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Regional Analysis of the Migration Patterns of Returning Farmers

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귀농인의 지역별 이동패턴 분석

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ABSTRACT : 초고령화된 한국 농촌에서 다양한 교육 및 직업 배경을 가진 중장년층 귀농인구의 유입은 고령화 문제에 대한 대안의 하나로 부각되고 있다. 본 연구는 농가 고령화에 대한 귀농인구의 잠재적인 기여도 측면에서 귀농인구의 지역별 유입·유출 패턴을 분석하였다. 분석에는 로그선형모형과 총합레퍼런스코딩을 사용하였고, 분석자료는 통계청의 2013년 귀농통계이다. 분석결과에 의하면, 귀농인의 절반 정도가 수도권에서 비수도권 지역으로 이주한 인구이고, 이들을 제외하면 귀농인의 대부분은 원 거주지가 있던 도 내에서 이동하고 있다. 귀농인의 귀농 전 대비 귀농 후 지역 내 오즈비(odds ratio)는 지역별로 차이가 있으며, 귀농인의 성별과 연령에 따라서도 지역별 유입·유출패턴이 다르다. 이는 귀농인 유입의 긍정적 효과를 높이기 위해서는 지자체별 차이를 반영한 특화된 정책이 필요하다는 것을 의미한다.

Key words : Aging, Log-linear Model, Migration Pattern, Returning Farmers, Urban-to-rural Migration[1)]

I. Introduction

In recent years, urban-to-rural migration has become an object of an ever-increasing attention as a way to alleviate the problems exacerbated by aging of rural population in Korea. Although aging of population is a common trend in many developed countries, the aging phenomenon in Korea is distinctively intensive for its rapid pace and the particularly large gap between urban and rural areas (UN, 2012). In 2010, the elderly ratio of urban population in Korea was around 10%, whereas that of rural areas amounted to 20%; furthermore, when only farmers were considered, the elderly ratio of rural population skyrocketed to 45% (Jung et al., 2013).

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Earlier studies indicate that elderly farmers are on average less competitive in adapting to rapid changes in agricultural technologies and socioeconomic environment (Barham et al, 2004; Foltz and Chang, 2002, Gillespie et al., 2010; Paxton et al., 2011). In consequence, other things being equal, elderly farmers tend to exhibit low agricultural productivity and thus low income – both farm and non-farm income – as compared to their younger counterparts (Jung and Cho, 2012). To attend this problem, the central and local governments of Korea have implemented relevant policies to promote urban-to-rural migration for farming and thereby to mitigate the aging problems of farmers and rural population (Lee, 2008; Seong et al., 2012).

Returning farmers are defined as individuals who moved from urban to rural areas to engage in farming. The number of returning farmers has greatly increased with the

implementation of the 'Comprehensive plan for rural migration' in 2009. The number of households headed by newly-migrated farmers reached approximately five thousand in 2010; the number of newly-migrated farmer households exceeded ten thousand in three consecutive years, 2011–2013 (Statistics Korea, 2013).[1)] In the survey of urban citizens, about a half of the respondents expressed their intention for rural migration, implying a large potential pool of returning farmers (Kim and Park, 2013).

Given that returning farmers tend to be younger than typical farmers, their influx into rural areas, when occurring in a substantial size, is expected to slow down the aging process of farm households (Roh et al., 2013). Returning farmers also tend to be more educated and have diverse occupational backgrounds (Chae, 2013; Kang, 2006; Oh, 2012), indicating their large potential with regard to contributing to the productivity enhancement and income increase of farm households. Whereas most rural migrants in the late 1990s were those who were driven into farming by economic hardship, returning farmers in recent years are more likely to be those who turned to agriculture for the benefit of economic opportunity and rural amenities (Hong et al., 2012; Kang, 2007; Seong et al., 2012). Kim and co-authors (2012) point out that this new inflow of returning farmers can vitalize the rural economy, yielding extensive social benefits.

The increasing influx of returning farmers and their potential role in the super-aged rural economy has drawn the growing attention of policy perspective and academia alike. Previous studies have addressed the issues such as the intention and motivation of urban-to-rural migration (Kang, 2007; Nam and Ha, 2011; Shin et al., 1998), current state and settlement stages of migrants (Chae, 2013; Kang, 2006; Lee and Park, 2012; Oh, 2012; Park et al., 2007), migrants' overall satisfaction (Kim and Seo, 2014; Lee, 2008), and policies on rural migration and returning farmers (Kim, 2009; Kim et al., 2004; Seong et al., 2012). These studies mostly relied on survey data from particular regions, lacking thus the national representativeness of the data surveyed. Furthermore, little has been done with respect to regional migration patterns of returning farmers, although such an analysis is a prerequisite for nationwide and region-specific policy design and implementation.

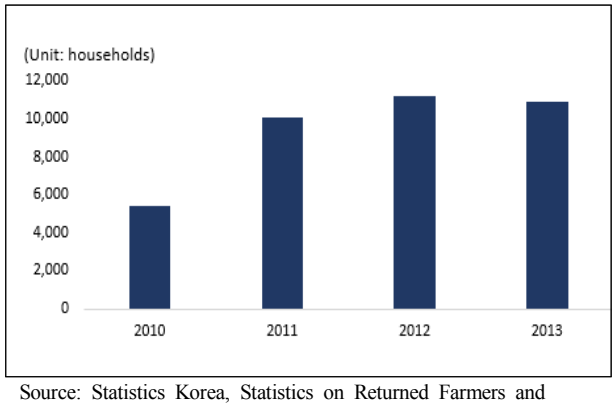
In this context, the novelty of the present research is that we analyze the migration pattern of returning farmers focusing on regional differences. Regional differences between the inbound and outbound migration patterns of returning farmers are analyzed by the odds ratio using the log-linear model. In addition, using the total sum reference coding method, we examine whether the regional migration patterns statistically differ by age and gender of returning farmers. The data used for these analyses are the 2013 data on returning farmers provided by Statistics Korea.

The remainder of this paper is organized as follows. Chapter 2 examines recent trends in urban-to-rural migration for farming and the differing features of returning farmers. Chapter 3 analyzes regional migration patterns of returning farmers, highlighting regional differences in the demographic features of returning farmers. Chapter 4 summarizes the key findings and draws policy implications.

II. Migration Trends and Features

1. Recent Trends of Urban–to–Rural Migration

In recent years, urban-to-rural migration has been observed in Korea on a relatively large scale. The number of rural migrant households surged to over sixty thousand for the last two years, 2012-2013, and nearly 40% of them were returning farmers who migrated to rural areas to newly engage in agriculture. As shown in Figure 1, especially in the last three years, more than ten thousand households moved from urban to rural areas and engaged in farming activities each year (Statistics Korea, 2013).



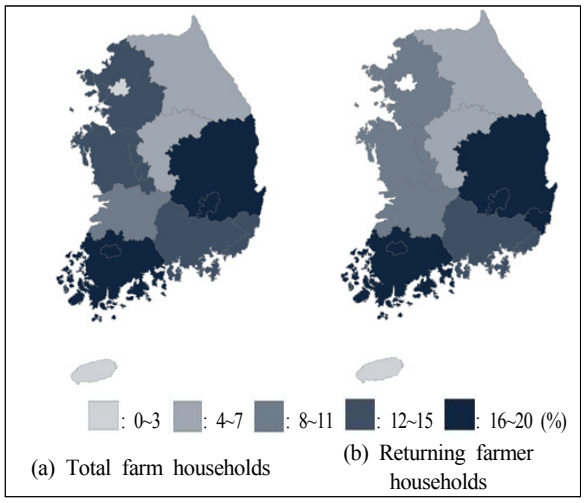
Source: Statistics Korea, Statistics on Returned Farmers and Migrators to Rural Regions (2010-2013)

Figure 1. Urban-to-rural migration for farming (2010-2013)

The regional distribution of returning farmers differs from that of typical farm households (see Figure 2). The proportion of returning farmer households in the capital area (Seoul, Gyeonggi and Incheon) is substantially lower than that of typical farm households; this implies that a large proportion of returning farmers are those who left the capital area and moved to non-capital areas. Nearly 50% of returning farmers are those who moved from the capital area to other regions. Returning farmer households tend to concentrate in Gyeongbuk and Jeonnam, which is similar to total farm households. We can thus conjecture that returning farmers from the capital area have a high tendency to migrate to distant regions (e.g., Youngnam, Honam) rather than to adjacent areas (e.g., the capital area).

Table 1 presents the migration flow of returning farmers based on the pre-migration residence areas. It confirms that the migrants from the capital area mostly move to the areas distant from their prior areas of residence; about a half of them are drawn to Honam and Chuncheong, and 16% them move to Youngnam. By contrast, migrants from the non-capital areas mostly move to nearby rural areas, exhibiting the pattern of intra-province migration. In particular, almost all migrants from Honam area move in the same province. The same trend applies to other areas, albeit to a lesser degree.

Table 2 shows the same migration flow of returning farmers from the perspective of post-migration regions. Almost all returning farmers who settle into the capital area are from the capital area, meaning that the inflow of returning farmers to the capital area from other areas is insignificant. Yet, considering the entire population of the capital area, it should be noted that the number of returning farmers moving to the capital area is relatively small. Except for the capital area, intra-province migration



Source: Statistics Korea, Census of Agriculture, Forestry and Fisheries (2010), Statistics on Returned Farmers and Migrators to Rural Regions (2013)

Note: 1) Metropolitan areas are included in the surrounding provinces.
2) Colored areas indicate the proportion of (returning) farm households in each province as a percentage to total (returning) farm households (Nationwide=100).

Figure 2. Regional distribution of total farm households and returning farmer households

Table 1 Regional migration flow of returning farmers (Regions before migration=100)

(Unit: %, households)

		Region after migration						N
		Capital area	Youngnam	Honam	Chungcheong	Gangwon	Jeju	
Region before migration	Capital area	18.64	16.04	25.74	25.30	11.74	2.52	5,194
	Youngnam	0.40	87.40	5.96	3.30	1.17	1.00	3,001
	Honam	0.28	1.59	96.47	1.18	0.21	0.28	1,446
	Chungcheong	2.32	7.30	11.95	75.22	2.32	0.77	904
	Gangwon	4.06	8.86	4.43	5.90	76.01	0.74	271
	Jeju	1.87	4.67	4.67	0.93	0.00	87.85	107

Source: Statistics Korea, Statistics on Returned Farmers and Migrators to Rural Regions (2013), Census of Agriculture, Forestry and Fisheries (2010).

Note: 1) Capital area includes Seoul, Gyeonggi and Incheon. Youngnam includes Gyeongbuk and Gyeongnam; Honam includes Jeonbuk and Jeonnam.
2) Metropolitan areas are included in the surrounding provinces.

significantly exceeds inter-province migration. It confirms that rural migrants, if not from the capital area, tend to move to neighborhoods of their residence area which they are familiar with. Intra-province migration is most distinct in Youngnam where two-thirds of returning farmers are those who move from urban areas in the same province. For Honam area, migrants from the capital area and those from the same province each constitute some 40% of returning farmers in the area. In Chungcheong and Gangwon, the majority of returning farmers are those who moved from the capital area.

2. Features of returning farmers

Returning farmers differ from the total population of farmers in various aspects. A distinct feature of returning farmers is that they are relatively younger than the total farm household population (Table 3). In case of total farm households, about 60% of farmers are aged 60 and over, with less than 3% in their twenties and thirties. By contrast, only a quarter of returning farmers are those aged 60 and over, with the majority in their 40s and 50s. As elderly farmers are inclined to have lower productivity in both farm work and non-farm activities (Jung et al., 2013), returning farmers are expected to contribute to productivity enhancement in agriculture and the vitality of rural life, more generally.

Another distinctive feature of returning farmers is that they tend to be highly educated and equipped with diverse professional experiences as compared to the total farm household population. Oh (2012) points out that about a half of returning farmers are college graduates. Chae (2013) also reports that over 50% of potential migrants who completed an education program on rural migration are college graduates. The high level of educational attainment of returning farmers is in contrast to the low schooling level of the total farm household population: in 2010, the average number of years in education was 8 for the total population of farmers, with lower schooling level for older farmer subgroups. Many of returning farmers also have experiences in a diverse range of occupations, including professional and managerial jobs (Chae, 2013; Kang, 2007; Shin et al., 1998). These diverse career experiences of returning farmers are also expected to be of help in their successful settlement in rural areas.

Returning farmers also differ from the total population of farmers in that they tend to focus on cultivation of high value-added products, such as vegetables, specialty crops, and orchard (see Table 4). Returning farmers' focus on these high value-added products has been intensified in the last few years. Whereas more than 40% of the total population of farmers grows rice, only 20% of returning

Table 2. Regional migration flow of returning farmers (Regions after migration=100)

(Unit: %, households)

		Region after migration					
		Capital area	Youngnam	Honam	Chungcheong	Gangwon	Jeju
Region before migration	Capital area	95.09	23.19	44.04	61.72	69.71	48.88
	Youngnam	1.18	73.51	5.90	4.74	4.00	11.19
	Honam	0.39	0.64	45.95	0.80	0.34	1.49
	Chungcheong	2.06	1.86	3.56	31.94	2.40	2.61
	Gangwon	1.08	0.67	0.40	0.75	23.54	0.75
	Jeju	0.20	0.14	0.16	0.05	0.00	35.07
Migration type	Capital area	95.09	23.19	44.04	61.72	69.71	48.88
	Intra-provinces	-	62.36	43.21	29.97	23.54	35.07
	Inter-provinces	**4.91**	**14.46**	**12.75**	**8.31**	**6.74**	**16.04**
N		1,018	3,597	3,036	2,129	875	268

Source: Statistics Korea, Statistics on Returned Farmers and Migrators to Rural Regions (2013).

Note: 1) Capital area includes Seoul, Gyeonggi and Incheon.

2) Metropolitan areas are included in the surrounding provinces.

3) The distinction between intra-province migration and inter-province migration is based on eight provinces - Gyeongbuk, Gyeongnam (Youngnam), Jeonbuk, Jeonnam (Honam), Chungbuk, Chungnam (Chungcheong), Gangwon, and Jeju.

Table 3. Age composition of total farm households and returning farmer households

(Unit: households, %)

	Total farm households (2010)		Returning farmer households		
	N	Years of schooling	2011	2012	2013
Under 40	33,143 (2.8)	13.0	1,202 (11.9)	1,292 (11.5)	1,253 (11.5)
40~59	427,618 (36.3)	10.5	6,319 (62.8)	7,064 (63.0)	6,809 (62.3)
60 and over	716,557 (60.9)	6.3	2,554 (25.3)	2,864 (25.5)	2,871 (26.2)
Total	1,177,318 (100.0)	8.0	10,075 (100.0)	11,220 (100.0)	10,923 (100.0)

Source: Statistics Korea, Census of Agriculture, Forestry and Fisheries (2010), Statistics on Returned Farmers and Migrators to Rural Regions (2013).

farmers do so. Lee (2006) and Jung et al. (2013) report that farmers cultivating vegetables and orchard are relatively young and have higher income as compared to those cultivating rice. Returning farmers' focus on high value-added crops is likely to yield higher farm income as compared to the farmers cultivating low value-added crops.

III. Migration Patterns by Regions

1. Data and Model

In recent years, finding patterns of the spatial structure of migration flows has been the subject of an ever-increasing number of studies. In this section, we exploit log-linear models to describe the connections between geographical regions of origin and destination of returning farmers. The goal of the analysis of returning farmer migration data is two-fold: (1) to describe migration trends between regions via statistical models, and (2) to test whether the structure of migration patterns differs by age and gender of returning farmers. Local and central governments can use this information to propose policies to attract potential returning farmers.

The analysis of migration patterns in this section is based on the 2013 data of returning farmers (Statistics Korea, 2013). Table 5 presents the number of original and

Table 4. Major crops cultivated by total farm households and returning farmer households

(Unit: Households, %)

		Total farm households[1)]		Returning farmer households[2)]	
		N	%	N	%
Major Crops	Rice	523,992	44.5	1,275	23.3
	Barley, Potatoes, Pulses	115,475	9.8	3,527	64.4
	Vegetables	224,862	19.1	2,900	53.0
	Specialty crops, Mushroom	28,196	2.4	1,732	31.6
	Orchard	169,178	14.4	1,874	34.2
	Floriculture, Ornamental plants	18,455	1.6	138	2.5
	Other crops	16,311	1.4	304	5.6
	Livestock	80,849	6.8	114	2.1
Total		1,177,318	100.0	5,475	100.0

Source: Statistics Korea, Census of Agriculture, Forestry and Fisheries (2010), Statistics on Returned Farmers and Migrators to Rural Regions (2013)

Note: 1) Farm households were classified into each major crop with the largest share in the total sales of agricultural products.

2) Based on the reports submitted by returning farmers to the agricultural management organizations. Since some returning farmers cultivate multiple crops, the sum of each household by major crops does not equal the total number of returning farmer households.

destination residence of returning farmers in 2013.

In migration studies, migration transition data during a given period of time are often summarized as a contingency table where frequency of each cell is assumed to follow a Poisson distribution. Log-linear models may be used to represent association between categorical variables associated with the Poisson regression models; the response variable is the frequency of each cell and the categorical variables (origin and destination residence in our case) are predictors.

The migration pattern data can be perfectly explained by the saturated log-linear model. Suppose n_{ij} is the number of returning farmers from region *i* to region *j*, and $\mu_{ij} = E(n_{ij})$. The multiplicative log-linear model is given in (1) and (2):

$$\mu_{ij} = e^{\lambda} e^{\lambda_i^X} e^{\lambda_j^Y} e^{\lambda_{ij}^{XY}} \quad (1)$$

or

$$\log(\mu_{ij}) = \lambda + \lambda_i^X + \lambda_j^Y + \lambda_{ij}^{XY} \quad (2)$$

where λ_i^X is the main effect of the origin residence, λ_j^Y is the main effect for the destination residence, and λ_{ij}^{XY} is the association between the origin and the destination residences. The saturated log-linear model that contains all main effects and interaction term can perfectly regenerate the data. In other words, the number of parameters in the saturated model is the same as the number of observations. However, in practice, the data should be described with a parsimonious model that explains the relationship among categorical variables. The simplest loglinear model is the independent model that contains only main effects. In the independence model, the cell frequencies can be predicted with products of the proportions of categorical variables. However, it is easy to see that the most common type of migration in Table 5 is intra-provinces, so the independence model does not fit well in this case. Hence we consider a rich class of alternative loglinear models to account for various structures of migration flow including marginal homogeneity, quasi-independence and quasi-symmetry. In addition, the total sum reference coding will be used to test whether the structure of migration patterns differs by age and gender of returning farmers.

2. Log-linear Models for Migration Patterns

We consider various statistical models accounting for the following association structure: (1) marginal homogeneity, (2) quasi-independence, and (3) quasi-symmetry.

While marginal homogeneity is not equivalent to a log-linear model, it is still useful to understand the structure of migration patterns. In migration data, marginal

Table 5. Regional migration flow

		Region after migration					
		Capital area	Youngnam	Honam	Chungcheong	Gangwon	Jeju
Region before migration	Capital area	1,606	1,429	2,300	2,144	954	234
	Youngnam	27	4,637	305	176	60	47
	Honam	8	47	2,468	34	5	6
	Chungcheong	39	135	180	1,212	39	14
	Gangwon	19	42	20	24	402	3
	Jeju	3	10	7	1	0	188

Table 6. Parameter estimates of quasi-symmetry model

	Capital area	Honam	Chungcheong	Gangwon	Jeju
Parameter estimates (95% C.I)	-3.7926 (-4.0192, -3.5660)	1.8578 (1.6302, 2.0854)	0.1914 (0.0148, 0.3680)	0.3703 (0.0992, 0.6414)	1.6406 (1.1261, 2.1551)
Odds ratio (95% C.I)	0.02 (0.0180, 0.0283)	6.41 (5.1051, 8.0475)	1.21 (1.0145, 1.4448)	1.45 (1.1043, 1.8991)	5.16 (3.0836, 8.6288)

homogeneity implies that there is no difference between before/after migration proportion of each region. It is represented in (3).

$$P(X=i)=P(Y=i) \quad \text{for} \quad i=1,\cdots,I \qquad (3)$$

For example, if the marginal proportion of the number of migrants leaving Youngnam equals the marginal proportion of migrants moving to Youngnam, the marginal homogeneity holds. Now we return to Table 5 and test the marginal homogeneity with the log-likelihood ratio test statistic (deviance=G^2). With the degree of freedom (df) 5, the deviance is 7,301, hence the marginal homogeneity fits badly. In other words, the marginal proportions are not the same before/after migration.

We note that the most common pattern in migration flow data is intra-province migration As a result, the large number of frequency on the main diagonal always implies that there is a positive dependence between the origin and the destination residences. To remove the effect of the main diagonal elements, we assume two different models for diagonal and off-diagonal cells separately. The quasi-independence model is similar to the independence model in off-diagonal cells but fits perfectly in main diagonal cells. The quasi-independence has the following form (4):

$$\log \mu_{ij} = \lambda + \lambda_i^X + \lambda_j^Y + \delta_i I(i=j) \qquad (4)$$

where indicator function $I(i=j)$ is 1 if $i=j$ and 0 if $i \neq j$. The quasi-independence model implies the independence of the off-diagonal elements. The quasi-independence model does not fit very well, so we consider a more general, quasi-symmetry model.

The quasi-symmetry is represented by the symmetry model (i.e., row and column are inter-changeable in a contingency table) except for marginal homogeneity condition. The model has the following form (5):

$$\log \mu_{ij} = \lambda + \lambda_i^X + \lambda_j^Y + \lambda_{ij} \qquad (5)$$

where for all $i<j$, $\lambda_{ij}=\lambda_{ji}$ holds for the parameters in $\{\lambda_{ij}\}$ which indicate the effects of (i,j) cell of the contingency table. When the quasi-symmetry model is fitted, the deviance is 9.768 with df 10, which is much better than in the other considered models. The effects of a specific region compared to a baseline region appear as parameter estimates. Table 6 presents the estimates of each region with Youngnam as the baseline region. For example, the result that the estimated parameter of Honam is 1.8578 means the odds of origin are 6.41(=exp(1.8578)) times to those of destination with respect to the case of Youngnam (baseline). If the probability of origin for Youngnam (see (6)) is small, the odds of origin for Youngnam can be approximated by the form of probability (see (7)):

$$p_{Youngnam} = \frac{\text{migrants from Youngnam}}{\text{population of Youngnam}} \qquad (6)$$

Table 7. Result of the method of total sum reference coding for the original data

		Region after migration						Marginal probability
		Capital area	Youngnam	Honam	Chungcheong	Gangwon	Jeju	
Region before migration	Capital area	2.0495	0.4927	0.9462	1.2968	1.4193	1.0330	0.4604
	Youngnam	0.0569	2.6382	0.2071	0.1757	0.1473	0.3424	0.2790
	Honam	0.0345	0.0547	3.4265	0.0694	0.0251	0.0894	0.1364
	Chungcheong	0.2664	0.2492	0.3964	3.9244	0.3106	0.3309	0.0860
	Gangwon	0.4121	0.2461	0.1398	0.2467	10.1634	0.2251	0.0271
	Jeju	0.1588	0.1430	0.1194	0.0251	0.0000	34.4177	0.0111
Marginal probability		0.0904	0.3347	0.2805	0.1908	0.0776	0.0261	

$$\frac{p_{\text{Youngnam}}}{1-p_{\text{Youngnam}}} \approx p_{\text{Youngnam}} \quad (7)$$

$$\text{Similarly,} \quad \frac{p^*_{\text{Youngnam}}}{1-p^*_{\text{Youngnam}}} \approx p^*_{\text{Youngnam}} \quad (8)$$

$$\text{where } p^{*_{Youngnam}} = \frac{\text{migrants to Youngnam}}{\text{population of Youngnam}} \quad (9)$$

Hence the ratio of the odds of origin to the odds of destination for Honam is approximately

$$\frac{p^*_{\text{Honam}}}{p_{\text{Honam}}} \Big/ \frac{p^*_{\text{Youngnam}}}{p_{\text{Youngnam}}} \quad (10)$$

Therefore, the result can be interpreted as that for a given subject the estimated odds of living in Honam instead of Youngnam after migration is 6.41(=exp(1.8578)) times the odds of living before migration.

Table 6 also shows the odds ratio for five regions (where Youngnam is baseline). In comparison to Youngnam, outflow overwhelms inflow in the capital area. In case of Honam and Jeju, inflow is greater than outflow. Likewise, Chungcheong and Gangwon show slightly higher inflow than outflow.

3. Migration Flow by Age and Gender with Total Sum Reference Coding

It is of great interest to test whether migration flow differs by factors such as age and gender of returning farmers. This can be tested with the total sum reference coding method. Note that the saturated log-linear model

Table 8. Result of the method of total sum reference coding for male data

		Region after migration						Marginal probability
		Capital area	Youngnam	Honam	Chungcheong	Gangwon	Jeju	
Region before migration	Capital area	2.0699	0.5006	0.9499	1.3002	1.3895	1.0734	0.4576
	Youngnam	0.0580	2.6365	0.1958	0.1652	0.1415	0.3417	0.2792
	Honam	0.0392	0.0545	3.4231	0.0600	0.0359	0.0770	0.1377
	Chungcheong	0.1739	0.2369	0.3916	3.9433	0.3412	0.3256	0.0868
	Gangwon	0.5007	0.2085	0.1309	0.2775	10.3591	0.3785	0.0280
	Jeju	0.2020	0.0781	0.1561	0.0455	0.0000	34.0843	0.0107
Marginal probability		0.0868	0.3369	0.2810	0.1929	0.0759	0.0265	

Table 9. Result of the method of total sum reference coding for female data

		Region after migration						Marginal probability
		Capital area	Youngnam	Honam	Chungcheong	Gangwon	Jeju	
Region before migration	Capital area	2.0240	0.4823	0.9413	1.2925	1.4552	0.9794	0.4641
	Youngnam	0.0556	2.6404	0.2219	0.1897	0.1546	0.3434	0.2787
	Honam	0.0287	0.0549	3.4309	0.0824	0.0114	0.1065	0.1347
	Chungcheong	0.3799	0.2658	0.4029	3.8972	0.2718	0.3381	0.0849
	Gangwon	0.2990	0.3001	0.1525	0.2017	9.9226	0.0000	0.0259
	Jeju	0.1107	0.2221	0.0752	0.0000	0.0000	34.8862	0.0117
Marginal probability		0.0951	0.3317	0.2798	0.1880	0.0798	0.0256	

can be presented of the mulitplicative form (see (11)).

$$n_{ij} = (T)(O_i)(D_j)(OD_{ij}) \quad (11)$$

where T is the overall component, O_i is the main effect of origin i, D_j is the main effect of destination j, and OD_{ij} represents the origin-destination interaction effect. The interaction component OD_{ij} can be defined as the ratio of observed migrants to expected migrants (see (12)).

$$OD_{ij} = \frac{n_{ij}}{[(T)(O_i)(D_j)]} \quad (12)$$

Thus, to measure the effect of interaction, we need to estimate other components. If we assume the independence model, we estimate $\hat{T} = n_{++}$, $\hat{O}_i = n_{i+}/n_{++}$, $\hat{D}_j = n_{+j}/n_{++}$, where n_{++} is the total number of returning farmers, n_{i+} is the sum of returning farmers from region *i,* and n_{+j} is the sum of returning farmers moving to region *j*. Using those estimates, OD_{ij} can be estimated with the above formula. This is called "total sum reference coding" (Little and Raymer, 2013). If the estimate of OD_{ij} is greater than 1, the number of the observed migrants is higher than that of the expected migrants from region *i* to region *j*.

Table 7 shows that returning farmers from the capital area and Youngnam are 46% and 28% of the original residence, respectively, while Youngnam and Honam account for 33% and 28% of the destination residence, respectively. For the interaction terms, there are 42% more migrants from the capital area to Gangwon than the expected number of migrants. That is, when we expect 100 migrants from the capital area to Gangwon, 142 migrants actually move to Gangwon from the capital area.

Tables 8 and 9 show the interaction estimates by each gender. To see their differences, Table 10 presents the ratio of interaction terms of Tables 8 and 9. For example, the ratio of males to females for migration from Honam to Gangwon is 3.14, while the ratio of males to females is 0.73 for migration from Honam to Chungcheong.

Tables 11 and 12 provide the interaction term estimates by age (above/below 50). Table 13 gives the ratio of the

Table 10. Result of the method of total sum reference coding for the male/female ratio

male / female		Region after migration					
		Capital area	Youngnam	Honam	Chungcheong	Gangwon	Jeju
Region before migration	Capital area	1.0227	1.0381	1.0092	1.0060	0.9548	1.0960
	Youngnam	1.0430	0.9985	0.8827	0.8710	0.9153	0.9951
	Honam	1.3635	0.9927	0.9977	0.7281	3.1411	0.7227
	Chungcheong	0.4579	0.8915	0.9720	1.01185	1.2557	0.9630
	Gangwon	1.6747	0.6947	0.8588	1.3758	1.0440	-
	Jeju	1.8255	0.3516	2.0743	-	-	0.9770

Table 11. Result of the method of total sum reference coding for returning farmers under 50

		Region after migration						Marginal probability
		Capital area	Youngnam	Honam	Chungcheong	Gangwon	Jeju	
Region before migration	Capital area	2.3089	0.4974	0.9510	1.2515	1.3887	1.0111	0.4003
	Youngnam	0.0666	2.6939	0.1762	0.1773	0.1237	0.2680	0.2792
	Honam	0.0616	0.0598	3.0730	0.0786	0.0191	0.0000	0.1726
	Chungcheong	0.2547	0.2951	0.3567	4.3325	0.3819	0.4464	0.0991
	Gangwon	0.5874	0.2282	0.1036	0.2142	11.6397	0.0000	0.0317
	Jeju	0.1545	0.1200	0.0636	0.0000	0.0000	27.6978	0.0172
Marginal probability		0.0857	0.3311	0.3125	0.1679	0.0692	0.0335	

Table 12. Result of the method of total sum reference coding for returning farmers aged 50 and over

		Region after migration						Marginal probability
		Capital area	Youngnam	Honam	Chungcheong	Gangwon	Jeju	
Region before migration	Capital area	1.8694	0.4885	0.9651	1.2945	1.4095	1.1323	0.5129
	Youngnam	0.0491	2.5904	0.2405	0.1746	0.1642	0.4528	0.2788
	Honam	0.0000	0.0478	3.8107	0.0632	0.0336	0.2893	0.1048
	Chungcheong	0.2826	0.1976	0.4390	3.6686	0.2518	0.0677	0.0759
	Gangwon	0.2281	0.2680	0.1878	0.2864	9.0430	0.6558	0.0231
	Jeju	0.1824	0.2042	0.2732	0.0818	0.0000	41.9728	0.0058
Marginal probability		0.0945	0.3378	0.2524	0.2107	0.0848	0.0197	

Table 13. Result of the method of total sum reference coding for the ratio of returning farmers under 50 / over 50

		Region after migration					
		Capital area	Youngnam	Honam	Chungcheong	Gangwon	Jeju
Region before migration	Capital area	1.2351	1.0181	0.9853	0.9668	0.9852	0.8930
	Youngnam	1.3556	1.0399	0.7325	1.0154	0.7536	0.5919
	Honam	-	1.2493	0.8064	1.2438	0.5670	0.0000
	Chungcheong	0.9015	1.4931	0.8127	1.1810	1.5168	6.5924
	Gangwon	2.5757	0.8514	0.5515	0.7479	1.2872	0.0000
	Jeju	0.8468	0.5878	0.2327	0.0000	-	0.6599

interaction terms from Tables 11 and 12. From Table 13, the ratio of OD_{32} is 1.2493, suggesting that migration from Honam to Youngnam is more attractive to younger returning farmers (below 50) than to their older counterparts (above 50), while the ratio of OD_{35} is 0.5670, implying that migration from Honam to Gangwon is preferred by elder returning farmers.

IV. Conclusion

The influx of returning farmers has been increasingly emphasized as an effective way to alleviate aging problems in the super-aged Korean rural areas. In order to facilitate urban-to-rural migration, the Korean government and rural authorities provide various incentives and forms of supports for rural migrants. However, there is a paucity of literature on regional migration patterns of returning farmers and their linkage to aging problems of rural population.

This study analyzed regional migration patterns of returning farmers using the log-linear model and total sum reference coding method. In order for returning farmers to enhance agricultural competitiveness and revitalize rural areas, not only the size, but also the demographic composition of returning farmers is crucial. In this regard, the in-depth analysis of regional migration patterns of returning farmers by age and gender will shed more light on the potential contribution of returning farmers on the regional level.

The key findings of the present study are as follows. First, our results suggest that about a half of returning farmers are those who moved from the capital area. About a half of the outflow from the capital area moves to Chungcheong and Honam. Less than 20% of migrants from the capital area opt to stay in the capital area. By contrast, returning farmers from non-capital areas mostly move inside the province where they were originally based.

Second, returning farmers have a high incidence of cultivating high-income crops as compared to typical farmers who specialize in rice cultivation. To a large extent, this trend can be ascribed to the fact that, compared to typical farmers, returning farmers are younger,

more educated, and have diverse job experiences. This finding supports the conjecture that returning farmers can contribute to the enhancement of agricultural competitiveness and farm income.

Third, the odds ratio of returning farmers before and after migration greatly differs across regions, implying a differing net effect of returning farmers on the size of rural population for each region. Furthermore, regional migration patterns of returning farmers significantly differ by their age and gender, implying a differing net effect of returning farmers on the demographic composition of rural population for each region. The capital area is characterized by the net outflow of migrants regardless of their age or gender. Migration from Honam to Youngnam or Chungcheong is more attractive to younger returning farmers (under 50) than their older counterparts (50 and over). On the other hand, migration from Honam to Gangwon is more attractive to older returning farmers than to the younger subgroup.

These findings substantiate the existence of regional differences in migration patterns and demographic composition of returning farmers, implying that local governments should implement adequate policies that suit region-specific situations. From the policy perspective, it is important to define the target group and design policy measures tailored to the needs of that specific target group.

Due to the data restrictions, the structural analysis of regional migration patterns of returning farmers in this study was confined to the age and gender of migrants. The comparison of migration patterns in terms of educational and occupational backgrounds of returning farmers should be an important extension of this study when the data allow. The investigation of returning farmers' settlement ratio and economic performance related to regional migration patterns would be another possibility to address in further research.

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