

## Identifying local labor markets in Korea

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### Abstract

The purpose of the paper is the delineation of local labor market areas in Korea on the basis of the travel-to-work flows surveyed at the basic administrative area. We sketch the local labor market areas using the commuting matrix derived from the sample data of the population and housing census.

Given such Origin-Destination trips to work, the rule based agglomerative algorithm creates a partition of the territory such that all areas satisfy the relevant validity rule. As a result of analyzing different self-containment criteria of 60-70%, 65-75%, and 70-80%, local labor market areas are classified into 37, 34 and 30 areas, respectively. These results suggest that the current administrative areas and local labor market areas are not consistent with each other. Above all, the problem identified in this study is the spatial discrepancy between the jurisdiction of the Employment Welfare Plus Center, which provides employment-related services, and the regional labor market area. These spatial discrepancies are likely to reduce the efficiency of the administration performance, so adjustment is necessary.

*Keywords:* Local labor market area, Functional regions,  
Administrative regions, Travel-to-work areas,  
Commuting matrix

*JEL Classification:* R10, R12

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## 1 Introduction

In Korea, 50% of the population and 74% of the headquarters of the top 1000 companies are concentrated in the Seoul Metropolitan area, which is 12% of the land area. Accordingly, the central government reestablished the governance and support system for balanced national development to support regional specialized development and independent growth. However, regional development policies operated on the basis of administrative area have limitations in that they do not properly reflect the spatial reality of actual economic activities. In other words, administrative areas are not always the most appropriate size for providing information to policy makers, and it is not possible to grasp how socio-economic trends differ from space to space (Casado Diaz and Coombes, 2011). Therefore, in order to design, implement and monitor effective regional development policies, it is important to address the appropriate geographic scale in policy making (OECD, 2020).

General economic linkages occur not only within the administrative areas, but also across administrative areas. However, the statistics available to us rely solely on statistics based on administrative or geographic areas. Thus, data on functional areas, such as local labor market areas, can supplement statistics based on administrative and geographic areas. For example, when policy makers implement employment service provision and regional industrial development policies, functional areas can complement administrative areas as a unit of analysis or as an object of policy decision.

The delineation of local labor market areas at an appropriate level can capture socio-economic interactions at the local level, improve policy efficiency, and support the principle of spatial equity.

## 2 Literature Review

Several approaches to the definition of local labor market areas have been developed by researchers in recent decades. There is a tradition of

regionalization studies based upon labor market variables. The local labor market area generally refers to the regional extent associated with the interaction between labor demand and supply (Goodman, 1970; Smart, 1974; Casado Diaz, 2000).

Most of the European debate has been the introduction of the American concept of a Standard Metropolitan Areas, which evolved into the concept of the 'daily urban system' in an attempt to explain patterns of activity around urban areas on a typical working day. This debate was incorporated in the definition of TTWAs (Travel to Work Areas) where a consistent method was used for the 1978 revision and the 1984 regionalization (Casado Díaz, 2000; OECD, 2020).

Local labor market areas generally refer to labor market units in which occurred strong socio-economic interactions such as population flow (Brown and Horton, 1970; Holmes and Haggett, 1977; Hemmasi, 1980), trade in goods and services (Brown and Pitfield, 1990), and traffic flows (Coombes et al, 1986; Andersen, 2002; Corvers et al, 2009; Landre and Hakansson, 2013), and interfirm relational data (Van Oort et al, 2000). When delineating local labor market areas, the goal is to aggregate areas of high socio-economic interaction. Despite these diverse socio-economic interaction matrices, there is no doubt that commuting flows are the most suitable database for delineation local labor markets. For example, commuting flows are considered the most frequent and regular activity with periodicity, and these flows are appropriate to indicate a functional relationship (Bujdoso et al, 2013). This study also conducts analysis based upon commuting data that reflect the socio-economic trends.

Four decades ago Smart (1974) stated that «there have been surprisingly few attempts to produce a systematic definition of areas by which the main relationships between homes and workplaces could be indicated, and a common framework of reference established for the study of planning and labor market issues». In the case of Korea, there is still no systematic definition of local labor market areas, and basic data on the local labor market areas has not been created.

The methods for the delineation of functional regions can generally be sorted into two groups: clustering methods and rule-based methods (Halás et al, 2015). Local labor market areas are delineated in most cases by rule-based methods. The rule-based method applying self-containment and population conditions was first proposed by smart (1974). Since then,

the rule-based method has been developed by coombs et al. (1979; 1982; 1986). In particular, coombs (2010) has received a lot of attention from researchers and is widely used.

Park (2005) attempted to delineate local labor market area for the first time in Korea. The results of applying the housing self-containment ratio, employment self-containment ratio, and Home Work Ratio were divided into 137 local labor market areas. This study is meaningful in that it first raised the necessity of delineating local labor market areas in Korea. Lee (2008) compared and analyzed dynamic changes by delineating local labor market areas for each commuting data of the 1995, 2000, and 2005 population and housing census. In addition, it examines how the boundaries of the districts expand as the minimum self-containment criterion and population criterion are changed.

### 3 Data and Methodology

#### 3.1 Data and variable descriptions

The data used in our exercise come from the 20% 2015 Population and Housing Census sample from Statistics Korea (KOSTAT). The 20% 2015 Census sample has 9,538,118 weighted observations and their weighted sum is 50,271,304. To derive the commuting matrix, we used 12,945,876 weighted sum data which contain information on both residence and working area. The basic unit of area in our exercise is *gu/si/gun* (administrative units in Korea) level but we integrate some level areas which are smaller administrative districts which are *gu*-level areas except in metropolitan cities. This redistricts 252 areas to 229 areas.

Table 1. The number of commuters in metropolitan cities and provinces

Metropolitan cities/provinces	Areas	Living commuters	Working commuters
Seoul	25	3,153,084	3,850,174
Busan	16	989,471	918,164
Daegu	8	640,620	555,179
Incheon	10	840,919	660,787
Gwangju	5	340,558	291,552
Daejeon	5	387,590	348,882
Ulsan	5	289,593	312,763

Sejong	1	41,215	51,304
Gyeonggi-do	31	3,534,768	2,942,920
Gangwon-do	18	248,534	255,590
Chungcheongbuk-do	11	276,201	296,454
Chungcheongnam-do	15	364,207	432,653
Jeollabuk-do	14	311,859	313,168
Jeollanam-do	22	237,402	286,335
Gyeongsangbuk-do	23	462,047	558,784
Gyeongsangnam-do	18	707,603	750,874
Jeju	2	120,210	120,298

Source: Population and Housing Census sample(2015)

Note: The number of commuters is weighted sum data which contain information on both residence and working area

In Table 1 we present summary statistic for the number of commuters living and working in each metropolitan city and province. First of all, Table 1 shows that the number of commuters in living and working is asymmetric in most areas. Moreover, we find that Seoul Metropolitan Area (Seoul, Gyeonggi, Incheon) has a more asymmetric commute structure. This asymmetry seems to show the difference between administrative areas and LLMA. However, as shown in Table 2, commuters in living and working is symmetric in most areas when we summarize data in regional economic zones.

Table 2. The number of commuters in regional economic zone

Regional economic zone	Areas	Living commuters	Working commuters
Seoul Metropolitan zone	66	7,528,771	7,453,881
Gangwon zone	18	248,534	255,590
Chungcheong zone	32	1,069,213	1,129,293
Daegyeong zone	31	1,102,667	1,113,963
Yeongnam zone	39	1,986,667	1,981,801
Honam zone	41	889,819	891,055
Jeju zone	2	120,210	120,298

Source: Population and Housing Census sample (2015)

Note: the number of commuters is weighted sum data which contain information on both residence and working area

### 3.2 Methodology

Studies which delineate LLMA have a purpose to find areas in which occurred interaction between labor demand and supply. These studies generally use commuting of employees as the measure of interaction in local labor markets because commuting data reflects information like

transport and housing between adjacent areas. Thus, in our exercise, we also use commuting data to analyze commute patterns of commuters.

Our algorithm is clustering method similar to Coombes and Bonds (2008). In this algorithm so-called ‘‘Coombes’ algorithm,’’ there are two important parameters: one is the number of commuters (or population) and another is self-containment.

Self-containment is classified into two types. they are determined by commuting matrix components. Figure 1 shows that commuting matrix and  $C_{ij}$  is the number of commuters living in  $i$  area and working in  $j$  area. In this matrix, demand-side self-containment (DSC) and supply-side self-containment (SSC) take the following form:

$$DSC_k = C_{kk} / \sum_{i=1}^N C_{ik} \quad SSC_k = C_{kk} / \sum_{j=1}^N C_{kj} \quad (1)$$

$$SC_k = \min(DSC_k, SSC_k) \quad (2)$$

Figure 1. Commuting matrix

		Working area			
		1	2	...	N
Living area	1	$C_{11}$	$C_{12}$	...	$C_{1N}$
	2	$C_{21}$	$C_{22}$	...	$C_{2N}$
	⋮	⋮	⋮	⋮	⋮
	N	$C_{N1}$	$C_{N2}$	...	$C_{NN}$

We delineate LLMA using following multistep method:

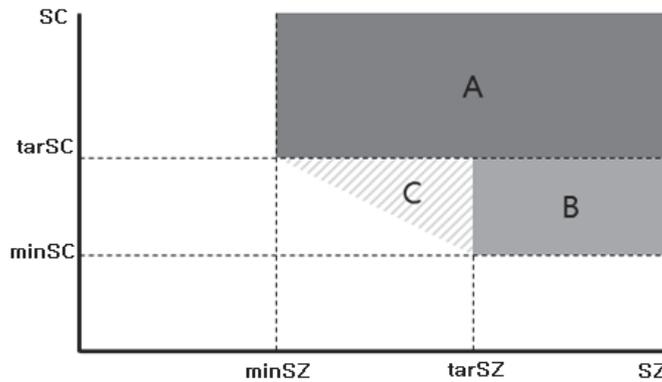
The first step for delineation is setting parameters. In Coombes’ algorithm, local labor market area is defined as the area that satisfies condition (4) and we call formula (3) is validity. tarSC is target value acceptable level of self-containment and minSZ is the minimum size of commuters (or population) to consider LLMA. Thus, if there is area which satisfies both minSZ and tarSC, we define that as LLMA. In case the size of area is large, if the area which satisfies both tarSZ and minSC, it is also defined as LLMA. In Figure 2, A, B, C are sufficient conditions for LLMA.

Block C shows that there is a trade-off between SZ and SC. Those conditions take the following form:

$$f_v(SZ, SC) = \min \left[ \frac{\min(SC, tarSC)}{tarSC} \right] \cdot \left[ 1 - \left( 1 - \frac{\min SC}{tarSC} \right) \cdot \max \left( 0, \frac{tarSZ - SZ}{tarSZ - \min SZ} \right) \right] \quad (3)$$

$$f_v(SZ_c, SC_c) \geq \left( \frac{\min SC}{tarSC} \right) \quad (4)$$

Figure 2. Sufficient condition for LLMA



$$\operatorname{argmax}_i [O_{kl} \times I_{kl} + O_{lk} \times I_{lk}] \quad (5)$$

$$O_{kl} = C_{kl} / \sum_{j=1}^N C_{kj} \quad (6)$$

$$I_{kl} = C_{lk} / \sum_{i=1}^N C_{ik} \quad (7)$$

In the second step, we define each single area as a potential LLMA (PL). Next step, we measure validity of each potential LLMA by formula (3). The fourth step is finding  $PL_k$  potential LLMA with minimum validity and disaggregate  $PL_k$ . Every single area from  $PL_k$  is aggregated to new  $PL_l$  which maximizes external relationship by formula (5). Until every potential LLMA satisfies condition for LLMA, we repeat the same procedure.

Table 3. Procedure for delineation

Step 1	Set up parameters(minSC, tarSC, minSZ, tarSZ)
Step 2	Define each single area as $PL$
Step 3	Measuring validity
Step 4	Disaggregate $PL_k$ with minimum validity
Step 5	Aggregate each area to new $PL_l$ by external relationship
Step 6	Repeat procedure from step3 to step5

### 3.3 Results

Using the 20% 2015 Census sample data, we delineate LLMA in Korea. Although common values for minSC are 0.6~0.7 and tarSC are 0.7~0.85(Franconi et al, 2017), we set up tarSC to 0.7~0.8 because our data only cover 229 single areas. Generally, there are no common values for minSZ and tarSZ because the smallest labor market size people consider is different by countries<sup>1</sup>. Thus, we set up SZ to 12,875~34,945<sup>2</sup> by threshold of Kim and Cho (2009)<sup>3</sup>.

In Table 4, we present a summary for our main results in this chapter and each column results from different self-containment. First of all, Korea has 37 LLMA when SC is 0.6~0.7. and the number of LLMA reduce with higher SC. In the case SC is 0.7~0.8, Seoul-Incheon area disaggregates and northern Seoul area aggregates to western Gangwon area. These results suggest that the current 17 administrative districts in Korea presented in Table 1 and the local labor market areas do not match.

Table 4. LLMA in regional economic zones

Regional economic zone	Self-containment		
	0.6~0.7	0.65~0.75	0.7~0.8
Seoul Metropolitan zone	3	2	3
Gangwon zone	5	5	3
Chungcheong zone	7	6	5
Daegyeong zone	8	7	7
Yeongnam zone	6	6	5
Honam zone	7	7	6
Jeju zone	1	1	1
Total	37	34	30

Source: Population and Housing Census sample (2015)

<sup>1</sup> Franconi et al, (2017) set up size to 1,000~10,000 and EUROSTAT set up 25,000 to 50,000.

<sup>2</sup> In our sample, it has information on 25.75% of the total population. Thus, we apply this ratio to 50,000~135,707 population.

<sup>3</sup> Kim and Cho (2011) set the minimum population that can be raised to a city as  $minSZ$  and the minimum population that can be set as a constituency as  $tarSZ$ .

Figure 3. LLMA (SC 60~70%)

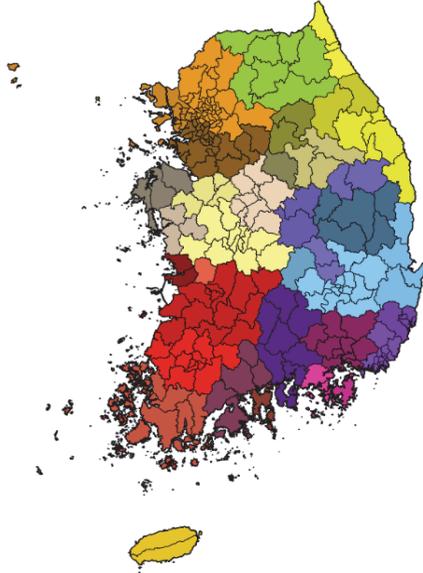


Figure 4. LLMA (SC 65~75%)

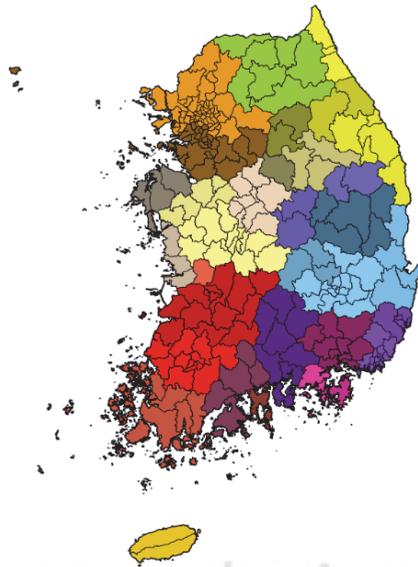
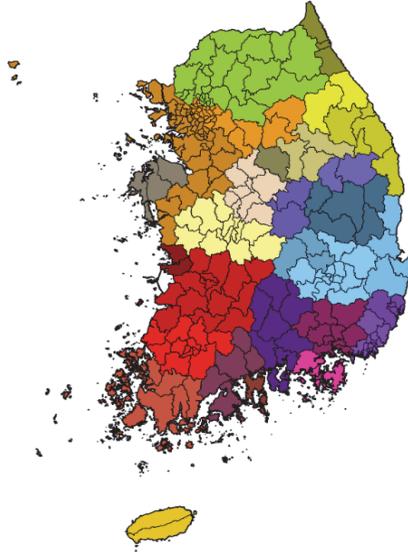


Figure 5. LLMA (SC 70~80%)



## 4 Policy Discussion

In the previous section, two core concepts of self-containment and integration are used as basic elements for functional interpretation of the local labor market area. The first concept, self-containment, means that the ratio of workers commuting beyond the boundaries of the administrative areas is limited, and the second concept means that the daily commuting intensity between administrative areas is high. In this section, a comparative analysis between the results of the local labor market areas based on the two concepts and the jurisdiction of the current Employment Welfare Plus Center is conducted.

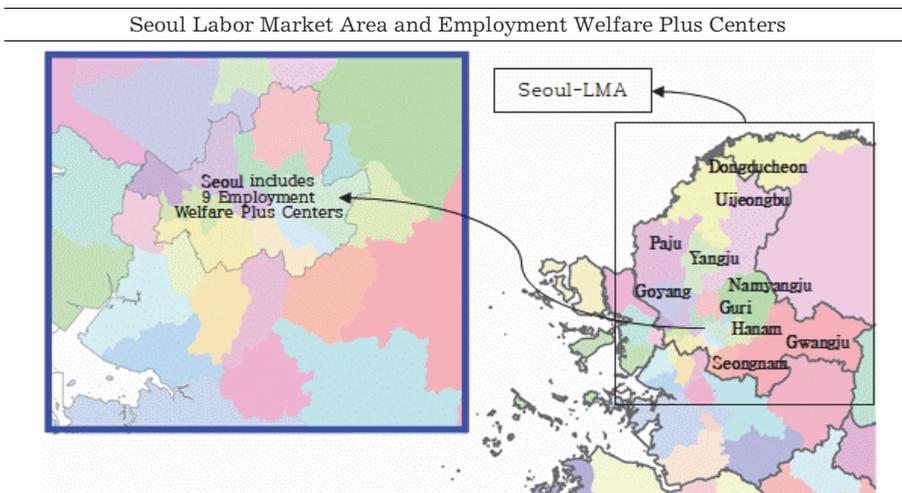
The Ministry of Employment and Labor's Employment Welfare Plus Center has jurisdiction over 100 centers (including 2 Employment Centers) across the country to promote various employment support services. In particular, geographic accessibility is a very important factor for policy consumers, as they have to visit the center in person to apply for

unemployment benefits, counseling, and apply for vocational education and training.

The comparative analysis is performed based on 7 regional economic zones (Seoul Metropolitan zone, Gangwon zone, Chungcheong zone, Daegyeong zone, Yeongnam zone, Honam zone, Jeju zone). Among the 7 regional economic zones, mismatches occur between the local labor market area and the Employment Welfare Plus Center in the Seoul Metropolitan zone, Gangwon zone, Chungcheong zone, and Honam zone.

The Seoul Metropolitan zone is divided into three major local labor market areas (Seoul-LMA, Gyeonggi-LMA, Incheon-LMA). Among them, the Seoul-LMA includes the entire centers under the jurisdiction of the Seoul Employment and labor Administration(SELA), as well as the Dongducheon, Uijeongbu, Namyangju, Guri, Hanam, Gwangju, Seongnam, Goyang, Paju, and Yangju Employment Welfare Plus Centers under the jurisdiction of the Central Employment and Labor Administration(CELA).

Figure 6. Seoul labor market area and employment welfare plus centers



Source: Population and Housing Census sample(2015)

Note: The thick solid line represents the local labor market area in the 60-70% range of self-containment.

The areas marked by color represent the jurisdiction of the Employment Welfare Plus Center.

The local labor market area in the Gangwon zone includes 7 Employment Welfare Plus Centers under the Central Employment and Labor Administration(CELA), a part of the Dongducheon Employment Welfare Plus Center under the Central Employment and Labor Administration(CELA), and a part of the Pohang Employment Welfare Plus Center under the Daegu Employment and Labor Administration (DGELA).

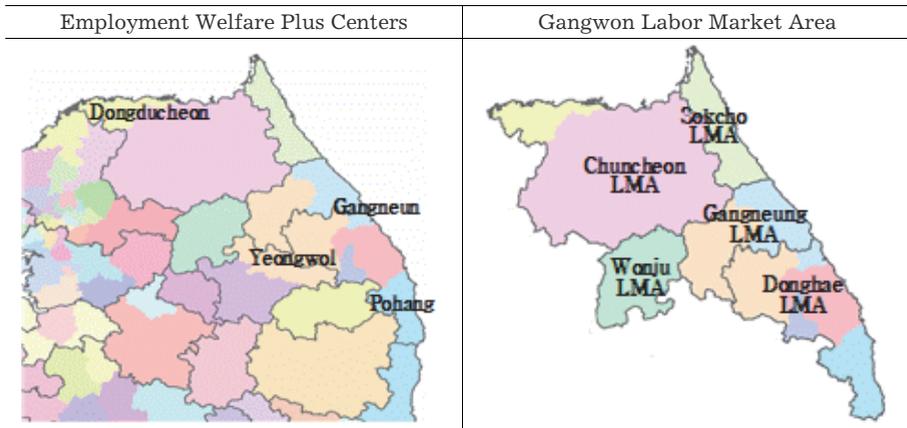
In the case of Gangwon zone, there are spatial discrepancies between the local labor market area and the Employment Welfare Plus Center.

First of all, the case of Cheorwon-gun, which is under the jurisdiction of the Dongducheon Employment Welfare Plus Center, is classified as Chuncheon-LMA, not the Seoul-LMA.

Next, the Gangneung Employment Welfare Plus Center is providing services across two local labor market areas (Gangneung-LMA and Donghae-LMA).

In addition, Pyeongchang-gun, Jeongseon-gun, and Yeongwol-gun, which are under the jurisdiction of Yeongwol Employment Welfare Plus Center, are included in different local labor market areas.

Figure 7. Gangwon labor market area and employment welfare plus centers



Source: Population and Housing Census sample (2015)

Note: The thick solid line represents the local labor market area in the 60-70% range of self-containment.

The areas marked by color represent the jurisdiction of the Employment Welfare Plus Center.

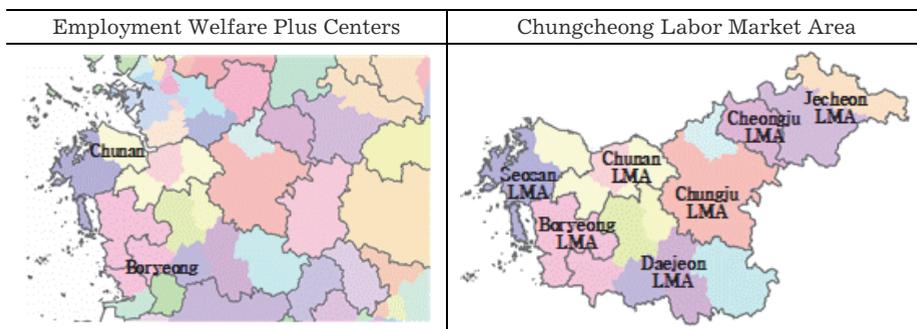
Lastly, Uljin-gun, which belongs to the Donghae-LMA, is under the jurisdiction of the Pohang Employment Welfare Plus Center, which belongs to the Daegu Employment and Labor Administration (DGELA).

The local labor market area in the Chungcheong zone includes 13 centers under the Daejeon Employment and Labor Administration (DJELA). and some of the Yeongwol Employment Welfare Plus Center under the Central Employment and Labor Administration (CELA). There are also spatial discrepancies in the Chungcheong zone.

First of all, the case of Dangjin-si, which is under the jurisdiction of the Cheonan Employment Welfare Center, is classified as the Cheonan-LMA, not the Seosan-LMA.

In addition, Seocheon-gun and Buyeo-gun, which are under the jurisdiction of the Boryeong Employment Welfare Plus Center, are classified into the Gunsan-LMA and Daejeon-LMA.

Figure 8. Chungcheong labor market area and employment welfare plus centers



Source: Population and Housing Census sample (2015)

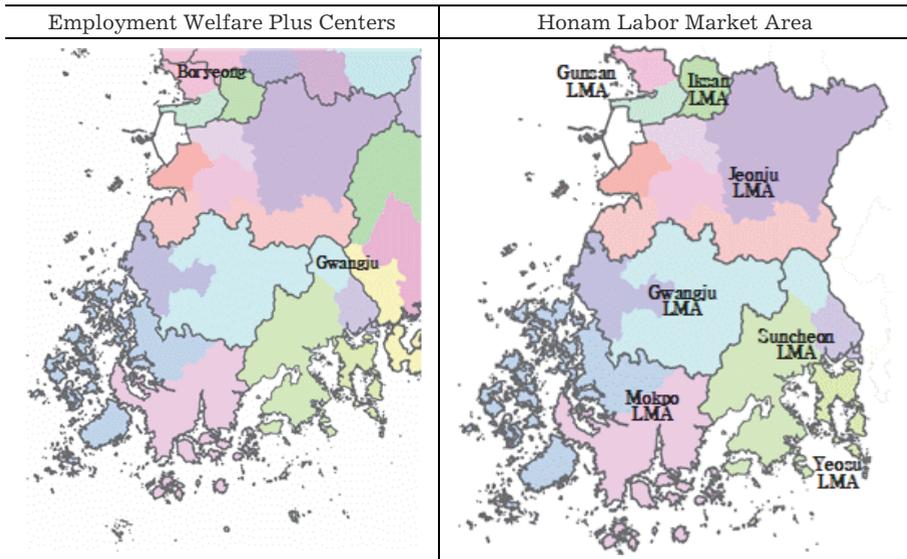
Note: The thick solid line represents the local labor market area in the 60-70% range of self-containment.

The areas marked by color represent the jurisdiction of the Employment Welfare Plus Center.

The local labor market area in the Honam zone consists of 14 centers under the Gwangju Employment and Labor Administration (GELA) and a part of the Boryeong Center under the Daejeon Employment and Labor Administration (DJELA). In the case of Seocheon-gun, which belongs to the Gunsan-LMA, it is the jurisdiction of the Boryeong Employment Welfare Plus Center under the Daejeon Employment and Labor

Administration (DJELA). And Gurye-gun, which belongs to the Suncheon-LMA, is under the jurisdiction of the Gwangju Employment Welfare Plus Center.

Figure 9. Honam labor market area and employment welfare plus centers



Source: Population and Housing Census sample (2015)

Note: The thick solid line represents the local labor market area in the 60-70% range of self-containment.

The areas marked by color represent the jurisdiction of the Employment Welfare Plus Center.

## 5 Conclusion

According to the analysis by applying different self-containment criterion of 60-70%, 65-75%, and 70-80%, local labor market areas are classified into 37, 34 and 30 areas, respectively. These results suggest that the current administrative areas and functional areas do not match. Above all, as a result of comparing the jurisdiction of the Employment Welfare Plus Center with the local labor market area, some of the Employment Welfare Plus centers contain more than two local labor market areas. Therefore, it is necessary to rearrange the jurisdiction of the Employment

Welfare Plus Center based on the local labor market area. Moreover, in order to improve the efficiency of administrative performance in the future, it is necessary to collect statistical data based on local labor market areas and use them to supplement statistical data collected based on the current administrative district.

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