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ARTICLE

How Rural Demographic Changes Affect Rural Policy Outcomes: A Cohort Analysis of Korea's Rural Revitalization Project

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ABSTRACT

The composition of the rural population in South Korea is highly skewed older, with the continuous trends of depopulation and aging at an unprecedented rate. However, with the constant inflow of urban-to-rural migrants, rural demographic groups have become more diversified over the last decade. Although relatively small in number, new groups of farmers with distinguished life values and experiences are becoming increasingly noticeable in rural areas. Against this backdrop, the present study attempts to examine the effectiveness of an area-based, community-led rural revitalization project by birth and farming experience cohorts. The paper employs a double-cohort model design that nests birth cohorts within farming experience cohorts using the propensity score matching and the ordered logit model. The comparison of the trajectory of agricultural income between the project-implemented areas and non-implemented areas suggests that the benefits of the project were unequally shared among different cohorts. Young farmers in their early career stage living in the project-implemented areas experienced a significant increase in the probability of earning a higher agricultural income. On the other hand, no perceptible difference

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in the agricultural income trajectory over the study years was found between the project implemented areas and non-implemented areas for the case of elderly farmers, regardless of their levels of experience in farming. The study highlights the necessity to reflect rural demographic changes when designing an area-based, community-led rural development project.

Keywords: Rural Development; Population; Econometric Models; Agriculture

1. Introduction

The composition of rural demography in South Korea (hereafter Korea) is changing drastically. The most apparent and worrisome trends in rural demography are young adults migrating to urban areas and the subsequent aging of the remaining population. The depopulation and aging of rural areas is a global phenomenon, but the fast rate of such change distinguishes Korea from other advanced and emerging economies. As of 2024, 55.8% of farm households are aged 65 or older [1].

An emerging contrary trend, however, is the constant inflow of individuals from urban areas. Although relatively small in number, the reverse urban-to-rural migration has been observed since the late 2000s, coinciding with the retirement of the baby boomer generation and the 2008 financial crisis. In 2009, the inflow of urban-to-rural migrants began, and the number of in-migrant householders seeking a career in agriculture increased by 83.4% (from 2,218 to 4,080); by 2011, the number was over 10,000, and this trend has continued.

Rural in-migration is led by retirees in their 50s and 60s, but the number of young adults in their 20s to 40s is becoming more substantial. With the increasing number of internal migrants from urban centers to rural areas, the composition of the rural demography of farmers is diversifying. A new type of population group markedly different from the elderly traditional farmers of the pre-industrialization era is emerging in today's rural societies in Korea.

Before the rapid industrialization period of Korea from 1962 to 1980, rural residents shared a comparatively homogeneous life cycle that affected the formation of rural societies comprised of individuals with similar life experiences, cultures, and values across generations. Unlike the elderly traditional farmers, farm successors, who remain in rural areas while most of their peers migrated to urban centers for prospective jobs, and in-migrants with urban backgrounds possess different life values and career attitudes.

The economic and demographic dimensions of the emergence of diversified demographic groups in rural areas are fairly well documented, but the impacts of such changes on rural policy outcomes remain underexplored. Against this backdrop, this study examines the effectiveness of Korea's Comprehensive Rural Village Development Project (hereafter CRVDP), focusing on differences across demographic cohorts defined by age and farming experience. To achieve this, the study employs a double cohort analytical framework within a quasi-experimental design, utilizing propensity score matching and an ordered logit model to rigorously assess whether the policy's impacts on agricultural income varied among distinct subgroups.

2. Literature Review

2.1. Demographic Changes in Rural Areas

Demographic changes in rural areas are a topic of increasing interest in the rural demographic literature that focuses on urban-to-rural migration and farm succession. These studies have highlighted the potential of rural in-migrants and farm successors as active agents of change in rural communities [2–4].

Studies that explore urban-to-rural migration have generally investigated migration motivations, destination choices, and migrants' socioeconomic characteristics. Many of these studies have attempted to identify rural pull factors in the context of the retirement period of the baby boomer generation. Overall, urban-to-rural migration is generally led by individuals in their 50s and 60s, who are seeking idyllic surroundings for a better quality of life [5]. Stockdale and Catney [6] observed that the age cohorts in retirement have led this trend of counter-urbanization. Regarding their motivations, Jauhiainen [4] examined the pull and push factors for baby boomers' returning to peripheral rural areas and found that natural amenities were the most significant factor. Onge et al. [7] also considered natural amenities as a key factor affecting the internal migration decision.

In Korea, a significant increase in urban to rural migration has occurred since 2009, coinciding with the retirement of the baby boomer generation. While some studies emphasize that retirees are drawn to rural areas primarily for natural amenities [8], others suggest that broader regional attractions beyond environmental factors are more important [9]. Despite these differences, there is general agreement that for this generation, farming is not a primary motive for migration [10]. This pattern aligns with the broader observation that as individuals age, amenity-related factors play a stronger role in migration decisions [11].

An emerging strand of urban–to-rural migration studies has explored the urban, young adults migrating to rural areas to become farmers. Together with young farming heirs, young entrepreneur farmers are being studied under the concept of the "young farmer problem." This problem is related to the perceived role of young farmers in the economic revitalization of rural areas [4]. Milone and Ventura [12] defined these farmers as a "new generation of farmers" and highlighted that their choice to become farmers contrasts with that of outwardly migrating young adults, who expect to increase their prospects. These authors emphasize that this new group is highly educated and thus has both knowledge and the ability to manage scarce resources strategically and collaborate with fellow farmers and consumers.

Some studies have analyzed the farming behaviors and motivations of young farmers. Zagata and Sutherland [4] report that young farmers, unlike previous generations, deliberately choose farming as a career, reflecting stronger economic motivations, involvement in value-added activities, and the ability to leverage urban networks. Inwoods et al. [13] further differentiate young farmers into first-generation and multi-generation categories, showing that first-generation farmers are more innovation-oriented but less profi- focused, whereas multi-generation farmers prioritize profits and are more resistant to innovation.

Other studies have focused specifically on farm successors. For example, Cavicchiolo et al. [14] highlight that succession likelihood is higher for large, efficient farms, influenced by both successor characteristics and external labor market conditions. Overall, recent literature emphasizes that today's young farmers are distinguished by high educational levels, entrepreneurial orientation, and socio-environmental values, contrasting sharply with the stability-seeking, routine-driven approach of older generations.

In Korea, agriculture-related motivations were reported as the biggest pull factor for the younger generation (those in their 20s to 40s), which starkly contrasts with that of the older generations, who were mostly attracted to rural areas by natural amenities [15]. Few studies have examined the disparate characteristics of young farmers in Korea in an attempt to draw policy implications to attract young adults to rural communities, where the aging population is the biggest problem. According to Jeong et al. [16], Korean young farmers (aged 18 to 39 years) have higher levels of education and income, larger-sized farmland, and a higher propensity to use information technology than older farmers (aged 40 or higher). Ma and Kim [17] also highlighted that young farmers generally have a high level of education, for example, 85.3% holding at least a bachelor's degree. These authors identified farm inheritance, large initial capital, experience in farming, and farm record keeping as determinants of young farmers' agricultural income.

In summary, studies have observed a gradually changing rural demographic landscape, driven by the influx of internal migrants from urban areas and the emergence of young farmers. As noted by Onge et al. [7], new migrants to rural regions often do not follow the conventional economic theories of migration. This group is well educated and practices nontraditional farming behavior, and this observation also applies to young farm successors. The unique background, experience, and social and cultural values of this group contribute to the heterogeneousness of rural societies. However, an understanding of how such differences may shape outcomes of a rural development policy is notably absent from the literature.

2.2. Conceptualization and Definition of Cohorts

The rural project that this paper aims to evaluate is the CRVDP, conducted from 2004 to 2013, which was initiated by the central government of Korea. The CRVDP is often regarded as Korea's representative rural development project due to its substantial budget and extensive coverage of rural areas throughout the country. Selected villages comprised of three to five smaller villages could receive 4 to 7 billion Korean Won (3.6 to 6.4 million USD) for up to four years.

The CRVDP had four goals: (1) expand bases for income generation, (2) improve the rural landscape, (3) improve residential facilities, and (4) build business management capacity. Among these, this study focuses on agricultural income generation because it is the most tangible and measurable indicator of policy effectiveness. Previous studies emphasize that income is not only a key measure of farm households' economic sustainability but also a prerequisite for improvements in other domains of rural life, such as residential conditions and community vitality [18,19]. In this sense, agricultural income reflects direct economic outcomes while simultaneously underpinning the attainment of the other three goals. Concerning agricultural income, the project included activities to promote new agricultural marketing channels and provide assistance for the cultivation of profitable crops, for example,

- Develop a specialized complex for eco-friendly agriculture;
- Construct agro-processing and storage facilities for organic products and local specialties;
- Hold farmers' markets;
- Facilitate direct sales and diversify marketing channels through rural tourism.

These activities demonstrate that the CRVDP emphasized sustainable farming practices and interactions with the urban community.

The CRVDP was a brand-new rural initiative for the Korean government in terms of not only the substantial budget [18] but also for its embracement of the concept of endogenous rural development; the project emphasized the community-based bottom-up approach in which rural residents lead and design diverse activities to enhance the viability of their own villages. By the same token, the CRVDP was also an unaccustomed project for most rural residents. Therefore, it can be reasonably posited that the values put forward by the CRVDP may have created conditions that either facilitated or constrained project participation of particular groups within rural communities.

Among rural residents in the project-implemented areas, some might have regarded the CRVDP as an invaluable opportunity, while others may have remained apathetic or found the same project a nuisance that tries to interrupt their serene neighborhood. If so, the level of compliance will be higher for the former, whereas that of the latter will be lower. As observed by Anderson [20], group membership is one determinant that contributes to one's compliance with a particular policy. It is because group membership is related to the attachment to particular values and practices. Based on the account by Coombs [21] that policy outcomes are shaped by the policy compliance of the target population, the present study posits that the effects of the project could differ by the membership in certain cohorts within a rural community.

A cohort is a group of individuals who experience a common event together within the same time period [22]. As a result, each cohort has a distinctive character reflecting the circumstances of its unique origination and history. Cohorts are typically specified by an individual's birth year, but also by the initial time period that establishes a status to which certain patterns of experience emerge. In this study, cohorts are identified by year of birth and the years of engagement in farming as a career.

Both birth and farming experience are closely related to farmers' disposition and farming behavior that may affect one's degree of compliance with a rural revitalization project. For instance, young farmers are generally highly educated, innovative, and oriented towards high-income activities, and they adapt to using Information and Communication Technology (ICT), through which they create a new networking culture with customers, suppliers, and fellow farmers. However, innovation is restricted for older farmers by their unwillingness or inability to adopt technological devices [23].

The experience in farming is simultaneously considered. New entrants differ from experienced farmers in that they encounter a considerable learning curve due to the biological nature of farming and the time it takes to become skilled in production [13]. As the career in farming increases, it becomes easier to use personal networks or acquire agriculture-related information, and accordingly, make changes or expand market channels or change crops to increase net earnings. Also, farmers who entered farming during the productivist agricultural regime[1] will strikingly differ from those who began farming in the post-productivism multifunctional agricultural regime. For instance, farmers who stepped into the agricultural sector in recent years tend to show a higher uptake of environmentally friendly farming practices [4,14].

Considering both birth and experience cohorts, young and new farmers tend to be more entrepreneurial as they strive to strategically manage scarce resources and seek autonomy [12,25]. On the contrary, elder farmers with many years of experience in farming would prefer following vested routines [26]. Therefore, unique attitudes, values, and farming behaviors of different cohorts would work as either barriers or capital resources that encourage or discourage policy compliance.

Compliance results when private interests are in alignment with policy prescriptions because such harmony ensures positive rewards from participation [20]. On the contrary, individuals of certain groups may resolve to noncompliance if their values, mores, and beliefs conflict with policy or if sufficient resources to comply are not available [20,21]. The specific values emphasized by the CRVDP were much more favorable to the young than to older generations. Thus, the young generation is more likely to have an affirmative attitude toward the project driven by their social values, motivations, and ability to take advantage of the government support.

In a rural setting where new groups of farmers with distinguished life values and experiences are emerging, a cohort analysis allows an elaborated interpretation of empirical findings. For this purpose, the study concerns specific cohorts as in **Table 1**.

Table 1. Categorization of cohorts.

Cohort			Definition
	2010	**2015**	
Birth Cohort (BC)	25–34	30–39	Young farmers
	35–44	40–49	
	45–54	50–59	Mid-aged farmers
	55–64	60–69	
	65–74	70–79	Elderly farmers
Experience Cohort (EC)	1–5		Beginning farmers
	6–10		Early-career farmers
	11+		Experienced farmers

The location of sub-populations, as highlighted in the literature review, is difficult to discern using the aforementioned categorization; however, it is nonetheless useful for determining the composition of certain cohorts. The birth cohort aged 55–64 years in the initial study period of 2010, who are also beginning farmers, are likely to be recent immigrants from the baby boomer generation. A majority of them were likely to have been born in rural areas but moved to cities for their education or career in later years; they are natural amenity-seekers who returned to rural settings with urban lifestyles and culture. Similarly, farmers in the cohort aged 65–74 years and the experienced cohort can be defined as elderly traditional farmers.

[1] Productivist agriculture refers to an intensive and expansionist farming driven by state support geared towards output and increased productivity which predominated from the period from the end of the Second World War to the beginning of the 1990s [24].

Most young entrepreneurial farmers are in the birth cohort aged 25–44 years in 2010, and also simultaneously belong to the entrant level cohorts. It is likely that they were born and grew up in urban areas and moved to the countryside motivated primarily by a career in agriculture. They chose to become farmers, which remarkably contrasts with the yearly outmigration of young adults [12]. Individuals in the cohort aged 25–34 years in 2010 with more than 11 years of farming experience are likely to be young successor farmers. They are individuals of rural origin, but some of them might have returned to their hometown after higher education in urban centers. Their choice to either remain or return to rural areas runs counter to the intention of young potential heirs to abandon agricultural activity [14].

3. Methodological Framework

3.1. Data and Variables

The main data used for empirical analysis are derived from the 2010 Korea Agricultural Census, when the CRVDP was being enforced, and the 2015 census, after the completion of the project. This data provides a set of micro-level individual and household characteristics of all Korean farm households. Among a total of 1,388 rural areas in *Eup* and *Myoen* administrative districts, 301 rural areas were identified as policy implementation areas using internal data acquired from the Ministry of Agriculture, Food and Rural Affairs (MAFRA).

The dependent variable used as an indicator of agricultural income levels is the total sales amount of agricultural and livestock products, information of which is coded in a categorical format in the census. **Table 2** presents the variables used in the analysis and their definitions. In addition to the cohort variables of age and experience, the demographic variables indicating life cycle, such as marital status and household size, selected explanatory variables are the probable determinants of agricultural income levels. The literature has demonstrated that the probability of farm households earning higher income is more likely among those headed by males with a high level of formal education [27–29].

Table 2. Definition of variables.

Variable		Definitions
Dependent Variable		
Agricultural income	INCOME	Total amount of sales < 1.2M KRW (= 1) 1.2M KRW ≤ Total amount of sales <3M KRW (= 2) 3M KRW ≤ Total amount of sales < 5M KRW (= 3) 5M KRW ≤ Total amount of sales < 10M KRW (= 4) 10M KRW ≤ Total amount of sales < 20M KRW (= 5) 20M KRW ≤ Total amount of sales < 30M KRW (= 6) 30M KRW ≤ Total amount of sales < 50M KRW (= 7) 50M KRW ≤ Total amount of sales < 100M KRW (= 8) 100M KRW ≤ Total amount of sales < 200M KRW (= 9) Total amount of sales ≥ 200M KRW (= 10)
Independent Variables		
Demographic		
Year	Year	2015 = 1, 2010 = 0
Age of householder	AC1	25–34 yrs of age
	AC2	35–44 yrs of age
	AC3	45–54 yrs of age
	AC4	55–65 yrs of age
	AC5	65–74 yrs of age (Ref.)
Gender	Male	Male = 1, Female = 0
Marital status	Married	Married = 1, Otherwise = 0
Household size	HHNUM	Number of household members
Socioeconomic		
Education	Eduy	Years of education
	Eduy_sq	Eduy*eduy

Table 2. *Cont.*

Variable		Definitions
Socioeconomic		
Experience in farming	EXP1	1–5 yrs of farming experience
	EXP2	6–10 yrs of farming experience
	EXP3	11 or more yrs of farming experience (Ref.)
Region variables	Capital	Capital region
	Kyungsangdo	Kyungsang province
	Chungcheongdo	Chungcheong province
	Kangwondo	Kangwon province
	Jeollado	Jeolla province (Ref.)
Agricultural		
Farm household characteristics	Computer	Utilize computer for work = 1, otherwise = 0
	Nonfarm	Has non farm income = 1, otherwise = 0
	Agribiz	Involved in agribusiness =1, otherwise = 0
Marketing channel	Wholesale	Wholesale, joint market
	Coop	Agricultural cooperatives and corporations
	Distributor	Government, collector, large distributors
	Processing	Processing companies and traditional markets
	Direct	Direct sales (Ref.)
Crop type	Rice	Rice
	Fruits	Fruits
	Others	Vegetables, flowers, medicinal and other special crops
	Livestock	Livestock
	Upland	Upland crops (Ref.)

Note: M = million; KRW = Korean Won; and Ref. = reference group.

Regarding regions, *Jeolla* province, the southernmost province of mainland Korea, where agriculture is characterized by fertile soil and warm temperatures, is the reference group. Because crop type is one important determinant of gross sales earnings, different regions specialize in different types of crops. For example, rice, the staple food in Korea, is mostly cultivated in parts of the capital region and *Kyungsang* province in the southeast and throughout *Jeolla* and *Chungcheong* provinces; a high proportion of farms in *Kwangwon* province, in the eastern part of Korea, cultivate food crops such as potatoes, and vegetables and fruits are mainly cultivated in *Kyungsang* province. In the analysis, *Jeju* province, Korea's largest island, was excluded due to the limited number in the birth and experience cohorts.

Agriculture-related explanatory variables used in the analysis are related to the capacity to sell agricultural products. These variables include the use of computers, the type of main marketing channel, and major crop types, and variables that affect the extent of farming, such as involvement in non-farm activities and agribusiness.

3.2. Methodology

3.2.1. Double Cohort Model Linking Age and Farming Experience

The double cohort model is based on the traditional APC model, a regression model designed to explain a socioeconomic phenomenon with respect to the effects of age, period, and cohort membership. Age effects refer to a specific outcome associated with the aging process or changes in the lifecycle trajectory. Period effects are the result of population-wide exposures at a specified point in time. Cohort effects refer to variations over time within a specific group of individuals who share a unique initial event, distinct to each cohort.

A valid APC model requires simultaneous identification of each effect; however, three variables are collinear because each effect is calculated as a function of the two other variables, such as period = age + cohort. This restricts a simultaneous estimation of three linear effects by a conventional multivariate regression model. Many approaches have been developed to overcome this identification problem [30–33]. The double cohort model overcomes the identification problem by defining cohort effects as the effects of multiple interaction terms among time periods and two types of cohort variables. The essence of the double cohort model applied in Myers and Lee [32,34] is to nest birth cohorts within immigration cohorts.

Applying the double cohort model, this paper considers that birth cohorts are nested within farming experience cohorts. Accordingly, farmers are characterized by dual cohort markers, one related to membership in birth cohorts and another related to membership in farming experience cohorts. Unlike the traditional APC model that includes a cross-sectional age variable, the application of the double cohort model allows for the recognition that cohorts increase in both age and farming experience and that changes in various outcomes, such as agricultural income, are attributable to both factors. Changes over time for each cohort are measured by the interaction of census year with cohort so that the end-of-interval status attainment is compared with that at the beginning. The double cohort method includes both a logistic regression specification and a data visualization method that displays cohort trajectories over the analyzed periods [34].

3.2.2. Propensity Score Matching

In the absence of a random assignment, the causal impact of a policy can be estimated in a quasi-experimental setting [35,36]. In this study, propensity score matching (PSM) developed by Rosenbaum and Rubin [37] was applied to form a treatment group of farmers from the project implemented areas and a control group of farmers from the areas where the project was not implemented. PSM allows the outcomes between two groups to be comparable because their members are farmers with similar traits, except for their residential location (i.e., project-implemented areas and non-implemented areas).

PSM relies on two assumptions that render the treatment assignment to be "strongly ignorable": the conditional independence assumption and the common support assumption. In this study, the conditional independence assumption posits that all household-level variables relevant to the probability of living in the project implemented areas are observable and included in the set of observed covariates. The common support assumption implies that for each household in the project-implemented areas, there is another matched household with a similar set of observed covariates in the project-not-implemented areas.

In our study, the farm household's residential location in the project-implemented areas serves as the treatment. Based on the aforementioned reasoning, this study employed the one-to-one nearest neighbor matching method with replacement that selects the *m* comparison units found in the non-treated areas whose propensity scores are closest to farm households located in the treated areas. The regression equation takes the following form [Equation (1)]:

$$Propesnity\ Score = Pr\left(T_i = 1\right) = \beta_0 + \beta_1 Z_i + \varepsilon_i \quad (1)$$

where *T* is a dummy capturing whether the household is located in implemented or nonimplemented areas, with *T* = 1 if the household is in the program-implemented area and 0 otherwise; *I* = 1, ..., *n* is the number of observations; *Z* is a vector of observed variables, for example, age, gender, and family size, that may affect the household's location; and ε is an error term. The description of variables by policy implementation for the two study periods, 2010 and 2015, after applying the PSM, is presented in **Appendix A**.

3.2.3. Ordered Logit Model

The dependent variable, agricultural income, is ordinal with ten categories (**Table 3**). Therefore, for both the treatment and control groups, an ordered logit model (OLM) is employed for the estimation of the cohort effects on agricultural income over five years.

The regression equation of the OLM is expressed as Equation (2):

$$y^* = \sum_{k=1}^{N} X_k \beta_k + \varepsilon \quad (2)$$

where y^* is the unobservable response variable that determines the observed variable y_i, X_k is the vector of independent variables (**Table 2**), β is the vector of regression coefficients to be estimated, and ε is an error term.

The continuous latent variable y^* has various threshold or cutoff points expressed by μ_i. In this model, F is the cumulative distribution function for the error term, which is assumed to be distributed logistically. The mathematical expression of the relationship can be described as Equation (3):

$$y_i = \begin{cases} 1\,if\; y^* \le \mu_1 (=0) \\ 2\,if\; \mu_1 < y_i^* \le \mu_2 \\ 3\,if\; \mu_2 < y_i^* \le \mu_3 \\ \vdots \\ J\,if\; \mu_{J-1} < y_i^* \end{cases} \quad (3)$$

In the OLM, μ_1 is normalized to zero to satisfy the proportional odds (parallel lines) assumption. The underlying logic of the proportional odds assumption is that all the coefficients except the intercept should be the same across the response categories [38,39].

Table 3. Classification of agricultural income and thresholds from the OLM.

Indicato (y_i)	Classification	Implemented Areas		Not-Implemented Areas	
		Intercept	μ_i	Intercept	μ_i
1	Less than 1.2 M	−0.8484	0.0000	−0.9016	0.0000
2	1.2 to 3 M	0.4541	1.3025	0.3430	1.2446
3	3 to 5 M	1.2661	2.1145	1.1509	2.0525
4	5 to 10 M	2.1542	3.0026	2.0095	2.9111
5	10 to 20 M	3.0118	3.8602	2.8309	3.7325
6	20 to 30 M	3.7051	4.5535	3.4965	4.3981
7	30 to 50 M	4.5756	5.4240	4.3497	5.2513
8	50 to 100 M	5.9187	6.7671	5.6679	6.5695
9	100 to 200 M	7.1912	8.0396	6.9014	7.8030
10	Over 200 M				

Note: Unit: KRW; and M = million.

Combining Equations (2) and (3), the predicted probability of belonging to a certain category of the dependent variable can be computed as in Equation (4).

$$\begin{gathered} Pr\,(y_t = 1) = F(-\sum_{k=1}^{K}\beta_k x_k) \\ Pr\,(y_t = 2) = F(\mu_2 - \sum_{k=1}^{K}\beta_k x_k) - F(-\sum_{k=1}^{K}\beta_k x_k) \\ \vdots \\ Pr\,(y_t = 10) = 1 - F(\mu_9 - \sum_{k=1}^{K}\beta_k x_k) \\ \text{where, } F(\theta) = \frac{1}{1+e^{-\theta}} = \frac{e^{\theta}}{1+e^{\theta}} \end{gathered} \quad (4)$$

Using the OLM, the main interest in this study is to compare the changes in the agricultural income trajectory for each cohort over the course of five years. Coefficients from the ordered logit model were used to compute expected values of attaining a high level of agricultural income for each cohort. The average gross earnings from the sales of agricultural products in Korea have been maintained within the range of KRW 26 million to 35 million over the last 10 years [40]. Therefore, the predicted probability of earning the total sales greater than KRW 50 million, or equivalently, P($y_i \ge 8$) is computed for each cohort in both project-implemented areas and non-implemented areas. Any difference in the agricultural income trajectory for each cohort between the groups of areas is then interpreted as the policy impact.

4. Empirical Results

4.1. Determinants of Agricultural Income

Analysis of the pooled sample from the 2010 and 2015 Censuses reveals the determinants of agricultural income in Korea (**Table 4**). Such determinants are indicated by the coefficients of independent variables without time effects. Regardless of the project implementation, a higher agricultural income is more likely for farm households headed by a married male with more household members. Householders' educational level, depicted by years of education, is also positively correlated with agricultural income, although the negative sign of its squared term suggests diminishing returns to education.

Using *Jeolla* province as the reference region, the negative coefficients in the remaining provinces suggest that households in *Jeolla* province are likely to earn more agricultural income than those in other regions. The use of computers for agricultural activity and participation in agribusiness was found to be positively associated with agricultural income. Conversely, a negative correlation was found between participation in nonfarm activity and agricultural income; this finding is reasonable because farmers who engage in nonfarm activities tend to spend fewer hours on farming activities [41].

Table 4. Ordered logistic regression results.

CRVDP Implemented			CRVD Not-Implemented	
Variable	**Coeff.**	**Std. Error**	**Coeff.**	**Std. Error**
Year	−0.0110	0.0121	−0.0650***	0.0121
Male	0.6121***	0.0137	0.5787***	0.0139
Married	0.4212***	0.0124	0.4039***	0.0125
Family	0.1248***	0.0034	0.0950***	0.0036
Eduy	0.1264***	0.0066	0.1481***	0.0068
Edu_sq	−0.0064***	0.0003	−0.0084***	0.0004
Capital	−0.4444***	0.0398	−0.0902***	0.0284
Kyungsangdo	−0.1848***	0.0090	−0.1646***	0.0092
Chungchungdo	−0.1451***	0.0098	−0.0332***	0.0101
Kangwondo	−0.3532***	0.0105	−0.2801***	0.0109
Computer	0.6783***	0.0091	0.6476***	0.0092
Nonfarm	−0.6719***	0.0076	−0.6661***	0.0077
Agribiz	0.6217***	0.0095	0.6650***	0.0096
Wholesale	−0.2293***	0.0334	−0.3078***	0.0438
Coop	−0.5226***	0.0323	−0.6319***	0.0431
Distributor	−1.2738***	0.0323	−1.5191***	0.0431
Processing	−2.0722***	0.0351	−2.3114***	0.0453
Rice	0.4730***	0.0144	0.5642***	0.0149
Fruits	1.3425***	0.0163	1.1999***	0.0169
Others	0.9639***	0.0147	1.1643***	0.0155
Livestock	2.3192***	0.018	2.5282***	0.0193
EXPERIENCE COHORT IN 2010				
(EC, Reference = Experienced farmers)				
Beginning farmers	−1.1802***	0.0228	−1.2222***	0.0229
Early-career farmers	−0.8195***	0.0179	−0.8631***	0.0180
BIRTH COHORT IN 2010				
(BC, Reference = 65–74)				
25–34	1.0682***	0.0606	1.2614***	0.0614
35–44	0.6916***	0.0228	0.7256***	0.0231
45–54	0.7547***	0.0140	0.7162***	0.0140
55–64	0.6014***	0.0117	0.5593***	0.0116
EXPERIENCE EFFECT WITH TIME (Year*EC)				
Beginning farmers	0.3645***	0.0497	0.3111***	0.0506
Early-career farmers	0.2918***	0.0559	0.2567***	0.0567
AGING EFFECT WITH TIME (Year*BC) (For experienced farmers)				
25–34 to 30–39	−0.2011	0.1412	−0.5560***	0.1507
35–44 to 40–49	0.2272***	0.0343	0.1430***	0.0347
45–54 to 50–59	0.3181***	0.0194	0.3017***	0.0194
55–64 to 60–69	0.1253***	0.0171	0.1062***	0.0171
EXPERIENCE AND BIRTH COHORT EFFECT WITH TIME (Year*EC*BC) (Relative to experienced farmers)				
For beginning farmers:				
25–34 to 30–39	0.6668***	0.1505	1.0338***	0.1601
35–44 to 40–49	0.1217**	0.0616	0.2338***	0.0626
45–54 to 50–59	−0.2652***	0.0528	−0.2628***	0.0536
55–64 to 60–69	−0.2603***	0.0524	−0.2516***	0.0532
For early-career farmers:				
25–34 to 30–39	0.8752***	0.1738	0.9118***	0.1835
35–44 to 40–49	0.3375***	0.0738	0.4004***	0.0750
45–54 to 50–59	−0.1872***	0.0652	−0.1408**	0.0659
55–64 to 60–69	−0.2406***	0.0673	−0.3004***	0.0679
Chi-squared	17,286.3612 ***		21,617.0984***	
Degrees of freedom	328		328	
Adj. R-square	0.3317		0.3243	
−2LL: intercept only	1,137,447.2		1,135,927.4	
−2LL: intercept and covariates	1,032,253.6		1,033,614.7	
Number of Obs.	265,503.0		265,503.0	

Note: **p* < 0.1; ***p* < 0.05; and ****p* < 0.01.

Among diverse agricultural marketing channels, farm households that mainly trade through direct sales were adopted as a reference group. The results indicate that agricultural income is lower for farm households that mainly sell agricultural products through wholesale markets, cooperatives, distributors, and processing companies in comparison to the reference group. With respect to major crops, the probability of earning agricultural income is higher for farmers who cultivate livestock, fruits, other crops, and rice in comparison to those who are primarily engaged in the cultivation of upland crops. Such a finding coincides with the typical Korean agricultural scene, where upland crops earn the lowest income, followed by rice, and livestock farmers have the highest average agricultural income.

A positive correlation was found between experience in farming and agricultural income. Experienced farmers were more likely to earn agricultural income than those in the beginning or early-career stage of their farming career, as suggested by the negative coefficients. With respect to age, farm households headed by senior farmers in the 65–74 age range were chosen as the reference group. The results suggest that the younger the farmers, the higher the probability of earning agricultural income. Considering the inverse relationship between age and farm productivity, with peak earnings at age ranges between 35 and 44 years [42], such a contrasting result supports the necessity to jointly consider the effects of both experience accumulation and aging.

The result found for the variable *year* presents an important finding regarding the effect of the CRVDP. It indicates that making agricultural income was more difficult in 2010 than in 2015 in both project-implemented areas and non-implemented areas. Likely, the economic recession initiated in 2008 had negatively affected the probability of earning agricultural income. What needs to be highlighted is that the magnitude of the coefficient is greater with statistical significance at the 1% level, where the project was not implemented. This finding suggests that in 2010, the conditions to generate agricultural income were more unfavorable for the areas that were not supported by the CRVDP. All things being equal, the CRVDP initiated in 2004 may have improved overall conditions of the project-supported areas such that farm households in these areas were less affected by the recession than those in the project-not-implemented areas.

4.2. Estimation of Agricultural Income Trajectories

4.2.1. Trends Shared by Project Implemented Areas and Non-Implemented Areas

Coefficients from the OLM were used to compute expected values of attaining a high level of agricultural income (i.e., KRW 50 M) for each cohort (**Table 5**). The results are shown in the format of double cohort plots in **Figure 1**. Separate plots are provided for the project implemented areas and the not-implemented areas to evaluate the project impacts. The slopes of the arrow are of greatest interest, indicating the rate of advancement into top-tier agricultural income households.

Table 5. Predicted values of earning a higher level agricultural income (%).

	CRVDP Implemented						CRVDP Not-Implemented					
	EXP1		EXP2		EXP3		EXP1		EXP2		EXP3	
AC	2010	2015	2010	2015	2010	2015	2010	2015	2010	2015	2010	2015
1	4.24	8.72	5.98	13.57	12.61	9.98	5.03	9.39	7.05	11.06	15.25	8.39
2	2.95	5.51	4.18	8.81	9.01	10.46	3.01	5.19	4.25	8.07	9.52	9.74
3	3.14	4.42	4.44	6.25	9.54	11.99	2.98	3.73	4.21	5.6	9.44	11.13
4	2.7	3.18	3.83	4.28	8.3	8.79	2.56	2.68	3.62	3.43	8.19	8.09
5	1.5	2.02	2.14	2.68	4.72	4.45	1.48	1.79	2.1	2.41	4.85	4.33

A conspicuous difference among the three types of experience groups is the initial probability of attaining the high levels of agricultural income as depicted by the left endpoints of the intervals. The starting points are the lowest for the beginning farmers, successively followed by the early-career farmers and the experienced farmers. In all age cohorts, the initial level of agricultural income in both project-implemented and non-implemented areas was substantially higher. Positive trajectories are found for all birth cohorts in the beginning and early-career farmers' cohorts, while the steeper slopes of the young farmers in the early-career cohort suggest the higher potential holds for these particular groups. Although of lesser intensity, relatively steeper slopes among young birth cohorts in the beginning farmer group are likely related to the entrepreneurial traits of the young generation of farmers.

The agricultural income trajectories for the experienced farmer cohort slightly differ from those of the two other experience cohorts. The young farmers in the youngest birth cohort experienced a considerable decline in the probability of earning a high-level income over five years. However, a substantial loss in the probability is then followed by a recovering trend of agricultural income for the case of young farmers who were in their mid-30s to mid-40s in 2010. This observation is analogous to the findings of previous studies, which indicate that succession farmers possess a unique advantage at the beginning of the settlement due to the 'succession effect'. However, their background may be an obstacle to discovering new markets or adopting innovations [43–45]. The trajectories depict that as young farm successors attempt to implement more innovative approaches and decrease the influence of their parents, the probability of earning a high-level income declines; a rebound suggests that this probability recovers as they gradually become self-reliant.

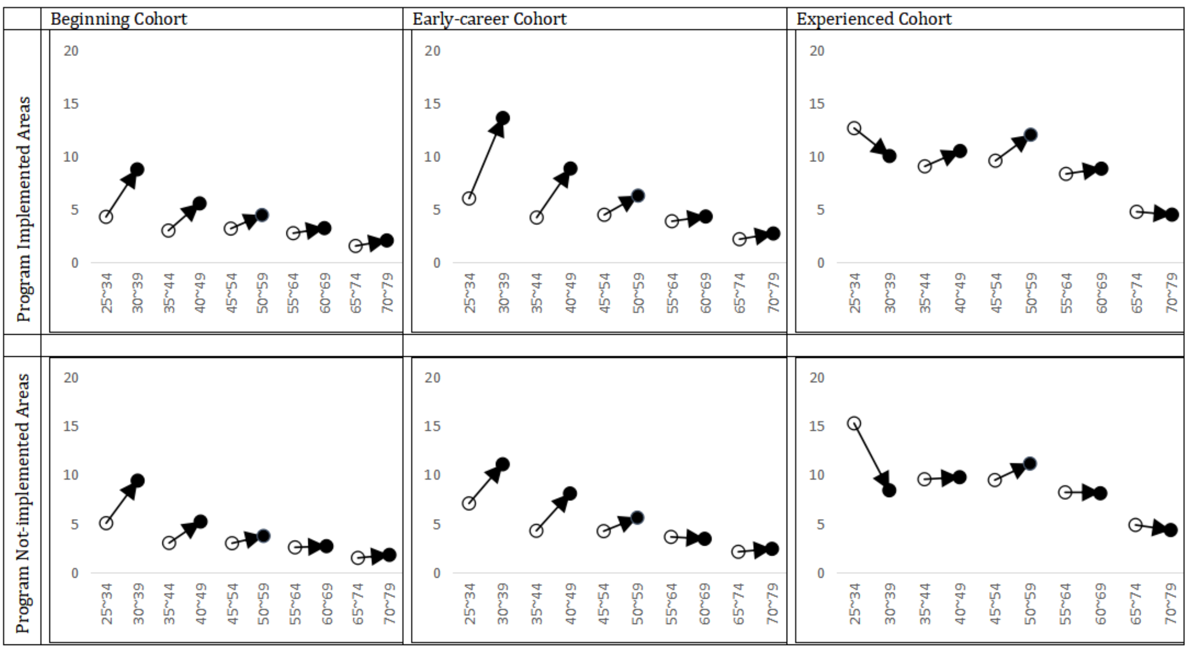

Figure 1. The change in the predicted value of making a high-level agricultural income $[P\left(y_i \geq 8\right)]$, 2010–2015.

4.2.2. Comparison of Trends in the Project Implemented Areas and Non-Implemented Areas

Graphs are useful for comparing the trajectories of agricultural income attainment between the project-implemented areas and non-implemented areas, drawing implications for the effectiveness of the CRVDP. All things being equal, the results of the comparison group show what would have occurred in the absence of the project implementation.

Discernible changes are observed over the analysis periods among four groups in the project's implemented areas: young farmers in their mid-20s to early 30s (in 2010) in either the early-career or experienced cohort, and young farmers in their mid-30s to early 40s (in 2010) in the early-career or experienced cohort. Of all the cohorts, the youngest farmers of the early-career cohort gained the most from the project, as suggested by the steepest slopes.

The youngest farmers of the experienced cohort also seem to have gained substantial benefits from the project. The same group of farmers in the areas where the project was not implemented underwent a serious loss in the probability of attaining a high-level of income, as indicated by a comparatively steep downward slope. The likely explanation for this finding is that the flatter negative slope in the project-implemented areas suggests that the project induced a cushioning effect that prevented a further decline in income for this particular cohort. Moreover, young farmers in the upper age range with more than six years of farming experience (early-career and experienced cohorts) in the project implemented areas had experienced an increase in agricultural income at a faster rate than those in the project non-implemented areas.

The change in slope among the older birth cohorts (mid-age and elderly cohorts) at all levels of experience is imperceptible compared with that of the two areas, suggesting that gains from the project are less obvious for older birth cohorts. This includes mid-aged farmers in either the beginning or early-career cohorts who were identified as in-migration baby boomers. This result is probably associated with their reasons for becoming farmers, of which income was not a major motivation. Furthermore, although the difference in the two areas is not obvious, the flattening slopes with the increase in the age range of cohorts show that senior farmers in all experience cohorts did not benefit much from the project implemented in their communities.

5. Conclusion

A rural revitalization project implemented at a community level will probably be affected by the augmented differences in characteristics of birth cohorts that emerged because of new demographic patterns in rural societies. Thus, the study attempted to analyze how changing demographic trends may have shaped the outcomes of a rural revitalization project in Korea. The effectiveness of such a project, or the CRVDP, is measured by its effect on increasing agricultural income levels. In addition to age, experience in farming is considered because it is an important factor determining agricultural income. To incorporate two types of cohorts into the empirical analysis, the double cohort model developed from the traditional APC model is employed.

All things being equal, the major differences in the probability of attaining high levels of agricultural income between the two study areas can be attributed to the implementation of the rural revitalization project. Young farmers in the early stages of their careers experienced a significant increase in their likelihood of earning higher agricultural income. This appears to result from their compatibility with the values and approaches emphasized by the project. In contrast, middle-aged and older cohorts with varying levels of farming experience were less able to benefit. The program's structure may have unintentionally discouraged participation from those whose goals or capacities did not correspond to the program's intended model.

These findings suggest that the current model of rural revitalization may unintentionally generate uneven outcomes within rural communities, creating disparities between groups who are better positioned to benefit and those who are not. To address this risk, future programs should be designed to reflect the diverse characteristics of rural populations by offering tailored support in areas such as marketing, training aligned with varying experience levels, and participatory governance structures that encourage inclusive engagement. Such efforts can improve accessibility, strengthen community participation, and ensure that the benefits of rural development are distributed more fairly across demographic groups.

Despite the valuable contributions, the study has several limitations. First, although the double cohort model offers a nuanced framework for analyzing the interaction between age and farming experience, the use of cross-sectional census data from only two time points limits the ability to capture dynamic or nonlinear cohort trajectories. Second, the analysis focuses exclusively on agricultural income as the outcome variable. While income is a critical indicator of economic performance, it does not fully reflect other important dimensions of rural revitalization, such as quality of life, community cohesion, or levels of civic engagement. Third, although propensity score matching reduces observable selection bias, unobserved factors such as individual motivation, social capital, or informal networks may still influence both program participation and income outcomes. Future studies may address these limitations by employing longitudinal data and expanding the scope of outcome indicators.

Author Contributions

Conceptualization, S.L.; methodology, E.C. and S.L.; formal analysis, E.C.; investigation, E.C. and K.L.; writing—original draft preparation, E.C. and K.L.; writing—review and editing, K.L. and S.L. All authors have read and agreed to the published version of the manuscript.

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Not applicable.

Data Availability Statement

The data presented in this study are available on request from the corresponding author. The data are not publicly available due to institutional data use policy.

Conflict of Interest

The authors declare that there is no conflict of interest.

Appendix A

Table A1. Description of variables based on the PSM modelling.

Variable	2010				2015			
	Implemented		Non-Implemented		Implemented		Non-Implemented	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Age								
AC1	0.0066	0.0809	0.0064	0.0800	0.0092	0.0953	0.0086	0.0921
AC2	0.0638	0.2443	0.0621	0.2413	0.0707	0.2563	0.0691	0.2536
AC3	0.2248	0.4174	0.2249	0.4175	0.2485	0.4321	0.2486	0.4322
AC4	0.3378	0.4730	0.3392	0.4734	0.3518	0.4775	0.3540	0.4782
Male	0.8800	0.3249	0.8830	0.3215	0.8687	0.3377	0.8708	0.3355
Married	0.8443	0.3625	0.8470	0.3600	0.8164	0.3871	0.8161	0.3874
Household size	2.5823	1.2485	2.5759	1.2165	2.2950	1.0824	2.2847	1.0526
Eduy	8.7364	3.1243	8.7450	3.1137	8.7911	3.0799	8.7998	3.0733
Eduy_sq	86.0856	61.0290	86.1703	60.6775	86.7689	58.9560	86.8821	58.8899
Experience								
EXP1	0.0511	0.2202	0.0510	0.2199	0.1103	0.3133	0.1104	0.3134
EXP2	0.0860	0.2803	0.0867	0.2814	0.0570	0.2318	0.0566	0.2311
Region								
Capital	0.0073	0.0853	0.0156	0.1241	0.0080	0.0890	0.0157	0.1243
Kyungsangdo	0.3028	0.4595	0.3432	0.4748	0.3019	0.4591	0.3434	0.4749
Chungchungdo	0.2085	0.4062	0.2160	0.4115	0.2076	0.4056	0.2201	0.4143
Kangwondo	0.1764	0.3812	0.1758	0.3807	0.1793	0.3836	0.1772	0.3819
Computer	0.2430	0.4289	0.2225	0.4159	0.2111	0.4081	0.1974	0.3980
Nonfarm	0.4463	0.4971	0.4591	0.4983	0.4006	0.4900	0.4191	0.4934
Agribiz	0.1733	0.3785	0.1573	0.3641	0.1886	0.3912	0.1850	0.3883
Marketing channel								
Wholesale	0.1218	0.3270	0.1284	0.3345	0.1269	0.3329	0.1227	0.3281
Coop	0.3663	0.4818	0.3718	0.4833	0.3930	0.4884	0.3914	0.4881
Distributor	0.4404	0.4964	0.4358	0.4959	0.4092	0.4917	0.4232	0.4941
Processing	0.0622	0.2416	0.0589	0.2354	0.0568	0.2315	0.0549	0.2278
Crop type								
Rice	0.4115	0.4921	0.4542	0.4979	0.4110	0.4920	0.4493	0.4974
Fruits	0.1509	0.3580	0.1473	0.3544	0.1616	0.3681	0.1580	0.3647
Others	0.2699	0.4439	0.2542	0.4354	0.2715	0.4447	0.2542	0.4354
Livestock	0.1017	0.3023	0.0859	0.2802	0.0722	0.2589	0.0604	0.2382
No. of observations	138,294		138,294		127,209		127,209	

Source: Statistics Korea [1,40].

References

[1] Statistics Korea, 2025. Farm and Fishery Household Economy Survey in 2024. Statistics Korea: Daejeon, Korea. (in Korean)

[2] Jauhiainen, J.S., 2009. Will the Retiring Baby Boomers Return to Rural Periphery? Journal of Rural Studies. 25, 25–34. DOI: https://doi.org/10.1016/j.jrurstud.2008.05.001

[3] Koutsou, S., Partalidou, M., Ragkos, A., 2014. Young Farmers' Social Capital in Greece: Trust Levels and Collective Actions. Journal of Rural Studies. 34, 204–211. DOI: https://doi.org/10.1016/j.jrurstud.2014.02.002

[4] Zagata, L., Sutherland, L., 2015. Deconstructing the 'Young Farmer Problem in Europe': Towards a Research Agenda. Journal of Rural Studies. 38, 39–51. DOI: https://doi.org/10.1016/j.jrurstud.2015.01.003

[5] Lee, M., Jung, S., 2023. Confirming the Applicability of Hass and Serow's Retirement Migration Model to Rural Retirees in South Korea and the Development of a South Korean Retirement Migration Model: Using FGI. Journal of Regional Studies. 31(4), 37–77. (in Korean)

[6] Stockdale, A., Catney, G., 2014. A Life Course Perspective on Urban-Rural Migration: The Importance of the Local Context. Population Space and Place. 20(1), 83–98. DOI: https://doi.org/10.1002/psp.1758

[7] Onge, J.M.S., Hunder, L.M., Boardman, J.D., 2007. Population Growth in High-Amenity Rural Areas: Does It Bring Socioeconomic Benefits for Long-Term Residents? Social Science Quarterly. 88(2), 366–381. DOI: https://doi.org/10.1111/j.1540-6237.2007.00462.x

[8] Jeong, J., Kim, S., 2019. Life Satisfaction of Urban-to-Rural Migrants in South Korea: Income vs. Nature. Journal of the Korean Society of Rural Planning. 25(4), 65–76. (in Korean)

[9] Park, J., Kim, K., 2016. The Residential Location Choice of the Elderly in Korea: A Multilevel Logit Model. Journal of Rural Studies. 44, 261–271. DOI: https://doi.org/10.1016/j.jrurstud.2016.02.009

[10] Kim, J.S., Lee, J.H., 2017. An Investigation on the Recent Urban-to-Rural Migration and Its Implications. KREI Agricultural Policy Focus. Korea Rural Economic Institute: Naju, South Korea. (in Korean)

[11] Huang, C., Liu, Y., Pan, Z., et al., 2023. Modeling Locational Choices of Older Adults in China, 2010–2015. Applied Geography. 155, 102954. DOI: https://doi.org/10.1016/j.apgeog.2023.102954

[12] Milone, P., Ventura, F., 2019. New Generation Farmers: Rediscovering the Peasantry. Journal of Rural Studies. 65, 43–52. DOI: https://doi.org/10.1016/j.jrurstud.2018.12.009

[13] Inwood, S., Clark, J.K., Bean, M., 2013. The Differing Values of Multigeneration and First-Generation Farmers: Their Influence on the Structure of Agriculture at the Rural-Urban Interface. Rural Sociology. 78(3), 346–370. DOI: https://doi.org/10.1111/ruso.12012

[14] Cavicchioli, D., Bertoni, D., Pretolani, R., 2018. Farm Succession at a Crossroads: The Interaction Among Farm Characteristics, Labour Market Conditions, and Gender and Birth Order Effects. Journal of Rural Studies. 61, 73–83. DOI: https://doi.org/10.1016/j.jrurstud.2018.06.002

[15] Ministry of Agriculture, Food and Rural Affairs (MAFRA), 2016. National Survey of Urban-to-Rural Migration. Ministry of Agriculture, Food and Rural Affairs (MAFRA): Sejong, South Korea. (in Korean)

[16] Jeong, Y., Hwang, J., Choi, Y., et al., 2019. Factors Affecting the Characteristics of Agricultural Management and the Management Performance of Young Farmers. Journal of Agricultural Extension & Community Development. 26(3), 143–151. (in Korean)

[17] Ma, S., Kim, N., 2019. Investigation on Factors Affecting Young Beginning Farmers' Successful Settlement in Rural Communities. Rural Economy. 42(1), 27–49. (in Korean)

[18] Hwang, J., Park, J., Lee, S., 2018. The Impact of the Comprehensive Rural Village Development Program on Rural Sustainability in Korea. Sustainability. 10(7), 2436. DOI: https://doi.org/10.3390/su10072436

[19] Liao, R., Chen, Z., Sirisrisakulchai, J., et al., 2025. Enhancing Rural Economic Sustainability in China Through Agricultural Socialization Services: A Novel Perspective on Spatial-Temporal Dynamics. Agriculture. 15(3), 267. DOI: https://doi.org/10.3390/agriculture15030267

[20] Anderson, J.E., 1984. Public Policy Making. Praeger Publishers: New York, NY, USA.

[21] Coombs, F.S., 1980. The Bases of Noncompliance With a Policy. Policy Studies Journal. 8(6), 885–892. DOI: https://doi.org/10.1111/j.1541-0072.1980.tb01179.x

[22] Ryder, N.B., 1965. The Cohort as a Concept in the Study of Social Change. American Sociological Review. 30(6), 843–861. DOI: https://doi.org/10.2307/2090964

[23] McKillop, J., Heanue, K., Kinsella, J., 2018. Are All Young Farmers the Same? An Exploratory Analysis of On-Farm Innovation on Dairy and Drystock Farms in the Republic of Ireland. The Journal of Agricultural Education and Extension. 24(2), 137–151. DOI: https://doi.org/10.1080/1389224X.2018.1432494

[24] Lowe, P., Murdoch, J., Marden, T., et al., 1993. Reg-

ulating the New Rural Spaces: The Uneven Development of Land. Journal of Rural Studies. 9(3), 205–222. DOI: https://doi.org/10.1016/0743-0167(93)90067-T

[25] Barbieri, C., Mahoney, E., 2009. Why Is Diversification an Attractive Farm Adjustment Strategy? Insights from Texas Farmers and Ranchers. Journal of Rural Studies. 25(1), 58–66. DOI: https://doi.org/10.1016/j.jrurstud.2008.06.001

[26] Conway, S.F., Farrell, M., McDonagh, J., et al., 2022. Farmers Don't Retire: Re-Evaluating How We Engage with and Understand the 'Older' Farmer's Perspective. Sustainability. 14(5), 2533. DOI: https://doi.org/10.3390/su14052533

[27] López, A.P., López, R., 2015. The Gender Gap in Agricultural Productivity: The Role of Market Imperfections. The Journal of Development Studies. 51(9), 1175–1192. DOI: https://doi.org/10.1080/00220388.2015.1028539

[28] Reimers, M., Stephan, K., 2011. Revisiting the Role of Education for Agricultural Productivity. IAI Discussion Papers. No. 214. Georg-August-Universität Göttingen, Ibero-America Institute for Economic Research (IAI): Göttingen, Germany. pp. 1–41.

[29] Luh, Y., 2017. The Impact of Education on Agricultural Productivity: Evidence from East Asian Economies. International Journal of Food and Agricultural Economics. 5(4), 11–24. DOI: https://doi.org/10.22004/ag.econ.266460

[30] Holford, T.R., 1983. The Estimation of Age, Period and Cohort Effects for Vital Rates. Biometrics. 39(2), 311–324. DOI: https://doi.org/10.2307/2531004

[31] Fienberg, S.E., Mason, W.M., 1985. Specification and Implementation of Age, Period and Cohort Models. In: Mason, W.M., Fienberg, S.E. (Eds.). Cohort Analysis in Social Research. Springer: New York, NY, USA. pp. 45–88. DOI: https://doi.org/10.1007/978-1-4613-8536-3_3

[32] Myers, D., Lee, S.W., 1996. Immigration Cohorts and Residential Overcrowding in Southern California. Demography. 33(1), 61–65. DOI: https://doi.org/10.2307/2061713

[33] Yang, Y., Land, K.C., 2008. Age-Period-Cohort Analysis of Repeated Cross-Section Surveys: Fixed or Random Effects? Sociological Methods & Research. 36(3), 297–326. DOI: https://doi.org/10.1177/0049124106292360

[34] Myers, D., Lee, S.W., 1998. Immigrant Trajectories Into Homeownership: A Temporal Analysis of Residential Assimilation. The International Migration Review. 32(3), 593–625. DOI: https://doi.org/10.2307/2547765

[35] Athey, S., Imbens, G., 2017. The State of Applied Econometrics: Causality and Policy Evaluation. Journal of Economic Perspectives. 31(2), 3–32. DOI: https://doi.org/10.1257/jep.31.2.3

[36] Rosenbaum, P.R., 2017. Observation and Experiment: An Introduction to Causal Inference. Harvard University Press: Cambridge, MA, USA.

[37] Rosenbaum, P.R., Rubin, D.B., 1983. The Central Role of the Propensity Score in Observational Studies for Causal Effects. Biometrika. 70(1), 41–55. DOI: https://doi.org/10.2307/2335942

[38] Lee, S.W., Min, S.H., Park, J.Y., et al., 2006. The Practice on Logit and Probit Model. ParkYoungSa: Seoul, South Korea. (in Korean)

[39] Williams, R., 2016. Understanding and Interpreting Generalized Ordered Logit Models. The Journal of Mathematical Sociology. 40(1), 7–20. DOI: https://doi.org/10.1080/0022250X.2015.1112384

[40] Statistics Korea, 2020. Farm and Fishery Household Economy Survey in 2019. Statistics Korea: Daejeon, South Korea. (in Korean)

[41] Zhao, Q., Bao, H.X.H., Zhang, Z., 2021. Off-Farm Employment and Agricultural Land Use Efficiency in China. Land Use Policy. 101, 105097. DOI: https://doi.org/10.1016/j.landusepol.2020.105097

[42] Tauer, L., 1995. Age and Farmer Productivity. Review of Agricultural Economics. 17(1), 63–69. DOI: https://doi.org/10.2307/1349655

[43] Barclay, E., Foskey, R., Reeve, I., 2007. Farm Succession and Inheritance: Comparing Australian and International Trends. RIRDC Project No UNE-88A. Rural Industries Research and Development Corporation (RIRDC): Kingston, Australia.

[44] Koh, S., 2001. The Social Reproduction Crisis of Farm Succession in South Korea: A Riverside Village Case Study. Journal of Rural Development. 24(1), 31–63. (in Korean)

[45] Sharma, P., Rao, S., 2000. Successor Attributes in Indian and Canadian Family Farms: A Comparative Study. Family Business Review. 13(4), 313–330. DOI: https://doi.org/10.1111/j.1741-6248.2000.00313.x