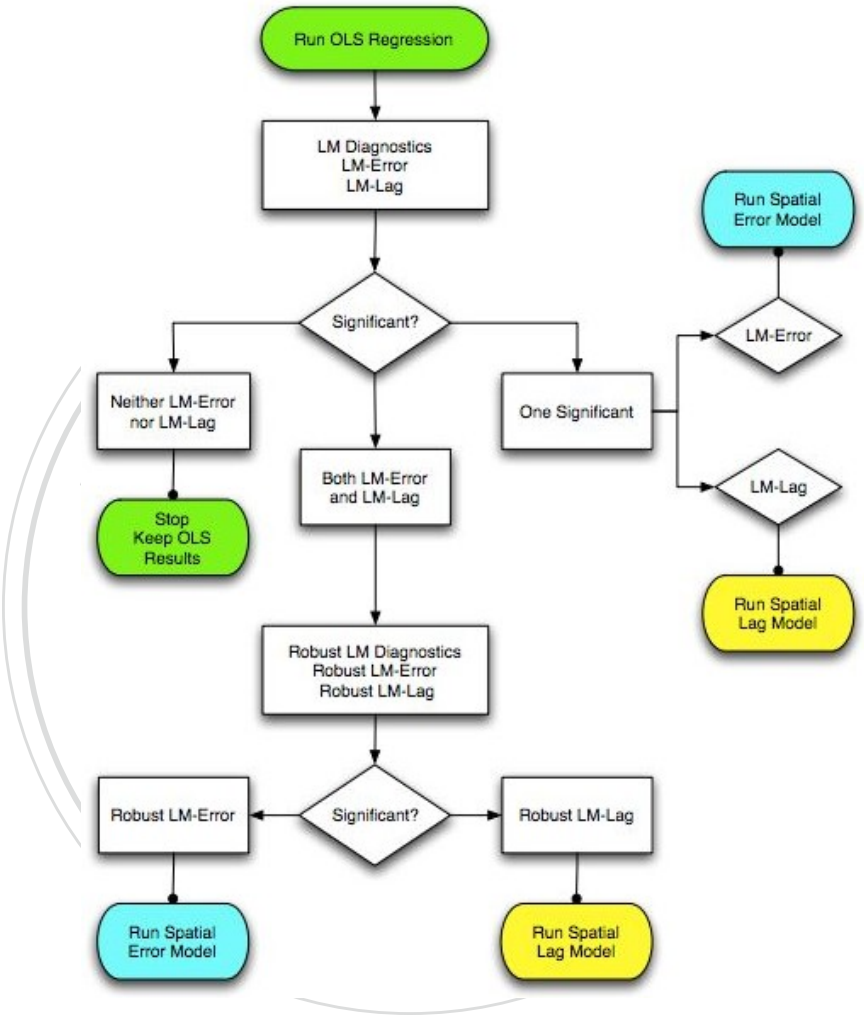

Figure 3. *Spatial regression model selection process. (Anselin, 2005)*

The spatial lag (Equation 2) and spatial error (Equation 3) models for examining the effect of the independent variables and spatial components on employment levels are given below:

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$$\textit{Barangay}\ \text{employment-to-population ratio} = \beta_0 + \rho W\_Employment + \beta_1 ACCESSIBLEFIRMS + \beta_2 HSGRAD + \beta_3 SKILLSTRAIN + \beta_4 MARRIEDFEMALE + \beta_5 UNDER25 + \beta_6 ECONOMICZONE + \beta_7 CLASSIFICATION + \beta_8 PROTECTEDAREA + \varepsilon \quad (2)$$

where:

ρ = the spatial coefficient

W_Employment = spatially lagged employment level

ε = error term

ρ indicates the degree of spatial dependence between neighboring areas' employment levels. This coefficient will be 0 if there is no spatial correlation between the dependent variables, making the equation equal to the previously given OLS model.

$$\textit{Barangay}\ \text{employment-to-population ratio} = \beta_0 + \beta_1 ACCESSIBLEFIRMS + \beta_2 HSGRAD + \beta_3 SKILLSTRAIN + \beta_4 MARRIEDFEMALE + \beta_5 UNDER25 + \beta_6 ECONOMICZONE + \beta_7 CLASSIFICATION + \beta_8 PROTECTEDAREA + \varepsilon \quad (3)$$

$$\varepsilon = \lambda W\varepsilon + \xi$$

where:

λ = the spatial error coefficient

$W\varepsilon$ = spatially correlated error terms

ξ = uncorrelated or random error terms

λ is the indicator of spatial dependence between the neighboring areas' error terms. If there is no spatial correlation between the error terms, λ will be 0 and the equation will be equal to the given OLS model.

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The model to be used for the interpretation of results depends on the kind of spatial autocorrelation in the data as indicated by the Moran's I and Lagrange Multiplier (LM) statistic: if the OLS model is spatially autocorrelated and shows a pattern of spatial dependence between the dependent variables, the spatial lag model is used. If the error terms show a pattern of spatial dependence between the error terms, the spatial error model is used.

IV. EMPIRICAL RESULTS AND DISCUSSION

The purpose of this study is to determine whether access to jobs has an impact on employment levels and to compare the degrees of access to jobs and employment levels between neighborhoods inside and outside Metro Manila. This chapter discusses the results derived from the regression analysis and hot spot analysis. As an initial step, descriptive statistics such as the mean, median, standard deviation, minimum values, and maximum values are presented in order to provide an overview of the data used in the study. Maps are also provided in the descriptive spatial statistics in order to visualize the spatial distribution of the data, and a hot spot analysis is conducted to determine whether the clusters in the spatial distribution map are statistically significant.

The main econometric procedures used to assess the impact of the number of accessible firms on employment levels are OLS regression and spatial regression. The differences between the models will be illustrated and compared in the chapter's results section. Finally, the chapter discusses the obtained results and how these results answer the research questions.

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4.1. Descriptive statistics

Table 2 presents each variable's descriptive statistics for all villages in the study area, while Table 3 presents the summary measures for employment-to-population ratio. According to the statistics, the average employment-to-population ratio in the study area neighborhood is 61.2%, and when examined according to region, the employment level is higher for villages inside Metro Manila (62%) than for those outside Metro Manila (60%). Table 4 also indicates that there is a large disparity in the average share of firms accessible from a given community when examined according to region, with the average share of accessible firms being drastically higher in Metro Manila than outside Metro Manila.

Table 2.

Descriptive statistics of all variables.

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum
Employment level	3,336	61.23415	5.486976	31.01449	86.70757
% Accessible jobs	3,336	0.2308512	0.4757931	0.0002485	6.572666
% HS graduates	3,336	78.28966	11.70944	18.47134	99.13043
% Skills training	3,336	2.888209	1.802689	0	13.50575
% Married female	3,336	23.29799	4.469615	4.587156	90.99361
% Under 25	3,336	29.98598	3.855447	9.523809	69.65429
Economic zone	3,336	0.0227818	0.1492295	0	1
Classification	3,336	0.6669664	0.4713691	0	1
Protected area	3,336	0.0562237	0.2303878	0	1

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Table 3.

Summary measures of employment-to-population ratio per region

Region	Observations	Mean	Standard Deviation	Minimum	Maximum
Metro Manila	1,663	62.34112	5.535484	31.01449	86.70757
Outside Metro Manila	1,673	60.13379	5.211827	44.63938	83.33334

Table 4.

Summary measures of % of accessible jobs per region

Region	Observations	Mean	Standard Deviation	Minimum	Maximum
Metro Manila	1,663	0.2976637	0.6096973	0.0002485	6.572666
Outside Metro Manila	1,673	0.1644381	0.270516	0.0002485	3.94524

Figure 4 shows the economic zones in the study area, and the graph shows that Metro Manila has the highest number of economic zones, followed by Laguna, Cavite, and finally Rizal.

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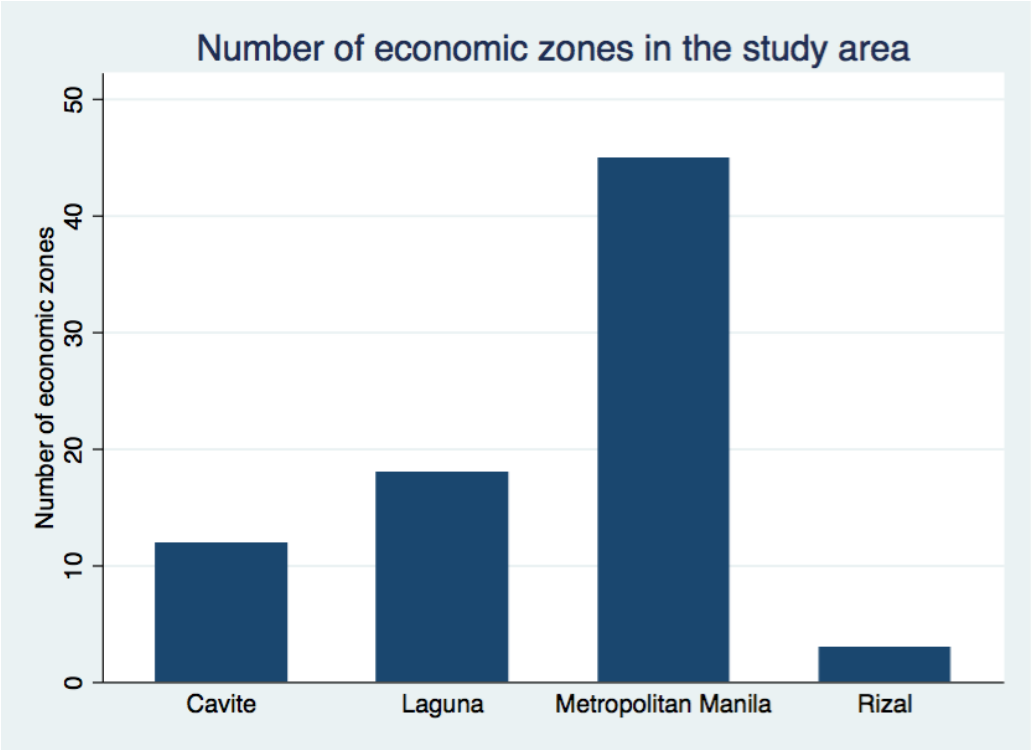

Figure 4. *Comparison of the number of economic zones in the study area.*

4.2. Descriptive spatial statistics

As part of the descriptive statistics, maps of the study area were also generated to illustrate the spatial distribution for each of the model's variables (Figures 5 to 12) and to gain an initial understanding of how the values of the attributes are spread out within the study area.

Based on the map of the employment-to-population ratio in Figure 5, high community employment levels tend to be concentrated in the Metro Manila area. The eastern parts of Laguna also appear to have high levels of employment, while most of Cavite and Rizal exhibit lower employment levels than the rest of the study area.

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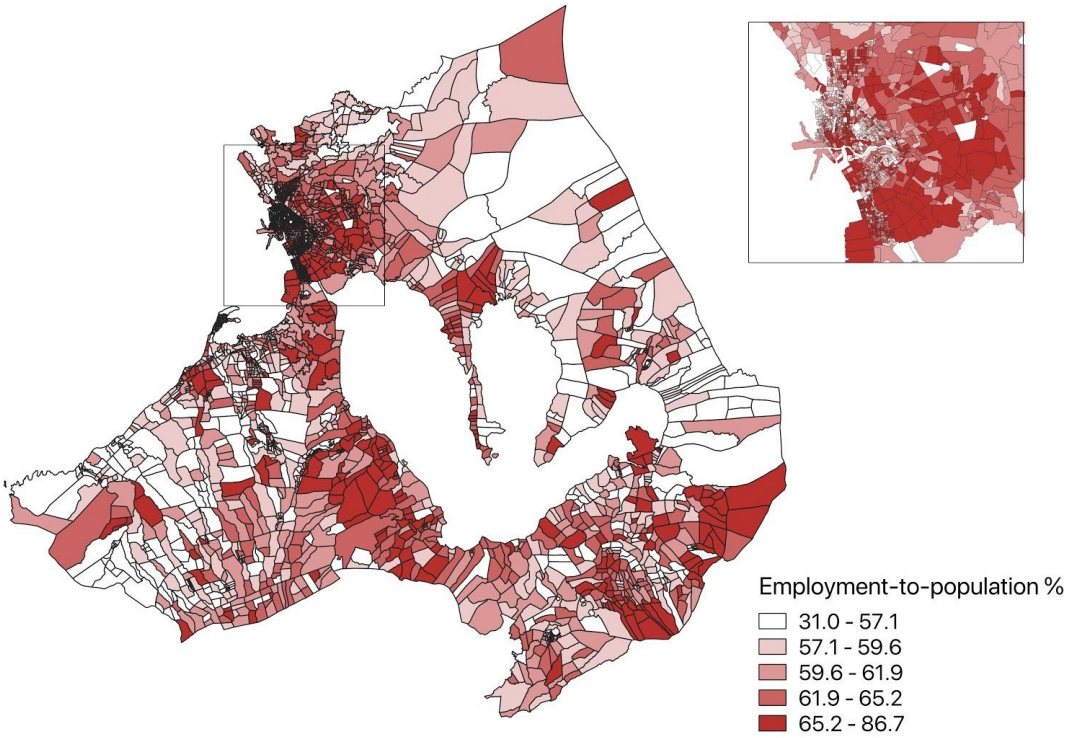

Figure 5. *Spatial distribution of employment-to-population ratio in the study area, classified according to quantiles.*

Although the spatial distribution map appears to show some patterns of clustering, this map alone cannot determine whether these clusters are statistically significant. In order to see more detail on which areas have a higher-than-average employment level, a hot spot analysis was conducted and the Getis-Ord-Gi* statistic was also generated and mapped, with the resulting hot spot map given in Figure 6.

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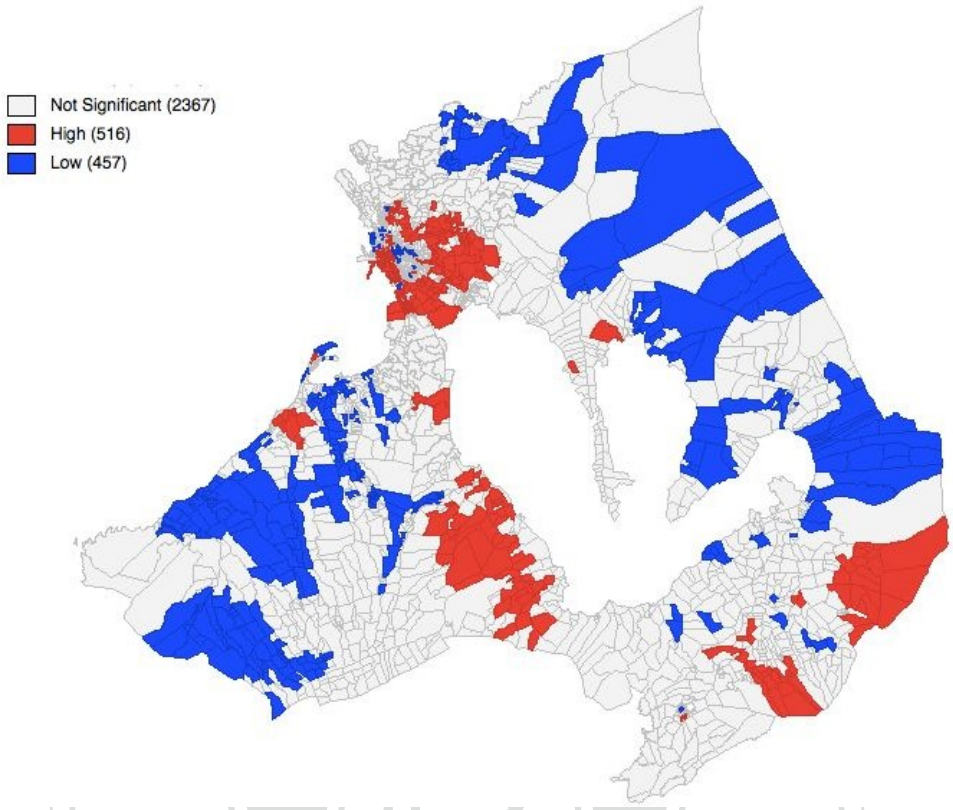

Figure 6. *Hot spot map of employment levels.*

According to the hot spot map in Figure 6, a large part of Metro Manila is composed of high employment clusters, with some exceptions in the central city and the northern part of the metropolitan area bordering on Rizal. Although some parts outside Metro Manila, particularly the Laguna area, also has multiple statistically significant clusters of high employment, the mapped results reveal that overall, the regions outside Metro Manila have larger clusters of communities with low employment levels, with larger areas of lower-than-average employment levels concentrated in the Cavite and Rizal provinces. The results of the hot spot analysis confirm the hypothesis that employment levels are not evenly distributed throughout the study area, with provinces experiencing lower employment levels than the rest of Metro Manila.

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On the other hand, the spatial distribution map of the percentage of accessible firms as illustrated in Figure 7 shows that the areas with the highest share of accessible firms are all found in Metro Manila and the areas immediately adjacent to the border such as the cities of Antipolo and Taytay in Rizal, and Dasmariñas and Imus in Cavite. There is a noticeable shift as communities move farther and farther outside Metro Manila: according to the map, the shares of accessible firms decreases with the distance from these high-access centers.

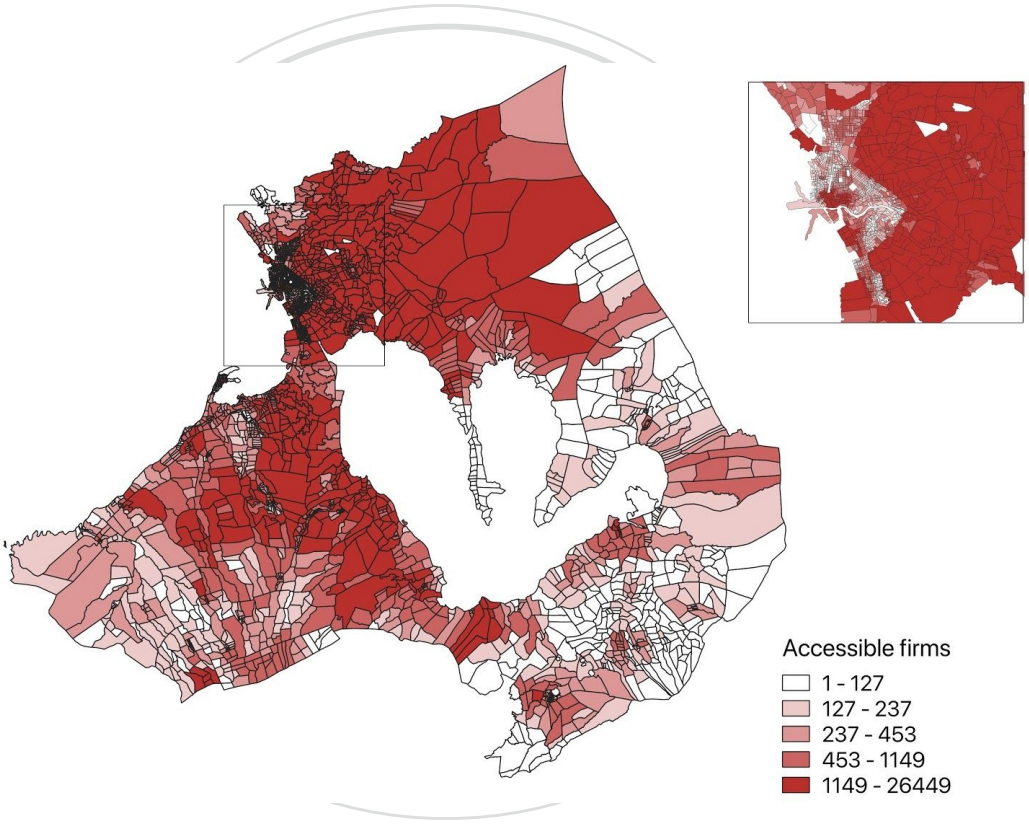

Figure 7. *Spatial distribution of accessible firms in the study area, classified according to quantiles.*

Just like with the employment levels spatial distribution map, it is necessary to generate the Getis-Ord-Gi* statistic in order to determine which of the high- or low-access clusters are statistically significant. Figure 8 shows that again, majority of Metro Manila is

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composed of high-cluster communities, compared to areas outside Metro Manila which are composed mostly of low-access clusters. The only exception to this are portions of Imus and Dasmariñas in Cavite, and Biñan and Santa Rosa City in Laguna, which are high-access clusters due to their proximity to the southern border of Metro Manila.

The results of the hot spot analysis confirms that communities with higher-than-average access to firms are mostly found in Metro Manila, and in contrast, majority of communities with low access to firms are outside Metro Manila, which means that the distribution of jobs and industries are not equitable. The presence of an uneven distribution of both jobs and employment levels supports the hypothesis that spatial mismatch exists in the Philippine setting, specifically in the context of Metro Manila and its adjacent provinces.

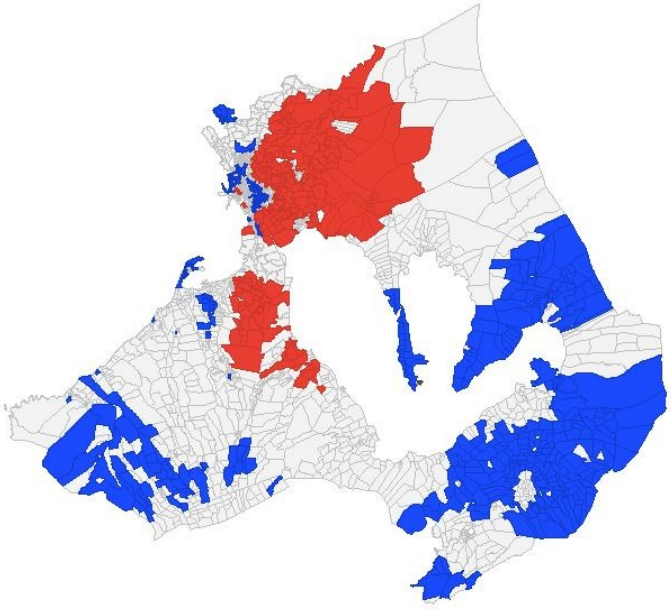

Figure 8. *Hot spot analysis of access to firms.*

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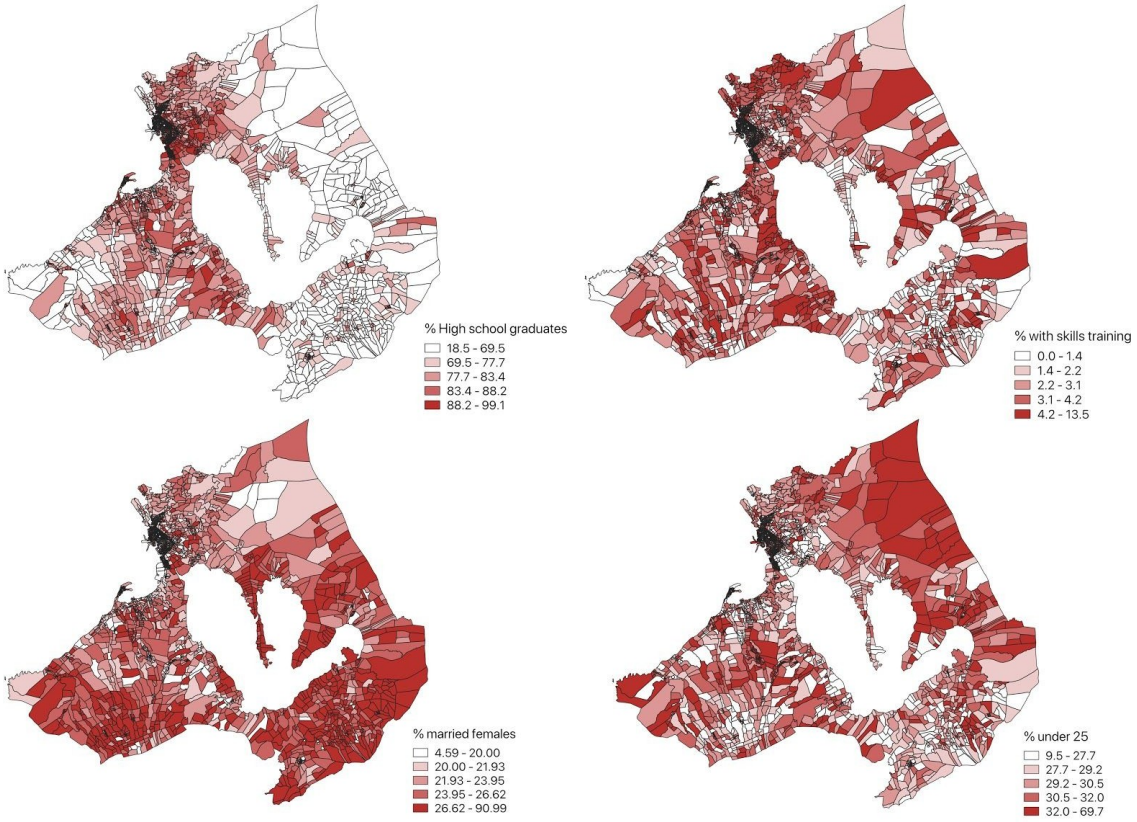

Figure 9. *Spatial distribution of independent variables in the study area, classified according to quantiles.*

Maps illustrating the spatial distribution of the control variables are shown in Figure 9. The maps indicate that the highest share of high school graduates in the working age population are in Metro Manila and the western side of Laguna. Low shares of high school graduates are mostly found in Rizal, southern Cavite, and eastern Laguna.

Moreover, according to the spatial distribution map, there is also a high share of individuals with skills training in the northern part of Metro Manila and in Calamba and San Pedro, Laguna. Clusters of high percentage of working age population with skills training can also be found in Antipolo, Rizal and the southern cities of Metro Manila such as Paranaque and Muntinlupa.

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As for married females, a high share of married females appears to be concentrated in Laguna and Cavite, while the lowest concentrations can be found in Rizal province and northern Metro Manila. Finally, a large share of individuals under 25 can be found in Rizal province, while the lowest concentrations are located in the eastern side of Metro Manila, particularly Pasig and Makati.

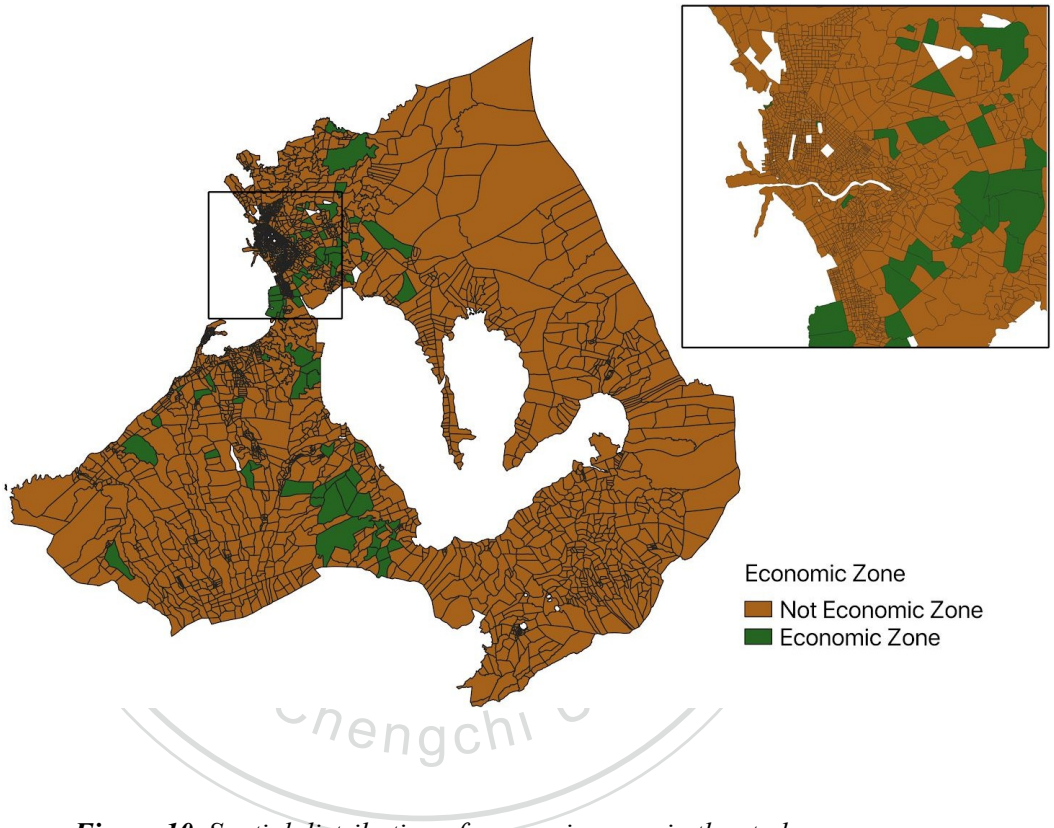

Figure 10. *Spatial distribution of economic zones in the study area.*

In accordance with the graph as given in Figure 4, the map on Figure 10 confirms that a large number of economic zones are in Metro Manila. Cavite also has some economic zones that are spread out throughout the province, while Laguna's economic zones are concentrated in Calamba, San Pedro, and Santa Rosa.

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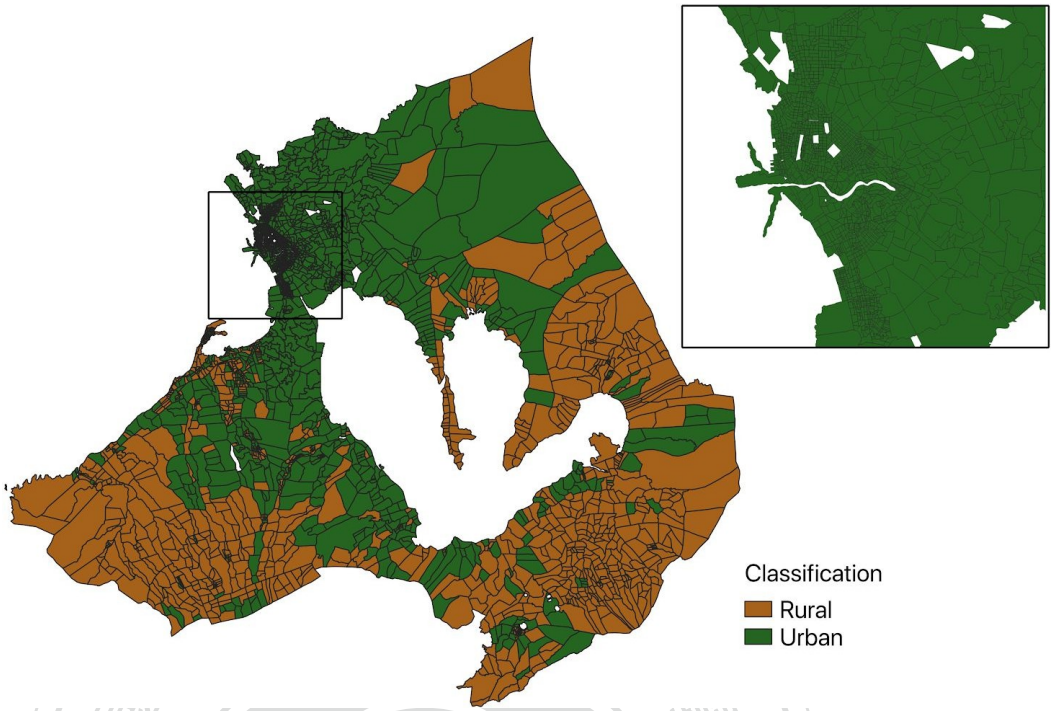

Figure 11. *Spatial distribution of rural and urban areas in the study area.*

The spatial distribution map of rural and urban areas as given in Figure 11 shows that Metro Manila is fully composed of urban communities. Though most of the adjacent provinces are composed of rural communities, urban communities are also noticeably present in parts of the provinces that are in the immediate vicinity of Metro Manila's borders: examples are Cainta, Antipolo, and Taytay in the province of Rizal; Bacoor, Dasmariñas, Imus, and General Trias in the province of Cavite; and San Pedro, Biñan, and Santa Rosa in the province of Laguna.

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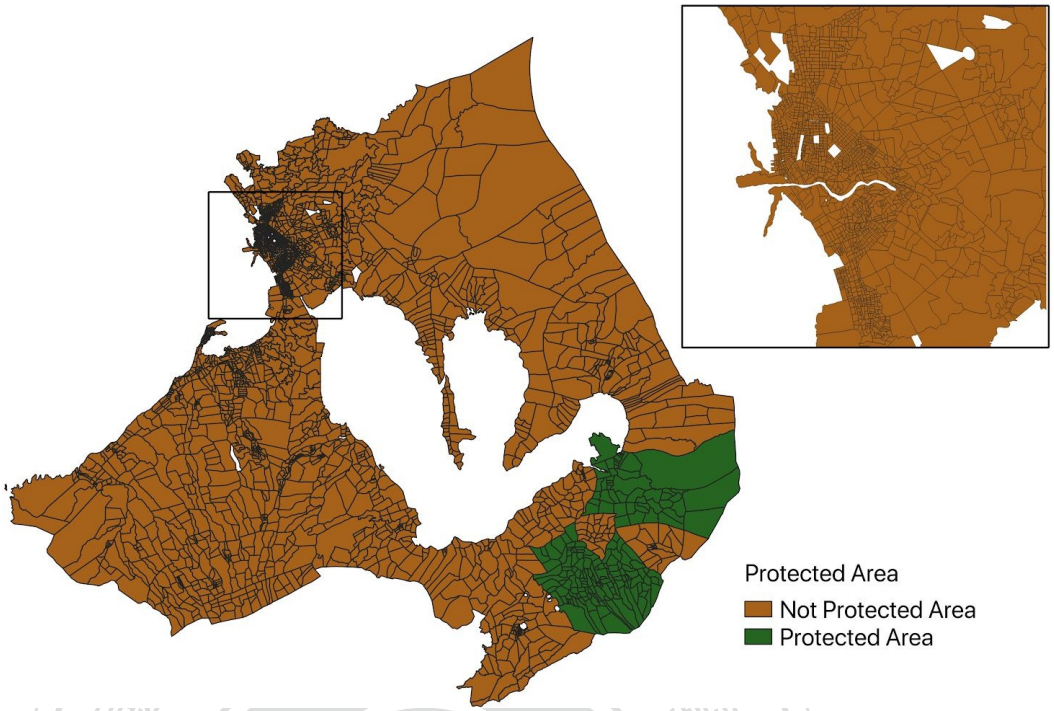

Figure 12. *Spatial distribution of protected areas in the study area.*

Figure 12 illustrates the spatial distribution of protected areas in the study area. According to the map, protected areas are mostly concentrated in the province of Laguna, particularly in Cavinti, Nagcarlan, Majayjay, and Liliw. When compared to the hot spot map of access to firms, it is noticeable that these same regions were part of the cold spots in that map. Thus, from these maps, it can be inferred that these regions have low access to firms because these areas are protected and are not allowed to be developed.

The maps of the variables show that places with high employment also tend to have higher accessibility to firms. The hot spot maps of employment levels and accessible firms show that both high employment and high access could be found in Metro Manila, suggesting a direct relationship between the two variables. The variable maps also show that employment levels also appear to be higher in places with a lower share of

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individuals under 25, as well as in areas with economic zones and protected areas. A regression analysis was run in order to confirm these relationships.

4.3. Regression model results

The hot spot analysis in the previous section was complemented by a regression analysis on the study area in order to determine which attributes contribute to being a high- or low-employment region and, more specifically, whether access to firms does affect employment levels. OLS regression was used first in order to determine the global, or average relationship between the variables. Test statistics were generated to ensure that the model does not violate any of the assumptions of linear regression, and spatial regression was used to correct for spatial autocorrelation.

Overall, the results show that the presence of accessible jobs around a village increases the employment-to-population ratio, and this result is consistent in both the classical OLS and spatial regression models. Besides the number of accessible jobs, the characteristics of a village's working age population and location are also significant contributors to employment levels. Nevertheless, the effects of the working age population attributes are smaller compared to the effects of the accessible jobs variable. Table 5 shows that the presence of accessible firms has a positive impact on a village's employment-to-population ratio.

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Table 5.

Empirical results for alternative specifications - OLS and spatial regression models

Dependent variable: Employment levels	OLS		Spatial lag model		Spatial error model	
	β	Robust SE	β	Robust SE	β	Robust SE
Constant	76.7107**	2.140798	40.1957**	1.75203	74.95**	1.32761
% Accessible firms	1.41375**	0.2040959	0.56150**	0.175277	1.30719**	0.283116
% of HS graduates	0.01618	0.0098725	-0.002366	0.0075998	-0.003465	0.0096151
% With skills training	-0.1217**	0.0499517	-0.029207	0.0423496	0.0367531	0.0455519
Married Female	-0.2173**	0.0401808	-0.1474**	0.0207156	-0.16698**	0.0234115
Under 25	-0.4285**	0.0420077	-0.3181**	0.0225283	-0.35443**	0.0249354
Economic zone	3.56099**	0.7707971	2.94331**	0.531797	2.53048**	0.539318
Classification	1.40509**	0.2642325	0.67358**	0.203747	0.834475**	0.258411
Protected area	3.23235**	0.4637508	1.58474**	0.362545	2.20275**	0.699662
W_Employment			0.54783**	0.0188492		
LAMBDA					0.570887**	0.0193405
Adj. R-squared	0.159415		0.361572		0.360048	
Breusch-Pagan test (prob.)	217.9659 (0.0000)		181.5671 (0.0000)		220.2250 (0.0000)	
Moran's I (prob.)	30.5808 (0.0000)					
LM - lag (prob.)	978.0896 (0.0000)					
LM- error (prob.)	919.7485 (0.0000)					
Robust LM - lag (prob.)	64.9419 (0.0000)					
Robust LM - error (prob.)	6.6008 (0.01019)					

*significant at 95% level **significant at 99% level

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4.3.1. OLS model results

The OLS results show that a 1% increase in the number of accessible firms from a given village also increases its employment-to-population ratio by an average of 1.41%, holding other variables constant. On the other hand, working age population characteristics, specifically the share of those who are likely to be disadvantaged or drop out of the labor force are also significant: with every 1% increase in the share of individuals under 25, the average employment-to-population ratio decreases by about 0.42%. Meanwhile, a 1% increase in the percentage share of married females in the working age population decreases the average employment-to-population ratio by about 0.21%.

The dummy variables for location characteristics such as economic zone designation, classification, and protected areas are all positive and significant: being designated as an economic zone would increase the average employment-to-population ratio by about 3.56% holding all other variables constant, while being an urban area increases the average employment level by about 1.40%. Being designated as a protected area, on the other hand, is associated with an increase of 3.23% in average employment levels.

Finally, no statistically significant linear relationship between employment levels and share of working age population with high school diploma was detected. The same goes for employment levels and the percentage share of working age population with skills training.

4.3.2. Checking regression assumptions

Test statistics were generated to ensure that the OLS model does not violate the assumptions of regression analysis as stated in the previous chapter. The variance inflation factor (VIF) was used to detect multicollinearity, while the Breusch-Pagan test

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and Moran's I statistic were used to detect heteroskedasticity and spatial autocorrelation, respectively.

The VIF of the model's variables are all less than 10 (Table 6), which indicates that multicollinearity is not a concern. The Breusch-Pagan test for heteroskedasticity also gave a value of 217.97 and had a p-value less than 0.001, so the assumption of homoscedasticity has not been met. Although the presence of heteroskedasticity in the data does not bias the estimates, it does make the estimates inefficient, making the standard errors larger and changing the range of the confidence interval. This is addressed in the model by using robust standard errors to draw more accurate conclusions from the hypothesis testing.

Table 6.

Variance inflation factor for the independent variables.

Variables	VIF	1/VIF
% Accessible firms	1.17	0.854317
% of High school graduates	1.37	0.729023
% With skills training	1.01	0.991197
Married Female	1.47	0.682177
Under 25	1.26	0.792243
Economic zone	1.09	0.913427
Classification	1.58	0.633059
Protected area	1.19	0.843518
Mean VIF	1.27	

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Judging from the spatial distribution map as given in Figure 5 and the hot spot map in Figure 6, there appears to be a pattern of clustering of the dependent variable, with high employment levels being concentrated in Metro Manila. The existence of this pattern implies that there is spatial autocorrelation in the data, which means that high or low values tend to be clustered together in a certain area. The Moran's I statistic was generated for the dependent variable in order to confirm the presence of spatial autocorrelation.

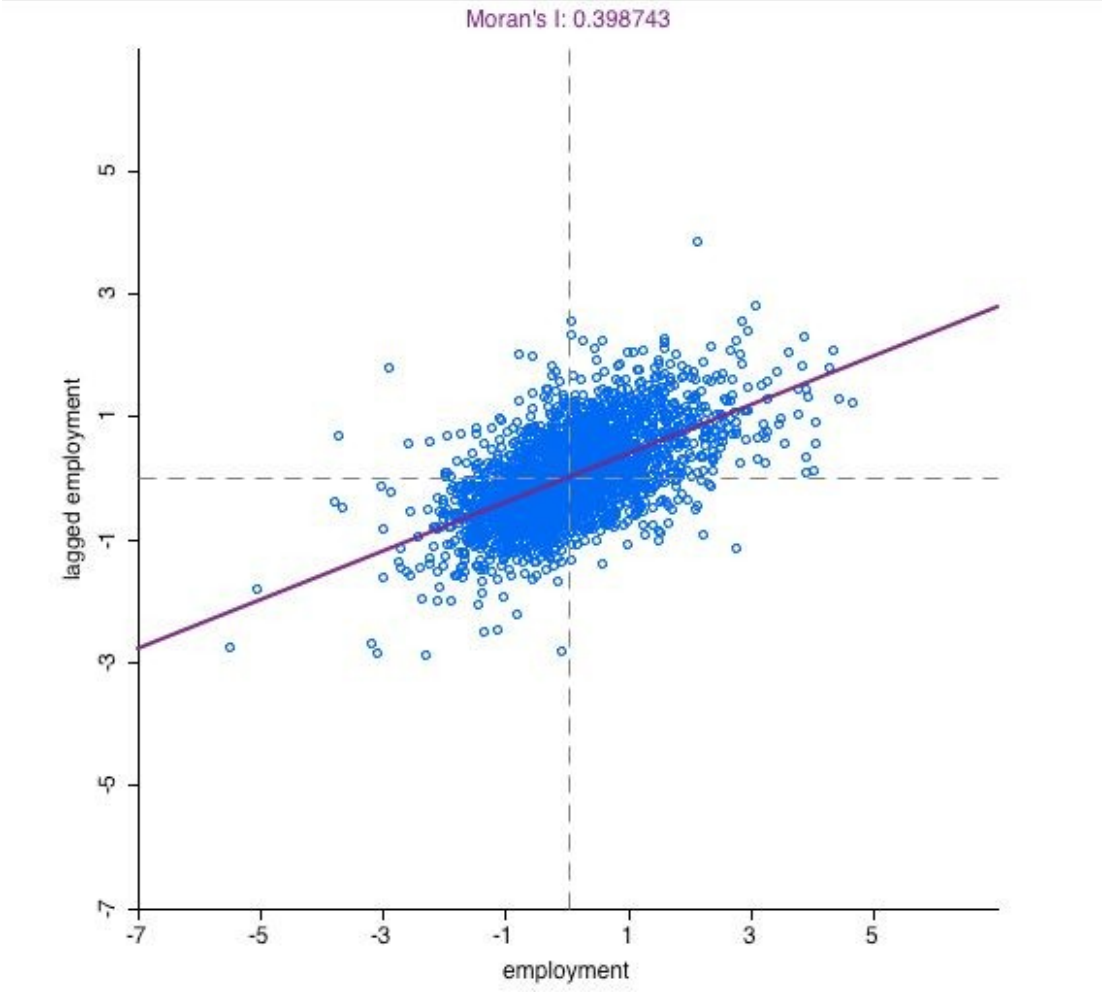

Figure 13. *Moran's I test statistic for the study area.*

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According to the results of the Moran's I test for the dependent variable (Figure 13), there is a positive spatial autocorrelation as indicated by the slope of the graph. A positive spatial autocorrelation indicates that there are clusters of high and low employment levels. Because of this, spatial regression must be used in order to correct the original OLS model since spatial autocorrelation could bias the model by underestimating or overestimating the coefficients of the variables. When accounting for spatial autocorrelation, spatial regression models can generate a variable which contains the degree of spatial interactions that are affecting the employment levels.

The decision-making process for spatial model selection as provided in Figure 3 states that the selection for the best spatial regression model is based on the Lagrange Multiplier diagnostics run after OLS regression. If the LM diagnostic - lag is significant, then the spatial lag model is run; otherwise, the spatial error model is run. If both are significant, the robust LM diagnostics are generated and whichever model's robust LM value is significant would be the appropriate model (Anselin, 2005). Judging from the LM and robust LM values provided in Table 5, both the spatial lag and spatial error model are significant and both must be tried in order to select the best model for interpretation.

4.3.3. Comparison of OLS and spatial regression models

This section compares the results of the OLS and spatial regression models, and draws attention to the effects of running the spatial regression model on the values of the coefficients. Furthermore, the section discusses the steps and criteria for choosing which specification is best for modelling employment levels in the context of the study area and the overall objectives of the research.

The OLS model shows that accessible firms has a higher impact on employment levels compared to working age population characteristics. This result is consistent even with

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the spatial lag model in place, with a 1% increase in accessible firms leading to about 0.56% rise in the average employment levels. The working age population and location characteristics that were significant in the OLS model are still significant in the spatial regression models. However, these coefficients are noticeably lower than the OLS coefficients. On the other hand, the spatial lag variable W_Employment is positive and significant, which means that spatial dependence between each village's employment levels exists and that a change in the dependent variable or any of the independent variables in one area would positively affect the other neighboring areas' employment levels. More specifically, the spatial lag model's results show that about 54% of the changes in neighboring areas' employment levels is absorbed by the given location's employment levels. Thus, the spatial lag variable captured the effect of spatial interactions in the study area; that is, the effects that were originally attributed to the variables in OLS were actually due to spatial interaction, which is the reason for the changes in the coefficients.

Variables that were significant for the OLS model and spatial lag model were also significant for the spatial error model, while accessible firms and location characteristics still have higher effects compared to those for population characteristics. The LAMBDA variable, which indicates the degree of spatial dependence between the neighboring areas' error terms, is also significant, which means that there might be unobservable geographic characteristics that affect employment levels. Again, the changes in the coefficients could be attributed to the addition of the LAMBDA variable, which accounts for the effects of unobserved spatial characteristics that were originally attributed to the variables in OLS.

Overall, both spatial models do not differ drastically from one another; both show almost similar significant variables. Both the lag variable and LAMBDA variable are also significant, which highlights the importance of spatial factors in determining employment

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levels. Not only does the addition of spatial variables correct the estimation of regression coefficients, it also improves the model in terms of the fit diagnostics and R-squared. Given that both LM-lag and LM error statistics are significant and both spatial regression models appear to improve the existing OLS model, the selection of the best model for interpretation will be determined through the statistics for model fit.

The log-likelihood, Akaike Information Criterion, and Schwarz Criterion are the most common diagnostics for model fit in spatial regression. Table 7 enumerates the model fit statistics for all models. The table shows that the diagnostics favor the spatial lag model in accounting for spatial autocorrelation in the context of the study. This means that, for the purposes of this research, spatial interactions between the dependent variables in neighboring areas are the most relevant in determining the employment levels of a certain community. Considering that the study is mainly interested in establishing and discussing the spatial patterns in employment levels between regions, the use of spatial lag model is most appropriate.

Table 7.

Comparison of statistics for model fit.

Criteria	OLS	Spatial lag	Spatial error
Log-likelihood	-10,096	-10,072.10	-10,075.96
Akaike Information Criterion	20,210.10	20,164.20	20,169.90
Schwarz Criterion	20,265.10	20,225.30	20,224.90
Adj. R-squared	0.158822	0.361743	0.360339

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Finally, the use of the spatial lag model is not only supported by the aforementioned statistics but is also in accordance with previous empirical research (Patacchini & Zenou, 2007) regarding the interaction between a region's employment levels with those of its neighboring areas: To provide an example of spatial interaction, when firms are set up in one area, the local employment-to-population ratio increases. However, the effect does not end in the village itself because the communities around the vicinity are affected as well (Manning & Petrongolo, 2015): the number of accessible firms from the area's neighboring regions increases, and an increase in the number of accessible firms in these adjacent villages would in turn increase their employment levels. The designation of one area as an economic zone or a protected area would have the same effects since both designations increase the amount of jobs available not only for residents of the designated area, but also for residents of its neighboring villages. Therefore, based on the theoretical considerations and the statistical values, the spatial lag model is the best model for modelling and explaining changes in employment levels in the study area, and thus will be used for interpretation and discussion in the next chapter.

4.4. Discussion of results

4.4.1. Distribution of accessible firms and employment levels

The hot spot analysis for accessible jobs in the study area show that neighborhoods with the highest access to potential employers are all located in Metro Manila. In comparison, a large concentration of neighborhoods with low access to jobs exists outside Metro Manila, particularly those outside the immediate vicinity or border of the metropolitan area. This confirms the hypothesis that communities in Metro Manila have higher access to jobs compared to those outside the metropolitan area.

On the other hand, the results of the hot spot analysis for employment levels show that neighborhoods with high employment levels are generally concentrated in Metro Manila, with some high employment clusters in the Laguna province. The results of the hot spot

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analysis are in accordance with the regression results: Based on the attributes of the hot spots and cold spots, regions with high employment levels have higher access to jobs and also have a more educated population. The previous maps show that most high employment regions also have a large proportion of population with a high school diploma. These areas are also designated as economic zones or are near to areas designated as economic zones. As shown in the spatial distribution maps, Quezon City and Makati in particular are sites of a large number of economic zones in Metro Manila, while San Pedro and Calamba are also sites of prominent industrial zones. Since these places attract a lot of firms due to their features as well as their infrastructure advantages, it is only natural that these places would also generate high employment. However, not all rural areas experience a disadvantage in employment; consistent with the regression results, protected areas also also exhibit high employment levels despite the absence of urbanization.

The regions with low employment, on the other hand, exhibit lower levels of access to firms, lower educational attainment for its population, and lower concentrations of economic zones. A large number of cold spots are found in the Cavite and Rizal provinces. Some of the cold spots, particularly those located in Dasmariñas, Antipolo, and Imus, are unexpected since these are considered major cities in their respective provinces, and yet communities in these cities are experiencing low employment levels. However, upon investigating other location characteristics as given in the spatial distribution maps, it appears that parts of these cities are still not thoroughly developed for industrial or residential use, so most of the cold spots are rural areas that are neither protected areas nor highly industrialized areas (Province of Cavite, 2015). Therefore, urbanization and industrialization appear to be related to employment levels as well.

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4.4.2. Effects of access to firms on employment levels

Previous literature studying the effects of accessible jobs on employment have had mixed results, and dissenting spatial mismatch studies state that access to jobs from a specific location has no significant effect, and that the characteristics of the working age population are more important determinants of employment. However, the spatial lag model shows that the presence of accessible firms from a village contribute to an increase in employment levels. This result is consistent even when accounting for location and working age population characteristics that may affect employment. The model results show that a 1% increase in the amount of accessible firms from a given location increases the employment-to-population ratio by 0.56%.

The result of the spatial lag model is in accordance with the study's hypothesis that the presence of nearby jobs has a positive impact on employment levels. Meanwhile, this result is in contrast with dissenting spatial mismatch studies stating that job access has an insignificant or minimal impact on employment levels. This means that in a near-homogeneous society such as the Philippines where race or ethnicity is not a major concern, a community's location and residents' access to jobs from that location play a pivotal role in determining local employment levels, consistent with Gobillon's spatial search-matching theory and existing studies supporting the spatial mismatch hypothesis. This is because being located in a place farther away from the job center would limit workers' employment options to those that are near their residence. If a worker's residential location only has a small number of firms in its vicinity, this lack of accessible choices would limit a worker's chances of being matched to a suitable job, thus increasing his chances of being unemployed and contributing to the lower employment levels of a region.

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4.4.3. Effects of population and location characteristics on employment levels

A number of the control variables regarding the characteristics of the working age population were significant according to the spatial lag model: Specifically, having a larger share of the workforce who are more likely to be disadvantaged in the labor force and opt out of labor force participation would decrease a place's employment levels. According to the spatial lag model, an increase of 1% in the share of married females in the working age population decreases the average employment-to-population ratio by about 0.15%, while a 1% increase in the share of individuals under 25 in the working age population is associated with a decrease in the average employment level by about 0.46%. A significant relationship between average employment levels and the share of the working age population with qualifications was not found, which implies that in the case of the study area, the low employment problem does not lie in the shortage of individuals with the minimum qualifications. According to statistics, the Philippine labor force is highly-educated and that there is a high share of workers with secondary, post-secondary, and tertiary education (Bersales, 2018); in spite of this, they still have difficulty in finding jobs. Moreover, a report by the World Bank states that unemployment is highest among those with higher educational attainment, suggesting that there is a supply of educated labor, but that there is a poor match between the skills of the available workers and the skills demanded by existing jobs in the market (Chua, et.al., 2013).

Location characteristics also have positive and significant contributions to employment levels: first, urban areas have higher employment levels than rural areas by about 0.67%, and being designated as an economic zone also significantly increases the average employment-to-population ratio by about 2.94%. These results imply that industrialization and urbanization are associated with high levels of employment in a region. These results are in accordance with the findings of the hot spot analysis conducted before the regression. Finally, designation as a protected area is also related to

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high levels of employment in a region; communities in protected areas can still experience increased employment levels despite the limited industrial or urban development of their lands since the local economy of protected areas depends on the preservation of their environment to generate not only revenue from tourism, but also tourism-related jobs for their residents (Jalani, 2012). Thus, despite not having a large number of firms around their area or a high rate of industrialization, residents can still have a wealth of opportunities to work and earn income through eco-tourism jobs.

V. CONCLUSION AND RECOMMENDATIONS

5.1. Conclusion and policy implications

This thesis investigated the spatial distribution of accessible jobs and employment, and whether there is a relationship between the amount of accessible job opportunities and a region's employment levels. In accordance with the underlying assumptions of the spatial mismatch hypothesis, the results of the study reveal that access to firms or potential employers is a positive significant determinant of employment levels in the Philippines, even when controlling for location characteristics and population characteristics that could affect residents' employability or labor force participation. The study also finds that high access to firms and high employment levels are mostly concentrated in Metro Manila, which again is consistent with the components of spatial mismatch. The presence of all three components in the study area confirms that spatial mismatch exists in the Philippines, particularly in the context of Metro Manila and its neighboring provinces.

Low employment is being addressed by the government primarily through the improvement of education and provision of skills training (Pantaleon, 2013; Senate of the Philippines, 2016); however, the findings of this research regarding the relationship of accessibility to firms and employment levels suggest that given the case of the study area, the problem is not the lack of an educated workforce, but rather the lack of accessible

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jobs or suitable jobs given their educational level. This shortage of suitable jobs makes workers want to migrate or travel to Metro Manila to find jobs. Thus, the problem of low employment in the Philippines cannot be solved merely by providing educational or skills training programs, as is being done in the present, since having a large number of highly-skilled or educated workforce would not be enough if there are no suitable job opportunities in the surrounding neighborhoods.

The unequal distribution of employment levels and potential employers between regions can be resolved through dispersed regional development in terms of job creation or investment (Pernia & Quising, 2003). Spreading development to other regions would help ensure that all regions will develop at a nearly equal pace, and having an equitable distribution of development efforts through dispersed regional development would also encourage firms or private partners to invest in provinces, thus creating more jobs. And when jobs are created in the provinces, the residents will have no need to commute or search far into the metropolis for work since there will already be suitable jobs that are nearer and more accessible from their places of residence.

The central government can encourage a more balanced investment and economic activity across regions by encouraging the implementation of decentralization measures. Although the Philippines has a Local Government Code that gives local government units the power to create their own revenue streams and implement ordinances, the Congress still has control over local legislation (Cepeda, 2017) and budget, which hinders local government units from readily implementing projects. A larger share of internal revenue collection must also be allocated to the local government units since they are the ones who know the conditions of each area and thus also have the best idea on how to resolve these issues. Moreover, the central government could also attract businesses and firms to invest in other areas besides Metro Manila by implementing improvements in government processes and pushing for better transparency in government transactions

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across the country. If investors could see that a good business climate also exists outside Metro Manila, they could be inclined to consider these regions when making investments or starting operations. Not only would this improved business climate have the potential to bring in foreign investment, it would also make a positive impression with locals themselves, who would also be encouraged to set up businesses and in turn generate employment by hiring residents living in the surrounding areas to work for them.

To be functional, developed, and desirable to live in, a place must not only have housing but also amenities such healthcare, transportation, entertainment, education, and most importantly jobs and industries. On the part of the local government units, they can improve the competitiveness and ease of doing business in their respective areas (Department of the Interior and Local Government, 2017) to attract more firms and industries to set up operations there, and in turn to encourage more people to live in these areas. This can be done by improving or building infrastructure such as roads and public transport to enable access to more areas, and providing basic utilities especially in areas that they plan to develop into a job or a residential center. For the past years, the central government has developed a universal diagnostic tool for ranking the competitiveness of each local government via the Cities and Municipalities Competitiveness Index. Measures like this are good indicators that can aid local government units in assessing their area's current strengths and identifying opportunities for improvement.

But although the results show that urbanization and industrialization are associated with higher employment levels, the positive impact of protected areas on the local employment-to-population ratio suggests that high employment can still be generated in rural or more distant areas if the local governments can determine and utilize the strengths of their village's location. This means that local governments can identify a key characteristic or industry that they could use as competitive advantage in order to generate jobs in these regions: for instance, selected rural areas may be good for

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eco-tourism and thus could be designated as protected areas, others may be located in productive lands and may be suitable for large-scale agriculture, and still others may be more suited for industries making use of or specializing in local products and raw materials that could be found in their locations. The strengths and opportunities of these rural areas must be considered in order to drive development into these regions and in turn generate jobs, which would lessen inequality in job opportunities and encourage residents to stay in their provinces to find work.

5.2. Recommendations for future research

There is a huge potential for expounding research on the spatial mismatch hypothesis in the context of the Philippines. This study only investigates the spatial mismatch hypothesis for the working age population in general, so further studies could also expound on the phenomenon by examining spatial mismatch for different groups of workers in the Philippines. Unlike the United States, the Philippines is not highly concerned with race and segregation; however, there are other marginalized groups or other groups of interest that may be affected by spatial mismatch. In particular, spatial mismatch regarding beneficiaries of government relocation programs is a timely topic to explore because of numerous issues and protests regarding the locations of the resettlement sites, which are outside the metropolitan area and far from beneficiaries' workplaces in the metropolis (Department of Public Works and Highways & Metro Manila Development Authority, 2017). If highly-specific individual-level data on these groups are available, then looking into this aspect of the spatial mismatch phenomenon would be a worthwhile pursuit to consider.

Researchers may also consider the possibility of investigating the phenomenon per industry or occupational group and see whether workers of a certain industry experience a greater extent of mismatch over those of other industries. These types of studies may still utilize GIS tools like the ones used in this paper to map out the spatial distribution

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and clustering of firms from different industries. It is possible that firms belonging to a certain industry are clustered in a certain area, and workers who may want to work in these industries may have a more difficult time finding jobs of this nature because of their location. On the other hand, some industries may be more evenly spread out and people who may want to work in these industries may have better access to those jobs. A study that checks for mismatch in different lines of business is worth pursuing and could give more insight into the phenomenon as it exists in the Philippine setting.

In terms of methodology, the continued use of spatial regression is recommended for future studies given the nature of the phenomenon and spatial data, which tend to display dependence. The use of spatial regression is superior compared to other types of data analysis models due to its ability to account for spatial heterogeneity or spatial dependence between neighboring areas. Ordinary regression methods do not account for these tendencies and even assume that observations are independent of each other, which is not true in the case of spatial data. Finally, spatial regression is able to isolate the effects of spatial dependence or interactions, making the estimates more efficient and leads to better inferences.

Improving on this study's methodology in measuring access to jobs is also a good way to expand knowledge on the topic. Due to data availability constraints, the measurement of accessible jobs was limited to the number of jobs within a catchment area defined by a specified travel time. Future studies regarding the topic could improve on this accessibility measure by getting the number of positions or job vacancies relative to the number of competing workers and accounting for distance decay, where nearer jobs would have more weight than jobs that are located farther away. Job seekers and workers typically prefer to work near their place of residence, and more distant jobs would be less attractive to them than jobs that are located nearer to their residential location. Alternatively, if ample data is available, researchers could incorporate commuting costs

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instead of using distance. Higher transportation costs would discourage workers from commuting to a certain location to work, especially if the costs are higher than their current or potential wages. Improvements like these would significantly enhance the study of spatial mismatch in the Philippine setting since the excessive development of the metropolitan areas means that more costs that reduce the efficiency of workers such as transportation costs and time lost due to traffic jams may arise. Accounting for these costs would make the measurement of accessibility more accurate, since traffic or high transportation costs may actually reduce the distance that a worker or job seeker may be able to cover given his search intensity, and in turn, there may actually be a smaller number of accessible jobs given these frictions.

Finally, researchers may also look into other metropolitan areas in the Philippines such as Metro Cebu or Metro Davao. These areas are major metropolitan areas in their respective island groups, which means that they also experience high growth and also has a large concentration of firms compared to their neighboring regions. Given the results of this study confirming that spatial mismatch does exist in Metro Manila and its surrounding areas, it would be worthwhile for future studies to see whether spatial mismatch also exists in other major metropolitan areas outside Luzon. If spatial mismatch is found in these regions, public and private sector partners would be able to address these concerns early and plan urban development accordingly. Finding whether spatial mismatch exists in this regions will be a useful contribution to Philippine spatial mismatch literature because these areas are not yet as highly-congested as Metro Manila, and any necessary changes in urban structure or investments in infrastructure will be easier to implement in these metropolitan areas.

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