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Mediating and Non-mediating Factors Influencing Couples and Non-couples' Cooperative Membership: Modelling Behaviors of Actors in Selected States of Nigeria

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Aims: Analyzing mediating and non-mediating factors influencing cooperative membership among couples and non-couples in addition to addressing gaps in understanding motivations and barriers so as to provide insights for tailored policies and effective cooperative models to enhance economic status and social well-being was the focus of this study.

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Study Design: Original research using primary data.
Place and Duration of Study: The study was conducted in six Nigerian states in 2023.
Methodology: Six Nigerian states were randomly selected to collect data from 820 farmers using structured questionnaires. Analytical techniques employed included descriptive statistics, factor analysis, structural equation and bivariate recursive models.
Results: The study revealed that adult-male-cooperative members outnumber non-members across all states which suggest wide gender disparities. Regional variations in gender disparities in cooperative membership also exist stressing the need for inclusive policies and targeted programs for youth and elderly. Significant driving factors identified at 1% levels of significance included commitment, transparency, economic status, and employee efficiency. On the other hand, significant constraints affecting participation included inadequate infrastructure, poor communication, and limited education. Distance to cooperative meetings (average=7.61km) is negative, indicating a lower likelihood of increasing membership but does not impact on off-farm participation in the short and long run. Recursive logit and probit models reveal long-term impacts, stressing the importance of careful intervention design and policy planning.
Conclusion: Varying prediction of cooperative membership benefits, especially for non-couples, emphasize the need for complementary geographical and longitudinal studies, but off-farm activities show potential long-term negative effects. Robust cooperative institutions effectively linked to off-farm participation require improved infrastructure, access to education, corporate governance and sound financial management.

Keywords: Bivariate recursive model; treatment effect; odds and risk ratios; latent variable; gender.

1. INTRODUCTION

1.1 Background of the Research

Cooperatives play a crucial role in fostering economic development, social cohesion, and individual empowerment. They offer members numerous benefits, including enhanced access to resources, financial support, and collective bargaining power (Birchall, 2004). Cooperative membership can be particularly significant in rural and developing areas, where access to conventional financial services and markets is limited (ICA, 2020). However, the factors influencing individuals' decisions to join cooperatives are multifaceted and can vary significantly between different demographic groups, such as couples and non-couples. This study aims to explore both the mediating and non-mediating factors that influence cooperative membership among couples and non-couples, thus providing a comprehensive understanding of the dynamics at play.

1.2 Problem Statement

Despite the recognized benefits of cooperative membership, there remains a gap in understanding the specific factors that influence individuals' decisions to join cooperatives, particularly when comparing couples and non-couples. Previous research has primarily focused on general factors affecting cooperative membership without delving into the unique motivations and barriers faced by these distinct demographic groups (Birchall and Simmons, 2009). Additionally, the role of mediating factors, such as demographic characteristics (e.g., age, income, education), in influencing cooperative membership decisions remains underexplored (Grootaert, 2001). This study seeks to address these gaps by identifying key factors, examining mediating influences, analyzing non-mediating factors, and comparing the motivations and barriers faced by couples and non-couples in joining cooperatives.

1.3 Justification of the Research

Understanding the factors influencing cooperative membership is essential for the design and implementation of effective policies and interventions aimed at promoting cooperative participation. By distinguishing between the motivations and barriers faced by couples and non-couples, this study provides targeted insights that help cooperatives tailor their outreach and support strategies to different demographic groups (Chaddad and Cook, 2004). Furthermore, by examining both mediating and non-mediating factors, this research offers a more nuanced understanding of the complexities involved in cooperative membership decisions. The findings of this study contribute to the development of more inclusive and effective cooperative models, ultimately enhancing their

impact on economic development and social well-being (ICA, 2020).

1.4 Research Objectives

i. To describe the socio-economic characteristics of the correspondents sampled for this study.
ii. To describe the key factors influencing cooperative membership and off-farm activities participation among couples and non-couples.
iii. To examine the mediating factors that affect the relationship between demographic characteristics (age, income, education) and cooperative membership.
iv. To determine the non-mediating factors that directly influence cooperative membership.
v. To compare the differences in cooperative membership motivations between couples and non-couples.
vi. To describe the common barriers to participation in cooperatives and off-farm activities by couples and non-couples.

1.5 Conceptual Review

The conceptual framework for this research incorporates both mediating and non-mediating factors, providing a comprehensive view of the dynamics involved in cooperative membership decisions.

Mediating Factors: These are variables that explain the relationship between demographic characteristics (such as age, income, education) and cooperative membership. Older individuals might have different risk tolerance and openness to cooperative membership compared to younger individuals. Age can influence how individuals perceive the stability and benefits of cooperatives. Higher income levels might make it easier for individuals to invest in cooperative membership, while lower-income individuals might see cooperatives as a means to improve their financial stability. More educated individuals may have a better understanding of the benefits and functioning of cooperatives, which can positively influence their decision to join. These demographic characteristics can mediate the relationship between individual backgrounds and their cooperative membership decisions by shaping their perceptions, motivations, and access to resources.

Non-Mediating Factors: These factors directly influence cooperative membership without the need for intermediary variables, that is, without being influenced by demographic characteristics. They include perceived benefits of cooperative membership, quality of cooperative management, transparency, and governance. Perceived benefits include access to financial services, market opportunities, social support, and enhanced bargaining power.

The framework distinguishes between the motivations and barriers faced by couples and non-couples in joining cooperatives. This distinction is crucial for developing tailored strategies to enhance cooperative membership across different demographic groups. For motivations, couples might join cooperatives to enhance household economic stability, access joint financial services, and benefit from cooperative support systems. Joint decision-making processes and shared economic goals can influence their membership decisions. While non-couples may prioritize individual economic empowerment, social networking opportunities, and personal development. In the aspect of barriers, challenges for couples might include joint decision-making, aligning individual interests, and balancing household priorities. While for non-couples social isolation, lack of peer support, and individual economic constraints can pose challenges.

Several studies have identified a range of factors that influence cooperative membership, including economic, social, and personal determinants. Economic factors such as income level, access to credit, and financial stability play a significant role in individuals' decisions to join cooperatives (Chibanda et al., 2019). Social factors, including trust in cooperative management, community support, and peer influence, also contribute to membership decisions (Bhuyan, 2017). Personal determinants such as education level, awareness of cooperative benefits, and individual attitudes towards collective action are equally important (Gasson, 1977).

Picture 1 shows how mediating factors influence cooperative membership through their mediating role, while non-mediating factors directly influence membership. And also the distinction between couples and non-couples in terms of motivations and barriers.

1.6 Theoretical Review

This research is developed on four theories namely: Theory of Reasoned Action, Social Capital Theory, Resource Dependence Theory

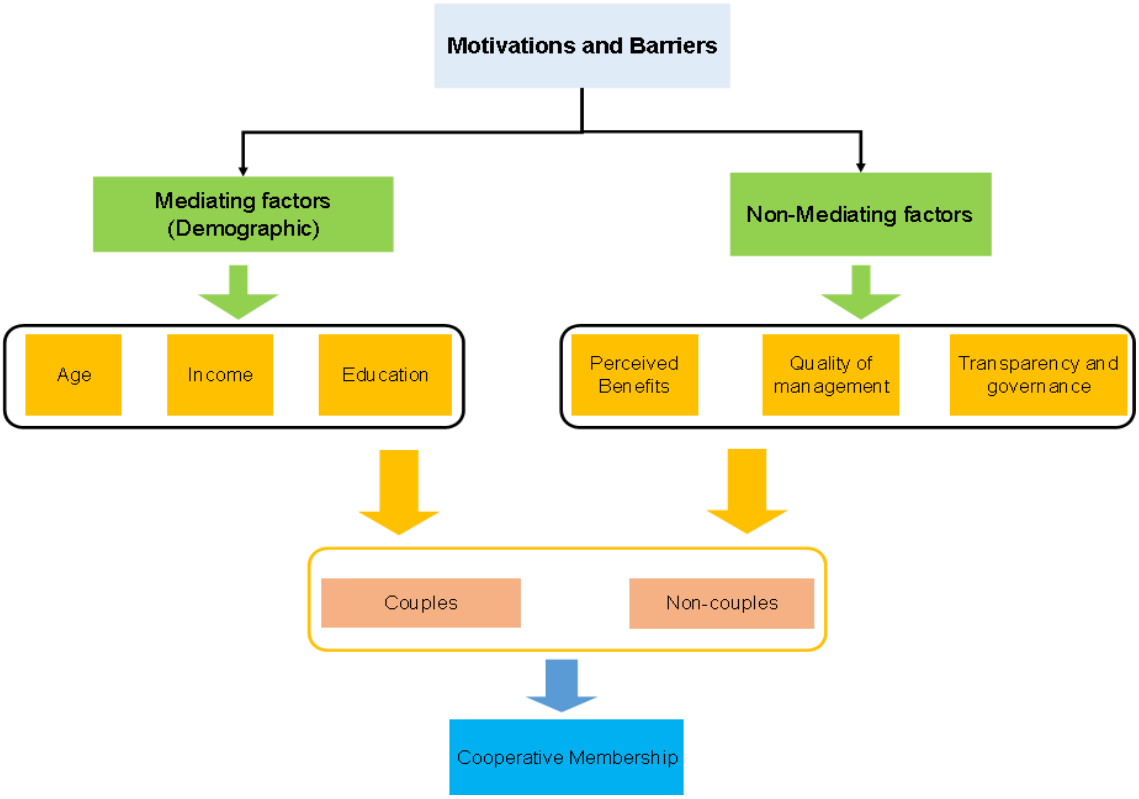
and Collective Action Theory. The Theory of Reasoned Action (TRA), developed by Fishbein and Ajzen (1975), which posits that individual behaviour is driven by behavioural intentions where these intentions are a function of an individual's attitude towards the behaviour and subjective norms. In the context of cooperative membership, TRA can help explain how individuals' attitudes towards cooperatives and the influence of social norms affect their decision to join a cooperative. Attitude towards the behaviour: This includes individuals' evaluations of cooperative membership, such as perceived benefits (economic stability, access to resources) and costs (membership fees, time commitment). Subjective Norms: These are the perceived social pressures to join or not join a cooperative. Family, friends, and community opinions can significantly impact this aspect.

Social Capital Theory, as discussed by Bourdieu (1986) and Coleman (1988), highlights the importance of social networks and relationships in facilitating collective action. In cooperatives, social capital can manifest through trust, norms of reciprocity, and networks that enable members to achieve mutual benefits.

Resource Dependence Theory developed by Pfeffer and Salancik (1978) suggests that organizations depend on external resources for survival, and they must manage their dependencies through various strategies. For individuals, joining a cooperative can be seen as a strategy to manage dependencies on resources like credit, market access, and technical support.

Collective Action Theory, rooted in the work of Olson (1965), explains how individuals work together to achieve common goals that they might not be able to achieve alone. Cooperatives are prime examples of collective action where members pool resources and efforts for mutual benefit.

Application of the Theories to Couples and Non-Couples: For couples, decision-making processes about joining cooperatives can be influenced by shared economic goals, household stability, and joint financial planning. Theories like TRA and Social Capital Theory can help explain how couples negotiate and agree on cooperative membership based on mutual benefits and social norms.



Picture 1. Conceptual framework on mediating and non-mediating factors influencing cooperative membership among couples and non-couples
Source: Authors' construct

For non-couples, individual motivations such as personal economic empowerment, social networking opportunities, and personal development are more pronounced. Resource Dependence Theory and Collective Action Theory can provide insights into how non-couples seek to manage dependencies and achieve individual goals through cooperative membership.

2. METHODOLOGY

This research was conducted in six selected states in Nigeria, namely, Federal Capital Territory, Kogi and Niger in central Nigeria, Anambra in the South-East, Kaduna in the North-West and Osun in the South-West. Apart from Niger State that shares international boundary with the Republic of Benin to the West, all the other states are internally bounded as shown in Table 1 and Fig. 1. Two local government areas were selected in each of the states in the study where a sampling frame of the membership of cooperative societies were established. A proportionate sample was drawn from the sampling frame given a total of 820 respondents in the study as shown in Table 2. The main data used for this study are from primary sources collected from respondents with the aid of structured questionnaire and interview schedules. A combination of analytical techniques was utilized. Various descriptive statistics were used, in addition, factor analysis and structural equation modelling (SEM) were employed to determine the nature of inter-relationships between the various barriers and the number of latent factors inherent in them (Tables 3 and 4). The latent factors (six from Table 3 and four from Table 4) were then retrieved and utilized.

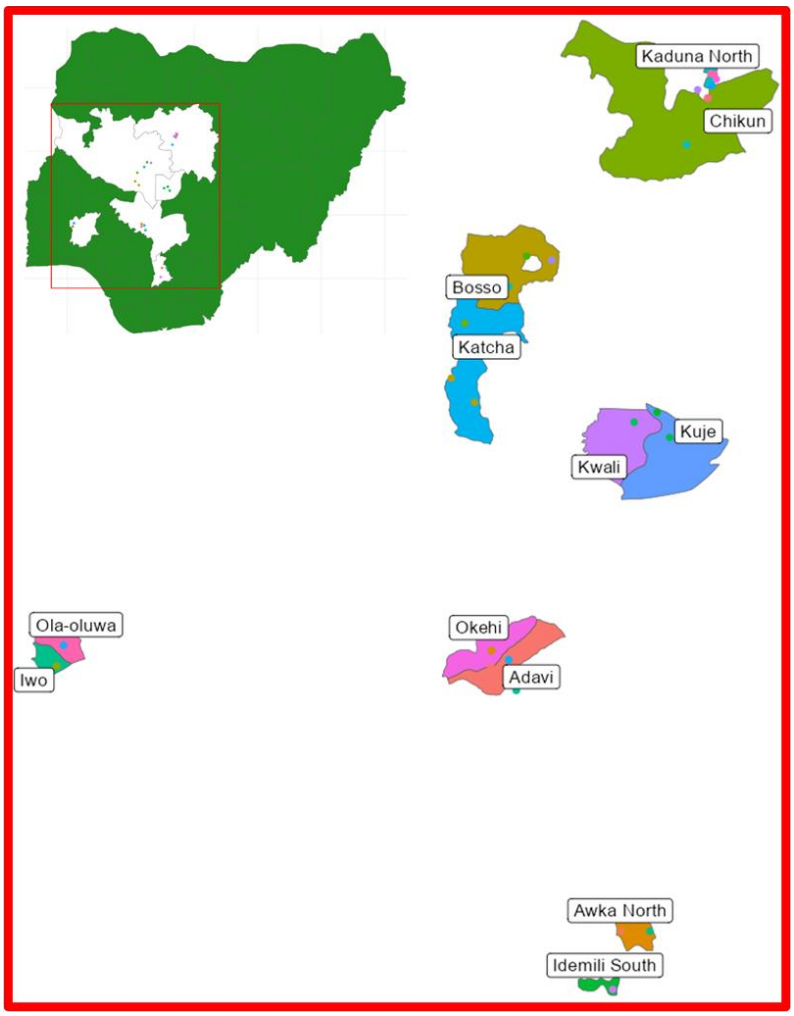


Fig. 1. Geographical location of the Nigerian states included in this study

Table 1. Location and description of the Nigerian states included in this study

State	Location	Number of LGAs	Major tribes	Major Economic activities	Population	LGAs in the study	Communities in the Study	Annual Rainfall	Annual temperature	Major crops produced
Osun	7°30′-8°00′N 4°00′-4°45′E	30	Yoruba	Farming	44,350,800	Iwo, Ola-oluwa	Agbelere, Binukonu, Ifalere, Kajola	1100-800 mm	21.10C-31.10C	Cocoa, kola, citrus, oil palm, maize, yam, rice, cassava, tomato, pepper
Kogi	7°20′-8°10′N 6°20′-7°10′E	21	Igala, Ebira, Okun	Farming, Mining	5,685,864	Adavi, Okehi	Eganyi, Kuroko, Ohuogogo, Okuha-ovo, Iruvu-papanchi, Eganyi, Iresuegeze, Abobo, Atami, Aku	1016-1524 mm	24-27°C	yam, cassava, maize, cowpea, melon, bambara nut, beniseed, oil palm, castor, cashew, citrus
Niger	9°00′-10°30′N 5°30′-7°10′E	25	Nupe, Gbagyi, Hausa	Farming, Fishing	6,783,300	Bosso, Katcha	Badeggi, Bakeko, Bisanti, Garatu, Maitumbi, Bosso	1219 mm	26.10-30.30°C	rice, guinea corn, maize, yam, beans, groundnut, sugarcane
FCT	8°30′-9°30′N 6°30′-7°30′E	6	Gbagyi, Koro	Administration, Tourism, Farming	3,278,779	Kwali, Kuje	Kilankwa, Dafa, Yangoji, Gwagwalada	1100-1600 mm	25-28°C	Maize, Rice, Cassava, Yam, Potatoes, Sweet potatoes, Tomatoes, Peppers, Cucumbers, Vegetables
Kaduna	9°30′-11°00′N 7°30′-8°30′E	23	Adara, Bajju, Atyap, Kamantan, Ham, Gbagyi, Gwong, Berom	Farming, Mining	9,032,200	Chikun, Kaduna North	Kabala Costain, Ungwan Rimi, Ungwan Shanu, Ungwan Sarki, Goin Gora, Ungwan Romi, Ungwan Yelwa, Nassarawa	1000-1300 mm	23-26°C	maize, rice, cowpea, groundnut
Anambra	5°30′-6°30′N 6°30′-7°30′E	21	Igbo	Farming, Trading	6,358,311	Awka North, Idemili South	Achalla, Ebenebe, Nnewi, Nnobi	212.36 mm	26.99°C	yams, taro, oil palm products, rice, corn, cassava, citrus fruits

Table 2. Sampling frame and samples drawn from the states included in the study

State	LGA	Sample frame	Member	Non-member	Total	%
Anambra	Awka North	50	30	11	41	5.00
	Idemili South	70	47	22	69	8.41
State total		120	77	33	110	13.41
FCT	Kuje	2525	80	20	100	12.20
	Kwali	778	37	13	50	6.10
State total		3303	117	33	150	18.29
Kaduna	Kaduna North	153	56	25	81	9.88
	Chikun	151	55	14	69	8.41
State total		304	111	39	150	18.29
Kogi	Adavi	90	59	18	77	9.39
	Okehi	80	38	5	43	5.24
State total		170	97	23	120	14.63
Niger	Katcha	415	38	20	58	7.07
	Bosso	635	50	28	78	9.51
State total		1050	88	48	136	16.59
Osun	Iwo	150	33	33	66	8.05
	Ola-Oluwa	200	44	44	88	10.73
State total		350	77	77	154	18.78
Grand total		5297	567	253	820	100

Table 3. Constraints to participation in off-farm activities

Constraint	Description
x01	State
x02	Poor transportation system
x03	Poor communication services
x04	Inadequate access to capital
x05	Lack of skill training and ability
x06	Rainfall variability
x07	Declining farm size
x08	Inadequate credit facilities
x09	Inadequate input delivery system
x10	No urban centre in proximity
x11	Lack of access to market
x12	Restriction on trade and movement
x13	Government policy
x14	Inadequate infrastructure
x15	Inadequate labour
x16	Terms of trade
x17	Limited availability of education
x18	Shortage of time
x19	Norms and religion
x20	Poor asset base
x21	Lack of awareness and training facilities
x22	Shortage of animal feed
x23	Unstable price of transportation cost

Table 4. Constraints to membership of cooperatives

Constraints	Description
x01	state
x02	Poor leadership
x03	Lack of commitment among members
x04	Lack of government support
x05	Corruption among members
x06	Lack of equal opportunities of members in taking decisions
x07	Inefficient cooperative employee
x08	Unqualified Management Committee Member
x09	Poor cooperative financial management and governance

Constraints	Description
x10	Lack of transparency and accountability of the Management Committee
x11	Weak economic status
x12	Difficult channel services
x13	Lack of cooperation among members

2.1 Recursive Bivariate Regression Model

To determine and examine the mediating and non-mediating factors affecting cooperative membership and off-farm participation of couples and non-couples, dynamic bivariate recursive modelling techniques were employed using household survey data which precludes randomly selecting households to join and not join cooperatives but self-selection of farm households into agricultural cooperative membership. This involves estimating two models. One for the mediator and another one for the outcome. Mediation analysis will involve examining the indirect effects of age and education on membership. Factors of motivation (economic stability, social networking, etc.) and their interaction term assesses how motivations differ between couples and non-couples.

Although the estimates of the influence of cooperative membership may suffer from self-selection bias related to both observable and unobservable factors, this has been mitigated by previous studies like Gopalan et al. (2022); Li et al. (2023); Zheng et al. (2023) by using recursive bivariate probit (RBP) model. RBP model addresses selection bias from observable and unobservable factors and estimates the direct marginal effects of cooperative membership, a binary explanatory variable on off-farm participation of farm couples and non-couples, also a binary dependent variable.

Zheng et al. (2023) used RBP model to jointly estimate farm households' decisions regarding cooperative membership and the impact of becoming members on farm couples' and non-couples off-farm participation, while at the same time accounting for endogeneity and selection bias. The decision to join cooperatives was modeled within an optimization framework, assuming that farm households are risk-neutral and maximize the net benefits from cooperative membership. Let C_i^* denote the differences in the net benefits derived by farm households with cooperative membership and those without. Households would prefer to join cooperatives should C_i^* exceed zero. Although C_i^* is subjective and unobservable, it can be expressed using a latent variable function as in equation 1.

$$C_i^* = \alpha X_i + \varepsilon_i, \text{ Where } C_i = \begin{cases} 1 \; if \; C_i^* > 0 \\ 0 \; otherwise \end{cases} \quad \text{(eq. 1)}$$

Where C_i^* represents a latent variable of cooperative membership, which is determined by the observed membership status variable C_i. The binary variable C_i takes the value of one if farm households are cooperative members and zero otherwise; α is the parameter to be estimated; X_i refers to a vector of explanatory variables that are expected to affect the likelihood of cooperative membership, ε_i represents the error term. Assuming that the decisions of farm couples and non-couples *apropos* off-farm participation are binary, the influence of cooperative membership and other variables on farm couples' and non-couples off-farm participation decisions can be modeled in equation 2.

$$O_i^* = \beta C_i + yZ_i + \mu_i, \text{ Where } O_i = \begin{cases} 1 \; if \; O_i^* > 0 \\ 0 \; otherwise \end{cases} \quad \text{(eq. 2)}$$

Where O_i^* is a latent variable denoting farm couples' and non-couples off-farm participation status; O_i is a dichotomous variable equal to one for off-farm workers and zero for non-farm workers; Z_i is a vector of variables affecting off-farm work decisions; β and y are vectors of parameters to be estimated; μ_i is the error term.

The RBP model jointly estimates equation 1, the treatment equation, and equation 2, the outcome equation, using the full information maximum likelihood (FIML) estimator. The error terms of the two equations are assumed to follow a bivariate distribution, which can be expressed in equation 3.

$$\begin{pmatrix} \varepsilon_i \\ \mu_i \end{pmatrix} \sim N\left(\begin{bmatrix} 0 \\ 0 \end{bmatrix}, \begin{bmatrix} 1 & \rho_{\varepsilon\mu} \\ \rho_{\varepsilon\mu} & 1 \end{bmatrix} \right) \quad \text{(eq. 3)}$$

Where $\rho_{\varepsilon\mu}$ is the correlation coefficient between the error terms of equations 1 & 2. A significant $\rho_{\varepsilon\mu}$ suggests that the error terms between the two equations are correlated, indicating that cooperative membership is endogenous. After estimating the coefficients using the RBP model, the corresponding marginal effects can be estimated to facilitate the interpretation of the

results. Moreover, the marginal effects can also be estimated at specific values of the covariates.

A crucial prerequisite for estimating the RBP model is the exclusion restriction on the explanatory variables; that is, at least one instrumental variable is included in Xi but not in Zi following Li et al. (2021); Owusu et al. (2021); Gopalan et al. (2022) and Zheng et al. (2023). A variable representing the distance from the respondent's residence to the nearest cooperative meeting point is used as the instrumental variable. It is thought that the likelihood of joining the cooperative is motivated significantly by how close the individual is to the meeting point, particularly, where the point is fixed. However, the proximity of a farm household to cooperatives is not directly associated with its members' participation in off-farm work. The explicit form of the bivariate recursive model is specified in equation 4.

$$y_1 = \beta_0 + x_6 + \text{Gender} + \text{Sex} + x_3 + x_4 + x_5 + x_7 + x_8 + x_{14} + x_{15} + x_{16} + x_{17} + x_{18} + x_{19} + x_{20} + x_{21} + x_{22} + x_{23} + e \quad (4)$$

$$y_i = y_1 + \text{Gender} + \text{Sex} + x_3 + x_4 + x_5 + x_7 + x_8 \quad (4a)$$

$$y_j \sim y_1 + x_6 + x_8 + x_9 + x_{10} + x_{11} + x_{12} + x_{13} \quad (4b)$$

Where y_1 = Agricultural cooperative membership; cooperative member = 1, non-member = 0; y_i = outcome recursive model for cooperative membership, y_j = outcome recursive model for off-farm participation (y_2 = Off-farm participation by couples; couples participated in off-farm work = 1, otherwise = 0; y_3 = Off-farm participation by non-couples; non-couples participated in off-farm work = 1, Otherwise = 0). The definition of the explanatory variable is in Table 5.

The technique involves joint estimation (eq. 4 & eq. 4a or eq. 4 & eq. 4b) of the unbiased coefficients of the effects of cooperative membership on the off-farm participation of farm couples and non-couples. The lead model (eq. 4) estimates the coefficients affecting membership while the recursive model (eq. 4a & eq. 4b) estimates the coefficients of the factors affecting off-farm participation of couples and non-couples. This modelling technique was chosen because it enables joint estimation of variances and other modelling metrics. But, in this research, the estimation was a search for the best combination of models for analyzing the

Table 5. Variables included in the various bivariate models

y1	Cooperative membership
y2	Off-farm participation by couples
y3	Off-farm participation by non-couples
x01	Gender###
x02	Sex
x03	Household size
x04	Education
x05	Social amenities
x06	Distance to cooperative meeting point
x07	Farming experience
x08	Extension visits
x10	Farm size
x11	credit accessed
x12	Health status
x13	State
x14	par-MR1 (Norms and religion)#
x15	par-MR2 (Poor communication services)
x16	par-MR3 (Inadequate infrastructure)
x17	par-MR4 (Terms of trade)
x18	par-MR5 (Inadequate labour)
x19	par-MR6 (Limited availability of education)
x20	Co-MR1 (Lack of commitment among members)##
x21	Co-MR2 (Lack of transparency and accountability of the Management Committee)
x22	Co-MR3 (Weak economic status)
x23	Co-MR4 (Inefficient cooperative employee)

 # latent variables retrieved from constraints to off-farm participation
latent variables retrieved from constraints to membership of cooperatives
60 years and above = elderly, 25-59 years = Adult, less than 25 years = youth (see Table 6)

Table 6. Age Distribution of the respondents

State	Sex	Min	Max	Range	Mean	Variance
Anambra	Female	20	67	47	42	28.73
	Male	21	58	37	31	48.62
Sub-Total		20	67	47	36	38.68
FCT	Female	20	59	39	36	58.77
	Male	20	75	55	43	32.56
Sub-Total		20	75	55	39	45.67
Kaduna	Female	18	60	42	42	27.62
	Male	18	70	52	41	27.38
Sub-Total		18	70	52	41	27.50
Kogi	Female	35	45	10	39	4.35
	Male	22	62	40	37	25.27
Sub-Total		22	62	40	38	14.81
Niger	Female	33	72	39	56	25.38
	Male	31	77	46	55	38.47
Sub-Total		31	77	46	56	31.93
Osun	Female	30	55	25	46	65.17
	Male	25	64	39	44	42.62
Sub-Total		25	64	39	45	53.89
Total All States		18	77	59	43	35.41
Female		18	72	54	43	35.00
Male		18	77	59	42	35.82
Total		18	77	59	43	35.41

factors affecting the dependents variables. The main advantage of this technique is that a variable, including the dependents variables themselves, can be modelled as a factor in both the lead and recursive models. Four combinations, i.e., probit-probit, logit-logit, probit-logit and logit-probit were tried successfully.

The analysis of the data and estimation of the various RBP models were in the R programming language (version 4.4.0, R Core Team, 2024) using various functions developed for the various tasks (Rosseel, 2012; Wickham, 2016; Epskamp, 2022; Pebesma & Bivand, 2023; Marra & Radice, 2023; Nmadu, 2024; Revelle, 2024).

3. RESULTS AND DISCUSSION

The distribution of the respondents is presented on Fig. 2 & Fig. 3 while Fig. 4 & Fig. 5 are the path diagram of the various constraints inter-connected with their respective latent variables.

The estimated coefficients of the various bivariate models for couples and non-couples are presented on Table 6. Fig. 6 – Fig. 9 show the simulated average effects from the various bivariate main and recursive models highlighting the distributions of the respondents based on membership of cooperative societies and whether they are couples or non-couples. In the same vein, the treatments effects and various ratios from the various bivariate models are presented on Fig. 10; and Fig. 11 are the various prediction about membership status and off-farm activities participation from the various bivariate models.

The results (Fig. 2 & Fig. 3) shows that those who are members and non-members of cooperatives are significantly different, but those who are members of cooperative are generally higher across all categories and states. Furthermore, adult males have the highest number among both members and non-members. Youth and elderly males are generally less represented compared to adult males and females. Kogi has the highest number of adult male members, followed by Osun and Kaduna. FCT and Niger also show significant numbers for adult males. Youth and elderly are lower across all states. Similar trends are observed with adult males being the highest in most states. Osun has a notably high adult males among non-members, followed by Niger and Kogi.

The factor analysis of the constraints to membership of cooperatives determined four latent variables as follows:

MR1 (**Lack of commitment among members**): When members are not committed, cooperative activities can suffer from poor participation, reduced trust, and inefficiency.

MR2 (**Lack of transparency and accountability of the Management Committee**): Transparency and accountability are essential for trust and effective governance. Their absence can lead to mismanagement and corruption.

MR3 (**Weak economic status**): The overall economic weakness of the cooperative or its members can limit the cooperative's ability to invest, expand, or sustain operations.

MR4 (**Inefficient cooperative employee**): The efficiency of cooperative employees affects daily operations, member satisfaction, and overall productivity.

In the same vein, the constraints to off-farm participation contains six latent variables as follows:

MR1 **(Norms and religion**): Cultural and religious practices that may affect development activities, possibly influencing labor availability, market participation, or adoption of new technologies.

MR2 (**Poor communication services**): Limited access to reliable communication can hinder information flow, affecting market access, coordination, and education.

MR3 (**Inadequate infrastructure**): Poor infrastructure limits access to markets, healthcare, and education, and can reduce overall productivity.

MR4 (**Terms of trade**): Adverse terms of trade can affect the profitability and sustainability of agricultural activities.

MR5 (**Inadequate la**bour): Shortages in skilled and unskilled labor can slow down development projects and reduce productivity.

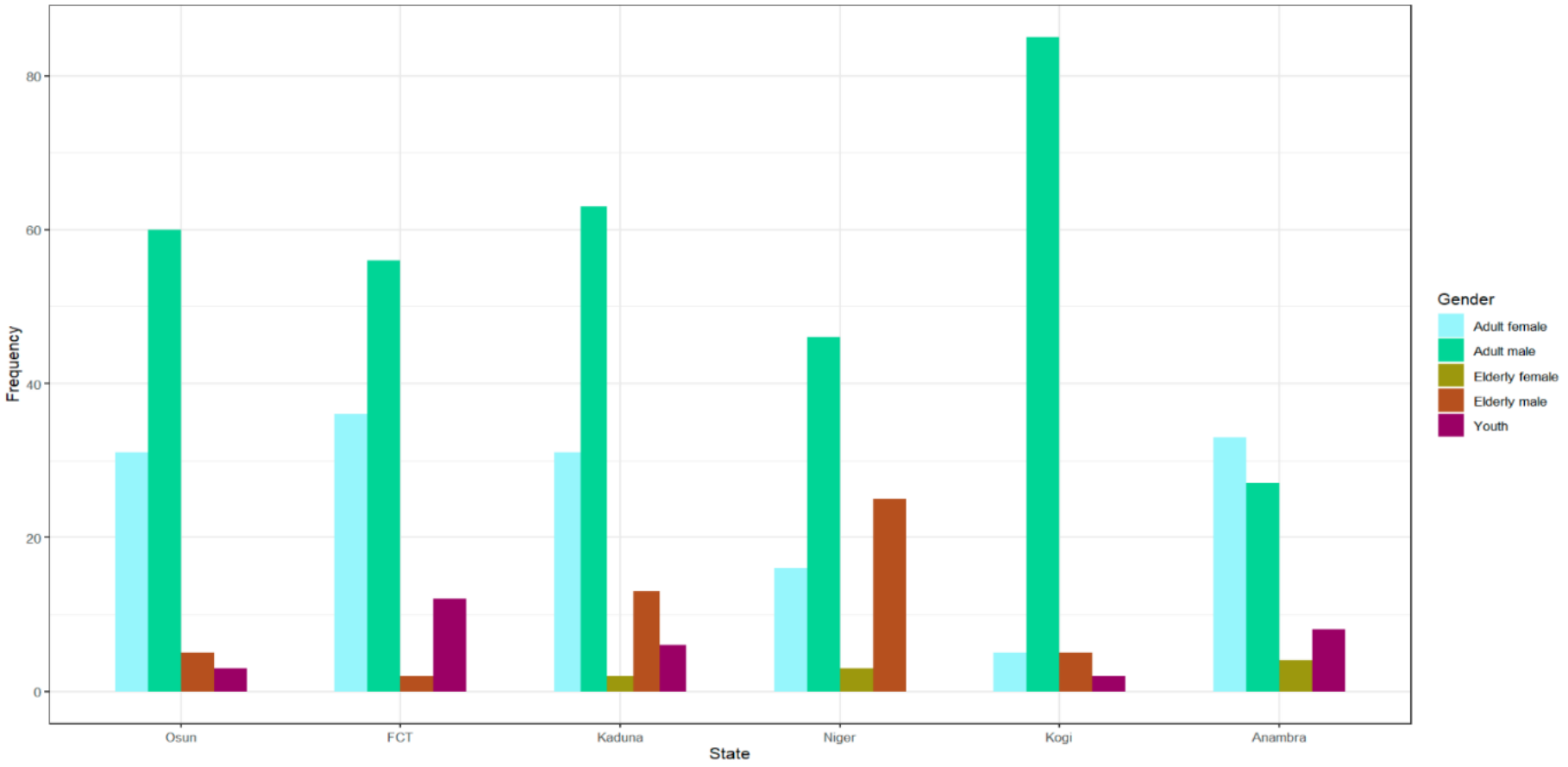
MR6 (**Limited availability of education**): Lack of educational opportunities can stymie human capital development and innovation.

The inter-connectivity between the observed constraints and their inherent latent variables are further demonstrated in Fig. 5.

The results on Table 7 have the following highlights:

- Significant and positive Intercept across most models, indicating a baseline probability for the outcome in question
- The coefficient for distance to cooperative meeting point is highly significant but negative across all models, indicating a strong negative relationship membership status suggesting that increasing changes in distance will produce lower likelihood of raising membership of cooperatives but off-farm participation was not impacted by distance.
- Varying significance and effects. For instance, Elderly males and Elderly females tend to show positive coefficients, while Youth often show negative coefficients indicating age-related differences in the outcome likelihood.
- Sex is generally negative but not significant, suggesting little influence and that sex (male) does not significantly influence the outcome in these models.
- Household size shows mixed significance but often negative, indicating a potential negative impact.
- Years of farming experience are highly significant but negative across all models, suggesting a strong negative impact.
- The number of extension visits is significant and positive, indicating a positive relationship.
- The various latent variables (x14-x23) show mixed positive and negative coefficients across models, indicating mixed relationships and highlighting the complexity of the relationships being modeled
- In terms of the models, coefficients are consistent in direction across different models for most variables

From Fig. 6 -Fig. 11, the logit and probit models show similar trends in their predictions for all statuses. The magnitude of predictions varies slightly, with logit models showing more pronounced effects (both positive and negative) compared to probit models. Also, recursive models consistently show negative predictions for both couples and non-couples. This suggests that when feedback loops or dependencies are considered, the outcomes are predicted to be negative for both groups, indicating the potential long-term negative impact of certain interventions. In addition, positive predictions for both couples and non-couples suggest that cooperative membership has beneficial effects. Non-couples benefit more from cooperative membership than couples, as indicated by the higher positive predictions. Lastly, negative predictions for both couples and non-couples


Frequency
80
60
40
20
0
Osun
FCT
Kaduna
Niger
Kogi
Anambra
State
Gender
Adult female
Adult male
Elderly female
Elderly male
Youth

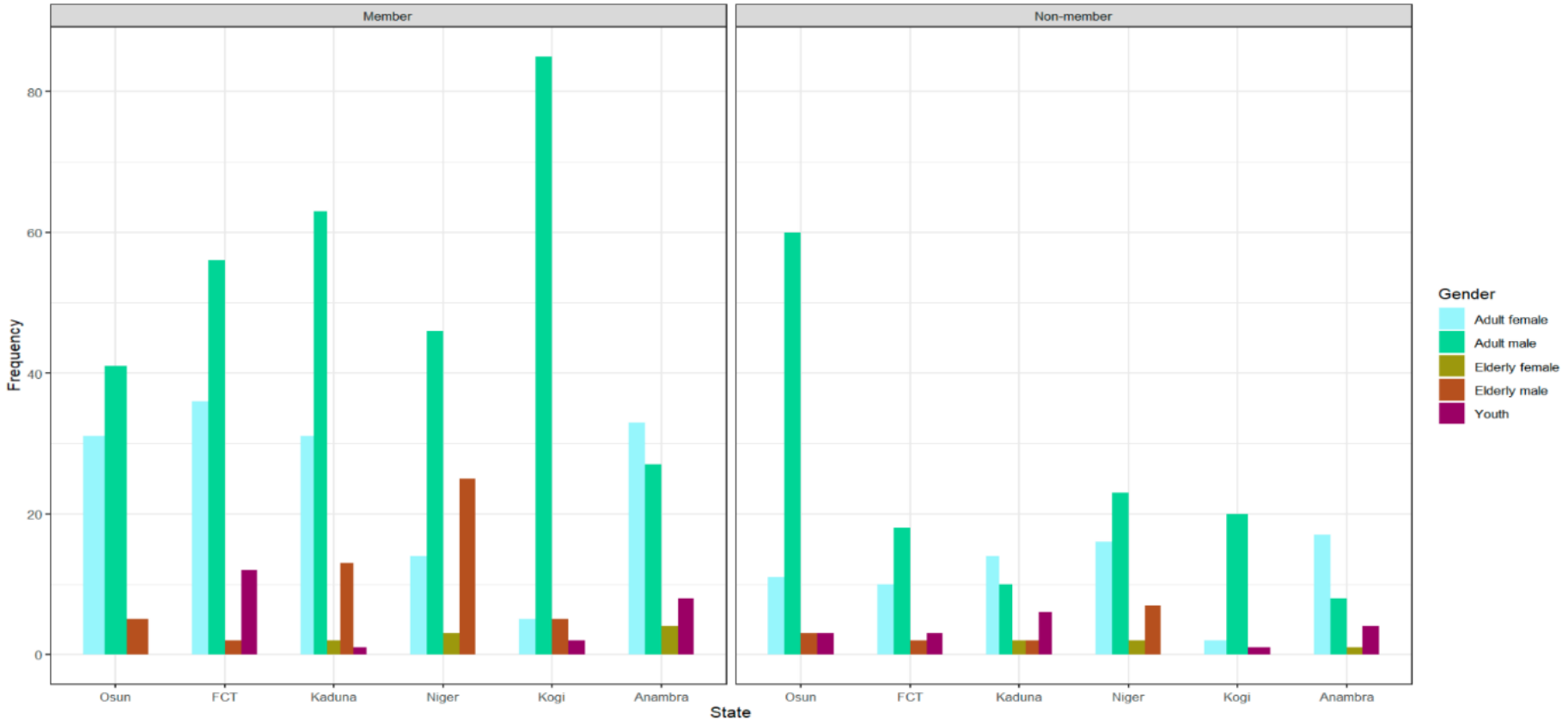


Fig. 2. Distribution of the respondents based on gender disaggregated by states and membership of cooperatives

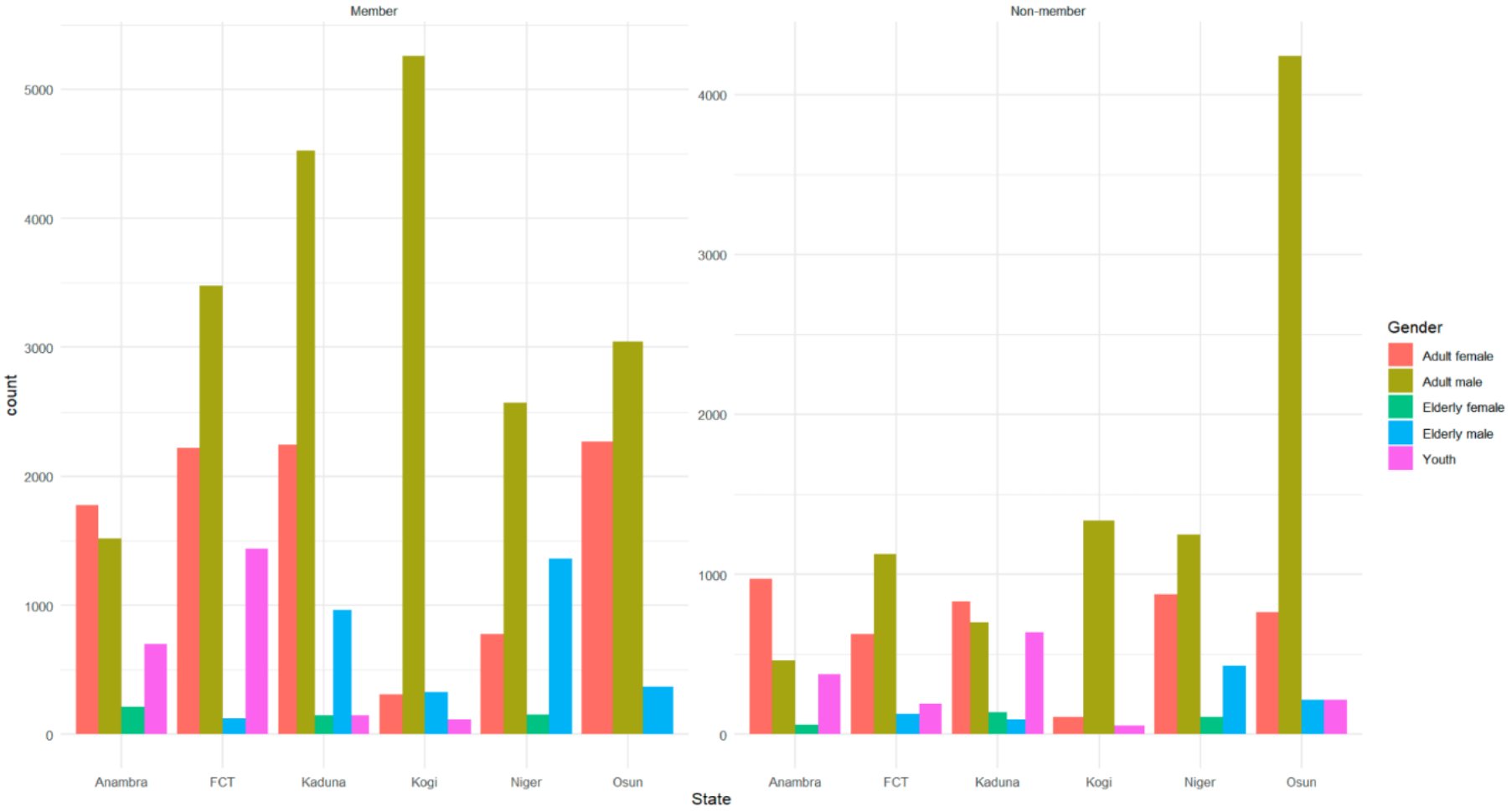

Member
Non-member
count
State
Anambra
FCT
Kaduna
Kogi
Niger
Osun
0
1000
2000
3000
4000
5000
Gender
Adult female
Adult male
Elderly female
Elderly male
Youth

Fig. 3. Distribution of latent variables disaggregated by states, membership of cooperatives and gender

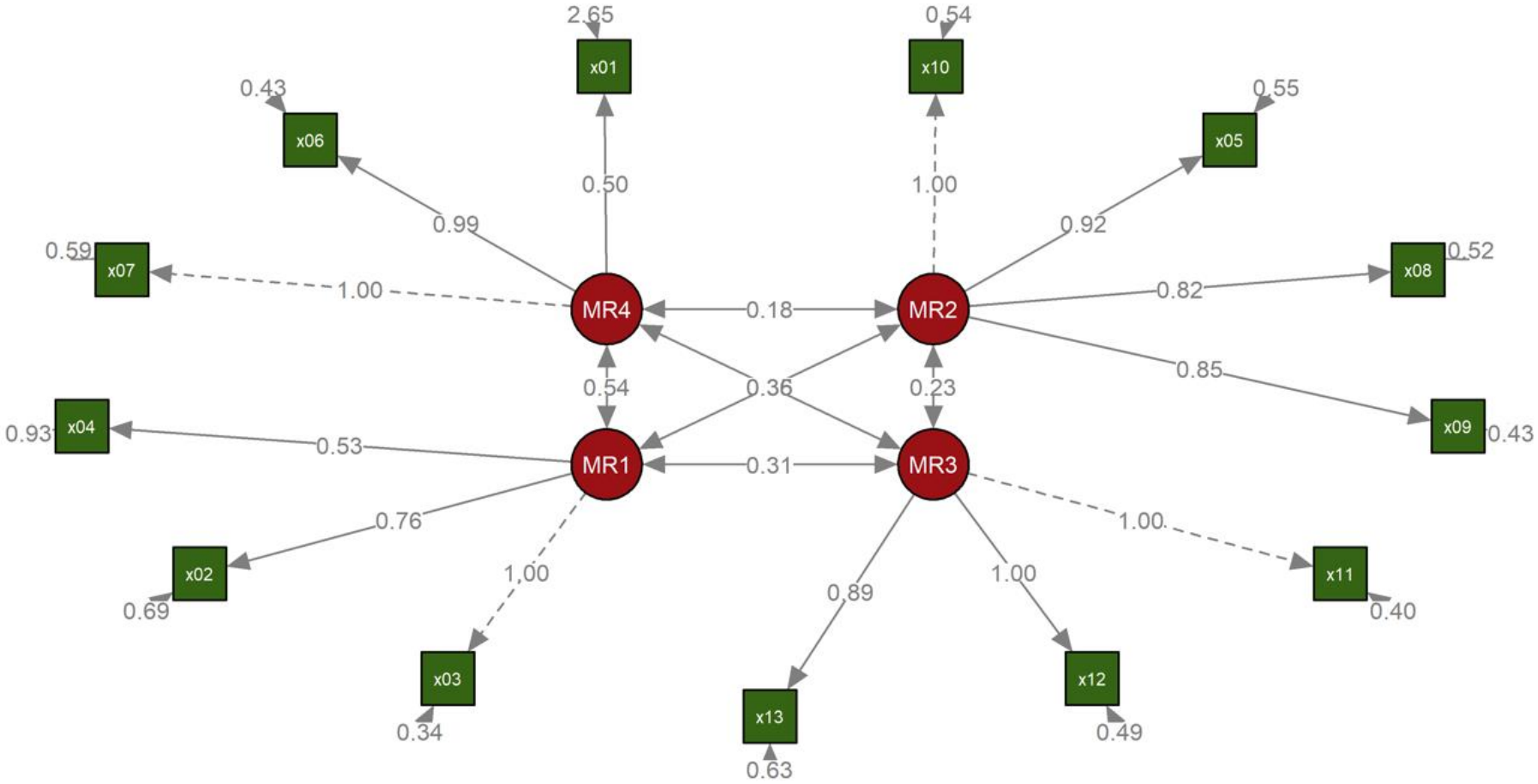


Fig. 4. Path diagram of the constraints to membership by the respondents in the study area

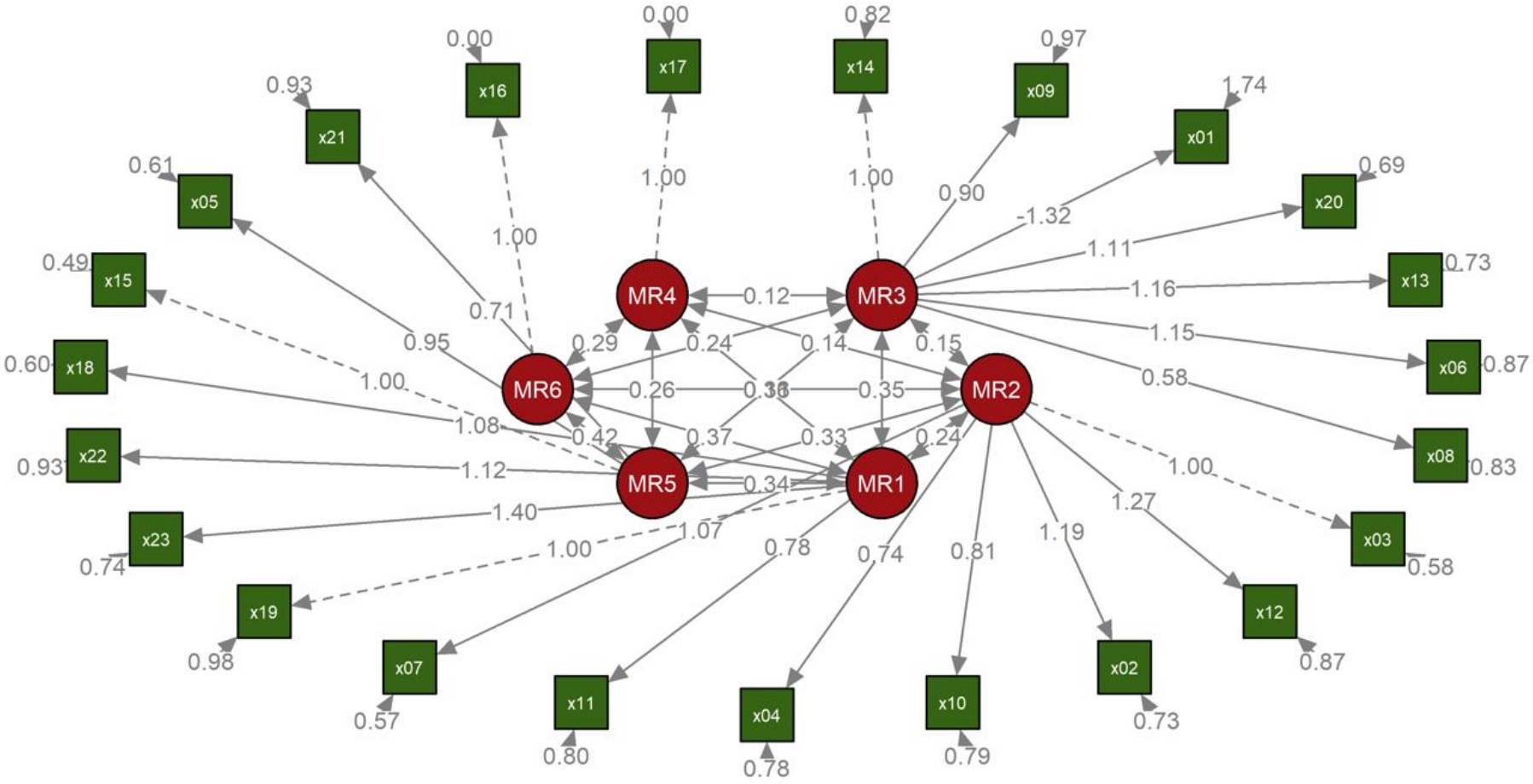


Fig. 5. Path diagram of the constraints to off-farm participation by the respondents in the study area

Table 7. Estimated coefficients of the various bivariate models for couples and non-couples in Nigeria

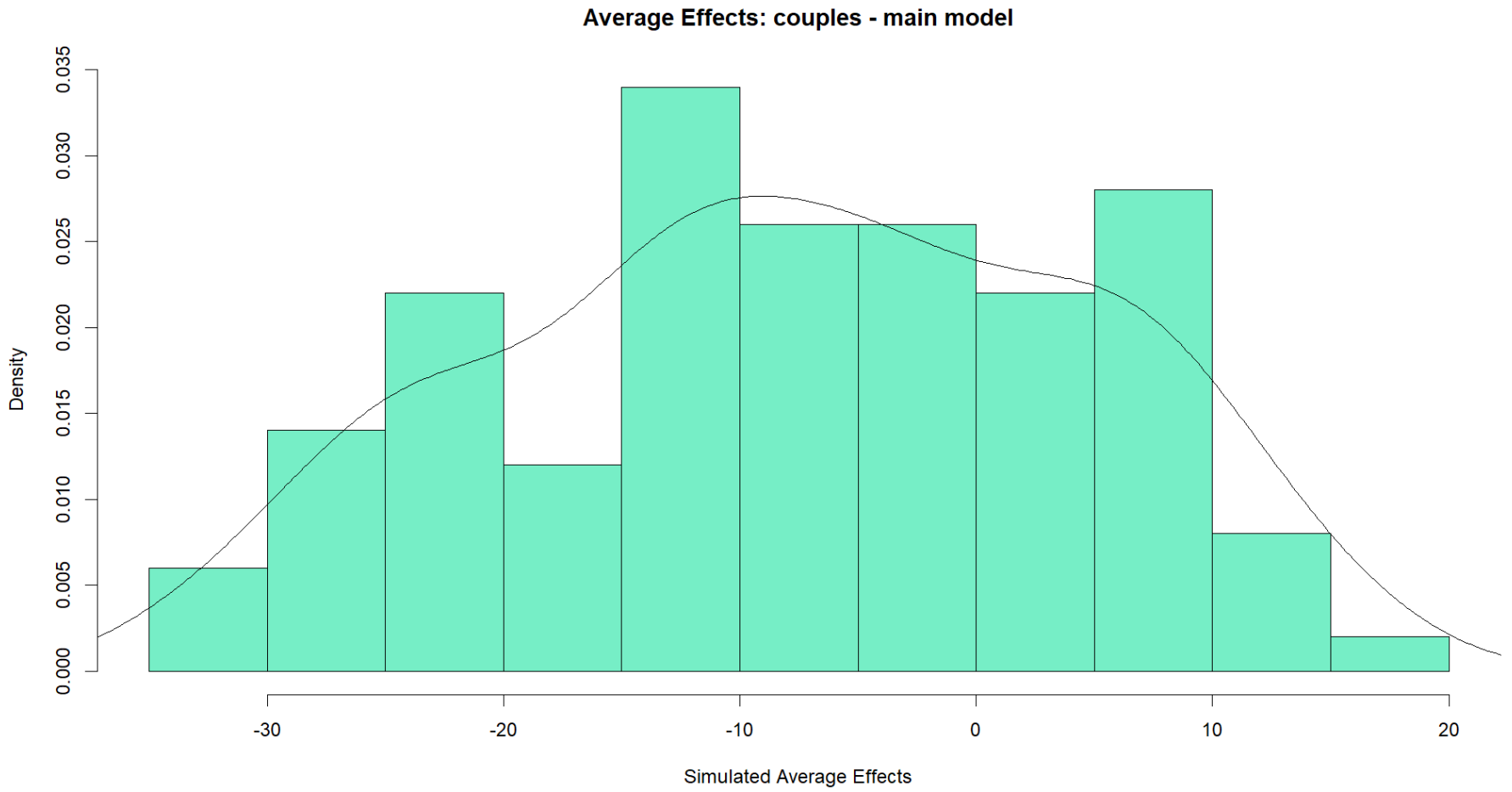
	Probit-Probit				Probit-Logit				Logit-Probit				Logit-Logit			
	A	**B**	**C**	**D**	**A**	**B**	**C**	**D**	**A**	**B**	**C**	**D**	**A**	**B**	**C**	**D**
Variable																
Intercept	0.98*	0.97.	1.2**	0.98*	0.99*	1.03*	1.19**	0.97*	1.66*	1.27	2**	1.62*	1.67*	1.34	1.99*	1.62*
	(0.42)	(0.51)	(0.44)	(0.43)	(0.42)	(0.51)	(0.44)	(0.43)	(0.73)	(0.92)	(0.77)	(0.75)	(0.74)	(0.95)	(0.78)	(0.75)
x06	-0.04***	-0.05***	-0.05***	-0.05***	-0.04***	-0.05***	-0.05***	-0.05***	-0.08***	-0.09***	-0.08***	-0.09***	-0.08***	-0.09***	-0.08***	-0.09***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Gender Adult male	0.24	0.22	0.2	0.15	0.23	0.22	0.2	0.15	0.35	0.28	0.31	0.19	0.35	0.3	0.31	0.18
	(0.36)	(0.36)	(0.36)	(0.36)	(0.36)	(0.36)	(0.36)	(0.36)	(0.61)	(0.62)	(0.62)	(0.61)	(0.61)	(0.62)	(0.62)	(0.61)
Gender Elderly female	0.44	0.31	0.31	0.39	0.42	0.29	0.31	0.4	0.66	0.56	0.44	0.62	0.63	0.53	0.45	0.63
	(0.4)	(0.41)	(0.41)	(0.41)	(0.4)	(0.41)	(0.4)	(0.41)	(0.65)	(0.68)	(0.66)	(0.66)	(0.65)	(0.68)	(0.66)	(0.66)
Gender Elderly male	0.86*	0.75.	0.71.	0.73.	0.85*	0.75.	0.72.	0.72.	1.4.	1.19.	1.17.	1.17.	1.37.	1.2.	1.18.	1.16.
	(0.42)	(0.41)	(0.41)	(0.41)	(0.42)	(0.41)	(0.41)	(0.41)	(0.71)	(0.71)	(0.71)	(0.7)	(0.71)	(0.71)	(0.71)	(0.7)
Gender Youth	-0.51.	-0.49	-0.5.	-0.58.	-0.51.	-0.48	-0.51.	-0.58.	-0.94.	-0.93.	-0.91.	-1.07*	-0.93.	-0.93.	-0.91.	-1.08*
	(0.3)	(0.3)	(0.29)	(0.3)	(0.3)	(0.3)	(0.29)	(0.3)	(0.5)	(0.5)	(0.5)	(0.5)	(0.5)	(0.51)	(0.51)	(0.5)
Sex Male	-0.19	-0.17	-0.14	-0.09	-0.19	-0.17	-0.14	-0.09	-0.28	-0.23	-0.22	-0.1	-0.27	-0.24	-0.22	-0.09
	(0.34)	(0.34)	(0.34)	(0.34)	(0.34)	(0.34)	(0.34)	(0.34)	(0.58)	(0.58)	(0.58)	(0.58)	(0.58)	(0.58)	(0.58)	(0.58)
x03	-0.03.	-0.03	-0.04.	-0.02	-0.03.	-0.04	-0.04*	-0.02	-0.05	-0.03	-0.06	-0.02	-0.05	-0.03	-0.06.	-0.02
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.04)	(0.03)	(0.04)	(0.03)	(0.05)	(0.03)	(0.04)
x04	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
x05	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.05	0.06	0.06	0.07	0.05	0.06	0.06	0.07
	(0.02)	(0.03)	(0.03)	(0.03)	(0.02)	(0.03)	(0.03)	(0.03)	(0.04)	(0.04)	(0.05)	(0.04)	(0.04)	(0.04)	(0.05)	(0.04)
x07	-0.03***	-0.03***	-0.03***	-0.03***	-0.03***	-0.03***	-0.03***	-0.03***	-0.05***	-0.04***	-0.05***	-0.05***	-0.05***	-0.04***	-0.05***	-0.05***
	(0.01)	(0.01)	(0)	(0)	(0.01)	(0.01)	(0)	(0)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
x08	0.06**	0.08***	0.08***	0.07**	0.06**	0.08***	0.08***	0.07**	0.11**	0.15***	0.14***	0.13**	0.12**	0.15***	0.14***	0.13**
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
x14	-0.1**	-0.11***	-0.12***	-0.11***	-0.1**	-0.11***	-0.12***	-0.11***	-0.17**	-0.19***	-0.21***	-0.19***	-0.17**	-0.19***	-0.21***	-0.19***
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.05)	(0.05)	(0.05)	(0.05)	(0.06)	(0.05)	(0.05)	(0.05)
x15	-0.05.	-0.07*	-0.08**	-0.08**	-0.05.	-0.07*	-0.08**	-0.08**	-0.09.	-0.11*	-0.14**	-0.14**	-0.1.	-0.11*	-0.14**	-0.14**
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)
x16	-0.07**	-0.06**	-0.06**	-0.06**	-0.07**	-0.06**	-0.06**	-0.06**	-0.12**	-0.11**	-0.11**	-0.1**	-0.12**	-0.11**	-0.11**	-0.1**
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)

	Probit-Probit				Probit-Logit				Logit-Probit				Logit-Logit			
	A	**B**	**C**	**D**	**A**	**B**	**C**	**D**	**A**	**B**	**C**	**D**	**A**	**B**	**C**	**D**
x17	0.17*	0.17*	0.17*	0.17*	0.17*	0.18*	0.17*	0.16*	0.29*	0.26*	0.28*	0.27*	0.29*	0.27*	0.28*	0.27*
	(0.07)	(0.08)	(0.07)	(0.07)	(0.07)	(0.08)	(0.07)	(0.07)	(0.12)	(0.13)	(0.12)	(0.12)	(0.12)	(0.13)	(0.12)	(0.12)
x18	0.08	0.05	0.05	0.05	0.08	0.05	0.05	0.05	0.12	0.07	0.07	0.08	0.12	0.07	0.07	0.08
	(0.06)	(0.07)	(0.06)	(0.06)	(0.06)	(0.07)	(0.06)	(0.06)	(0.11)	(0.11)	(0.11)	(0.11)	(0.11)	(0.11)	(0.11)	(0.11)
x19	0.13	0.14	0.16.	0.15.	0.13	0.14	0.16.	0.15.	0.22	0.22	0.27.	0.26.	0.23	0.23	0.27.	0.27.
	(0.08)	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)	(0.14)	(0.15)	(0.15)	(0.14)	(0.15)	(0.15)	(0.15)	(0.14)
x20	-0.16	-0.09	-0.06	-0.06	-0.15	-0.1	-0.07	-0.05	-0.26	-0.1	-0.09	-0.07	-0.25	-0.11	-0.1	-0.07
	(0.1)	(0.11)	(0.1)	(0.1)	(0.1)	(0.11)	(0.1)	(0.1)	(0.17)	(0.18)	(0.17)	(0.17)	(0.18)	(0.19)	(0.17)	(0.17)
x21	0.05	0.08**	0.08*	0.08*	0.05	0.08**	0.08*	0.08*	0.09	0.16**	0.14**	0.13*	0.1	0.16**	0.14**	0.13*
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.06)	(0.05)	(0.05)	(0.05)	(0.06)	(0.05)	(0.05)	(0.05)
x22	0.06	0.08.	0.08.	0.08*	0.06	0.07	0.08.	0.08*	0.11	0.16*	0.13*	0.14*	0.11	0.16*	0.13*	0.14*
	(0.04)	(0.05)	(0.04)	(0.04)	(0.04)	(0.05)	(0.04)	(0.04)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.08)	(0.07)	(0.07)
x23	0.11	0.04	0.03	0.04	0.1	0.05	0.03	0.04	0.18	0.03	0.06	0.07	0.17	0.04	0.06	0.06
	(0.07)	(0.08)	(0.07)	(0.07)	(0.07)	(0.08)	(0.07)	(0.07)	(0.12)	(0.14)	(0.12)	(0.12)	(0.12)	(0.14)	(0.12)	(0.12)
Intercept	-0.28	-4.16***	0.35	-2.95***	-0.51	-6.81***	0.66	-5.19***	-0.34	-4.28***	0.33	-2.87***	-0.63	-7.09***	0.63	-5.07***
	(0.35)	(0.87)	(0.31)	(0.88)	(0.61)	(1.49)	(0.54)	(1.52)	(0.36)	(0.83)	(0.31)	(0.87)	(0.64)	(1.45)	(0.53)	(1.49)
y1	-0.17	0.47	-0.78*	-0.52	-0.19	0.61	-1.27*	-0.94	-0.1	0.79	-0.77*	-0.62.	-0.04	1.23	-1.23*	-1.09.
	(0.35)	(0.5)	(0.31)	(0.4)	(0.64)	(0.88)	(0.55)	(0.68)	(0.37)	(0.48)	(0.3)	(0.36)	(0.7)	(0.91)	(0.53)	(0.61)
y1:x11	-0.02	-0.03	0.01	-0.01	-0.04	-0.05	0.02	-0.02	-0.02	-0.02	0.01	-0.02	-0.04	-0.04	0.02	-0.03
	(0.02)	(0.03)	(0.03)	(0.03)	(0.04)	(0.05)	(0.05)	(0.05)	(0.02)	(0.03)	(0.03)	(0.03)	(0.04)	(0.05)	(0.05)	(0.05)
Gender Adult male	0		0.36		-0.02		0.61		-0.01		0.35		-0.03		0.6	
	(0.35)		(0.34)		(0.58)		(0.59)		(0.35)		(0.35)		(0.59)		(0.59)	
Gender Elderly female	0.91*		-0.61		1.45*		-1.09		0.91*		-0.62		1.45*		-1.11	
	(0.39)		(0.55)		(0.66)		(1.08)		(0.39)		(0.55)		(0.67)		(1.08)	
Gender Elderly male	0.46		-0.25		0.71		-0.51		0.44		-0.25		0.69		-0.53	
	(0.39)		(0.43)		(0.64)		(0.79)		(0.39)		(0.43)		(0.65)		(0.79)	
Gender Youth	-0.44		0.42		-0.72		0.68		-0.45		0.42		-0.72		0.69	
	(0.28)		(0.27)		(0.46)		(0.46)		(0.28)		(0.27)		(0.46)		(0.46)	
Sex Male	-0.08		-0.28		-0.12		-0.48		-0.08		-0.28		-0.11		-0.48	
	(0.34)		(0.32)		(0.56)		(0.55)		(0.34)		(0.33)		(0.56)		(0.55)	
x03	0.05**		-0.14***		0.09**		-0.27***		0.06**		-0.14***		0.09**		-0.27***	
	(0.02)		(0.02)		(0.03)		(0.04)		(0.02)		(0.02)		(0.03)		(0.04)	

	Probit-Probit				Probit-Logit				Logit-Probit				Logit-Logit			
	A	**B**	**C**	**D**	**A**	**B**	**C**	**D**	**A**	**B**	**C**	**D**	**A**	**B**	**C**	**D**
x04	0.02.		0.02*		0.03.		0.03*		0.02.		0.02*		0.03.		0.03*	
	(0.01)		(0.01)		(0.01)		(0.02)		(0.01)		(0.01)		(0.01)		(0.02)	
x05	0		0.02		0.01		0.02		0		0.02		0.01		0.02	
	(0.02)		(0.02)		(0.03)		(0.04)		(0.02)		(0.02)		(0.03)		(0.04)	
x06		-0.01		0.01		-0.02		0.02		-0.01		0.01		-0.01		0.01
		(0.01)		(0.01)		(0.02)		(0.02)		(0.01)		(0.01)		(0.03)		(0.02)
x07	0		-0.01.		-0.01		-0.01		0		-0.01.		-0.01		-0.01	
	(0)		(0)		(0.01)		(0.01)		(0)		(0)		(0.01)		(0.01)	
x08	-0.04.	0	0.03	-0.02	-0.06.	0	0.05	-0.03	-0.04*	-0.01	0.03	-0.02	-0.07*	-0.01	0.05	-0.03
	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)	(0.03)	(0.04)	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)	(0.03)	(0.04)
x09	0.04*	0.47***		0.09	0.07*	0.78***		0.17	0.04*	0.46***		0.09	0.07*	0.77***		0.17
		(0.07)		(0.07)		(0.12)		(0.12)		(0.07)		(0.07)		(0.12)		(0.11)
x10		0.15***		-0.03		0.24***		-0.05		0.14***		-0.02		0.24***		-0.05
		(0.04)		(0.03)		(0.07)		(0.06)		(0.04)		(0.03)		(0.07)		(0.06)
x11		0.05.		0.01		0.08.		0.02		0.04		0.02		0.06		0.03
		(0.03)		(0.03)		(0.05)		(0.04)		(0.03)		(0.03)		(0.05)		(0.04)
x12		-0.2***		0.31***		-0.35***		0.54***		-0.2***		0.31***		-0.36***		0.54***
		(0.06)		(0.06)		(0.1)		(0.11)		(0.06)		(0.06)		(0.1)		(0.11)
x13FCT		-1.82***		0.72**		-3.11***		1.26**		-1.81***		0.71**		-3.12***		1.25**
		(0.25)		(0.25)		(0.46)		(0.44)		(0.25)		(0.24)		(0.46)		(0.44)
x13Kaduna		-1.06***		0.78***		-1.75***		1.36***		-1.06***		0.77***		-1.76***		1.34***
		(0.2)		(0.2)		(0.34)		(0.36)		(0.19)		(0.2)		(0.34)		(0.36)
x13Kogi		-0.26		0.43*		-0.44		0.81*		-0.28		0.43*		-0.5		0.82*
		(0.2)		(0.19)		(0.35)		(0.35)		(0.19)		(0.19)		(0.33)		(0.34)
x13Niger		-0.84***		0.14		-1.41***		0.28		-0.84***		0.14		-1.44***		0.28
		(0.19)		(0.2)		(0.33)		(0.37)		(0.19)		(0.2)		(0.33)		(0.37)
x13Osun		-0.88***		0.91***		-1.49***		1.61***		-0.81***		0.88***		-1.39**		1.56***
		(0.24)		(0.24)		(0.4)		(0.42)		(0.25)		(0.24)		(0.43)		(0.42)

*Values in parenthesis are standard errors 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1*

A=Cooperative membership: couples, B=Recursive model: couples, C=Cooperative membership: non-couples, D=Recursive model: non-couples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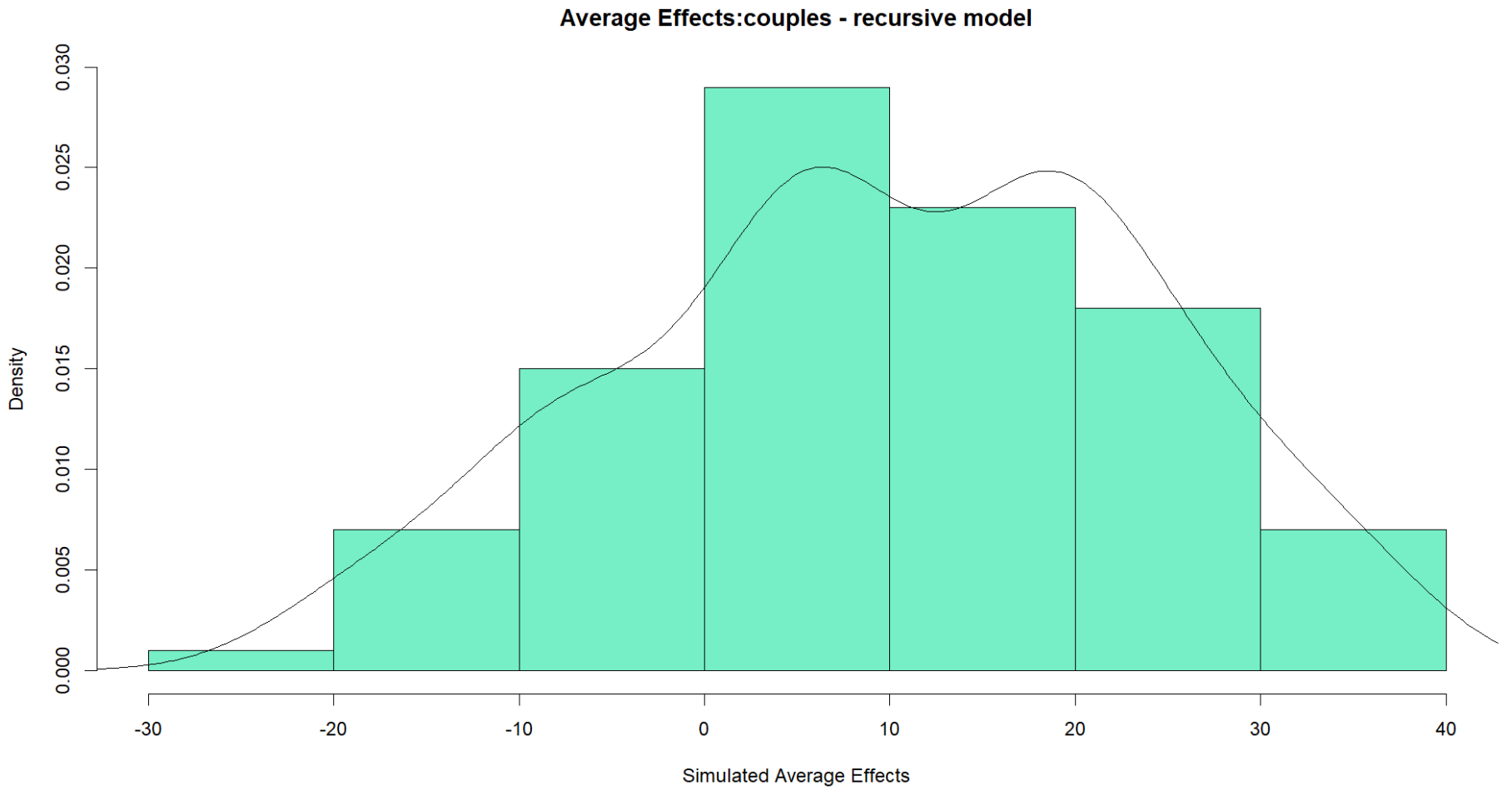
Simulated Average Effects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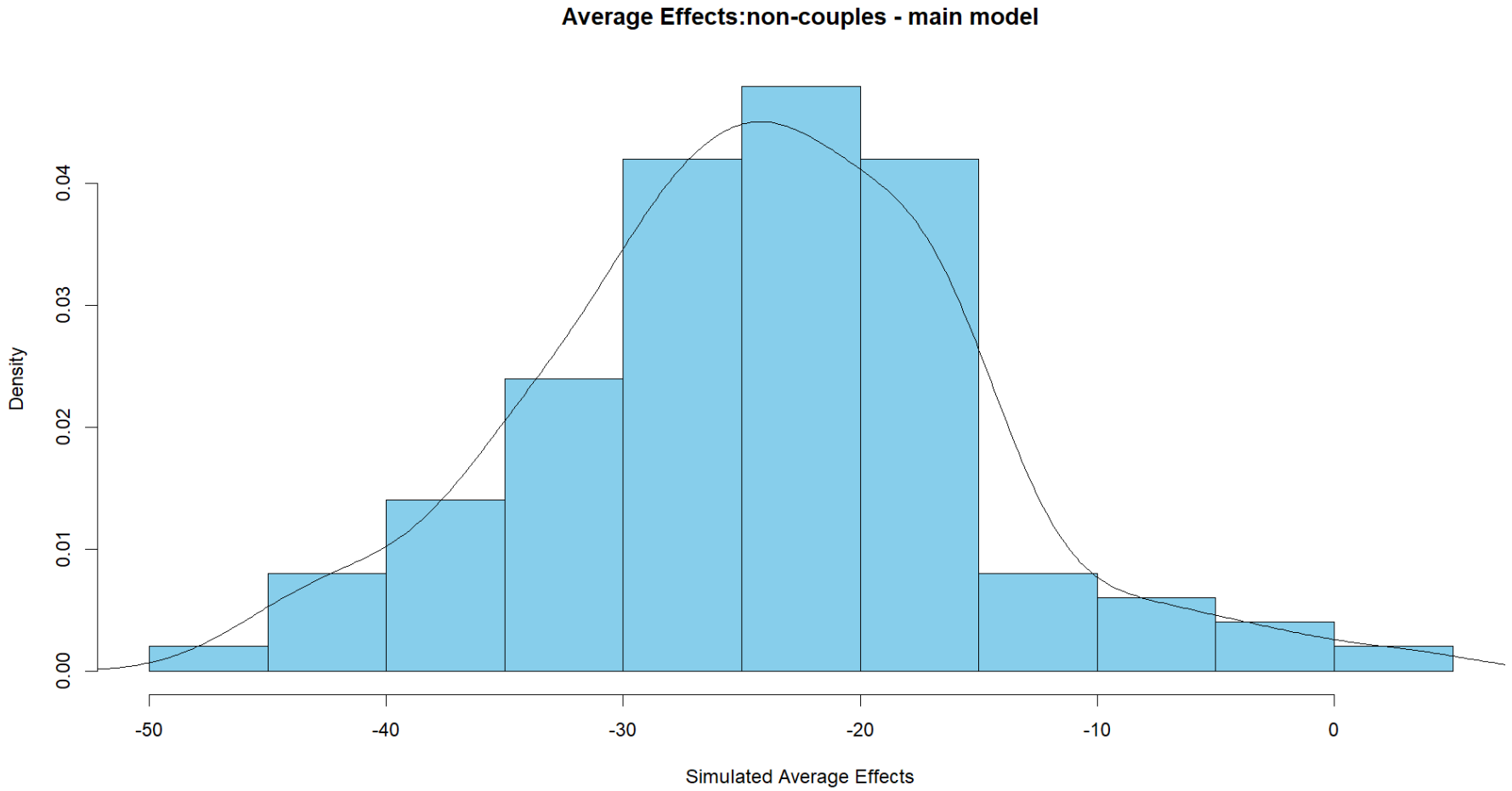
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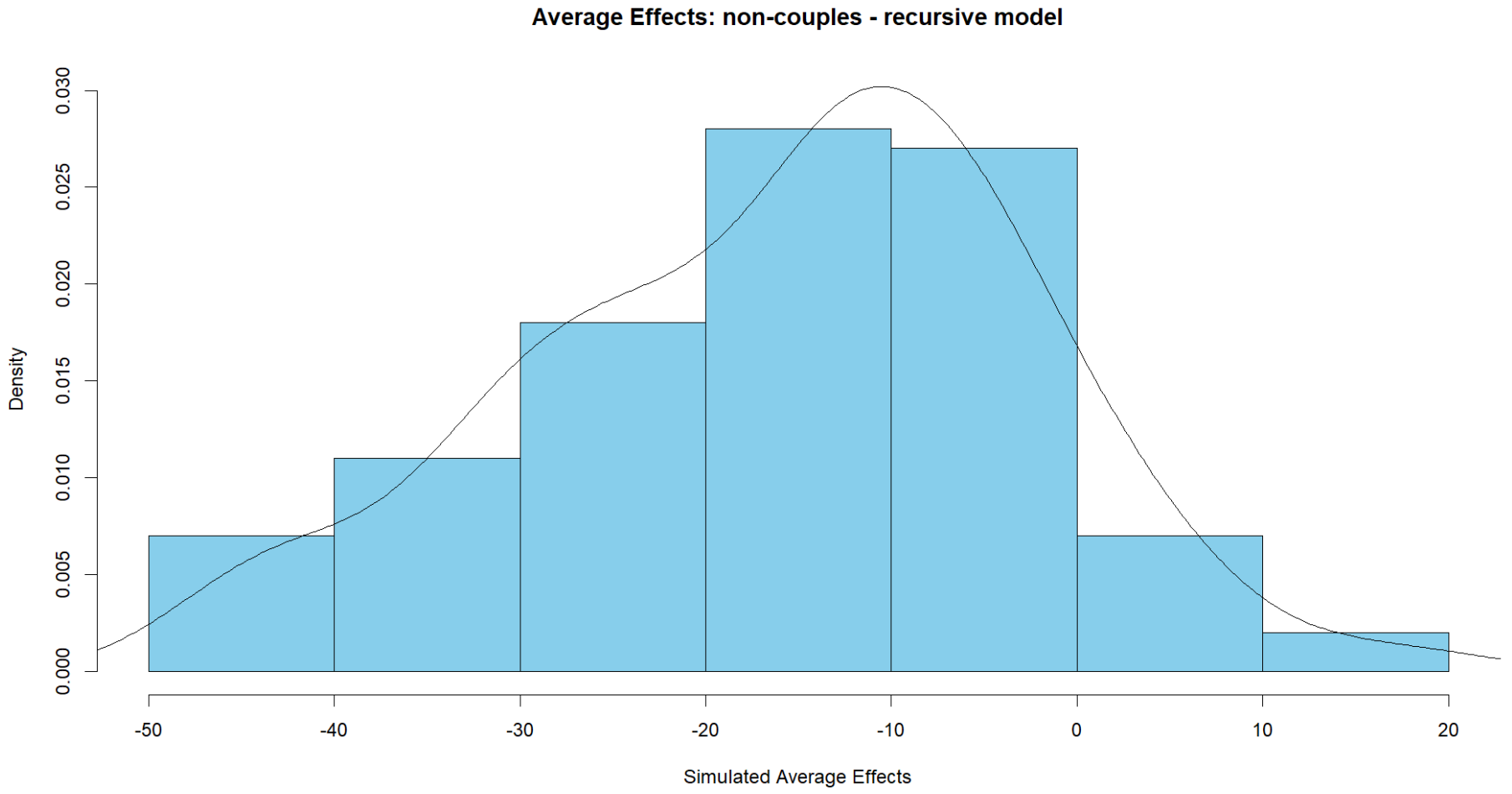
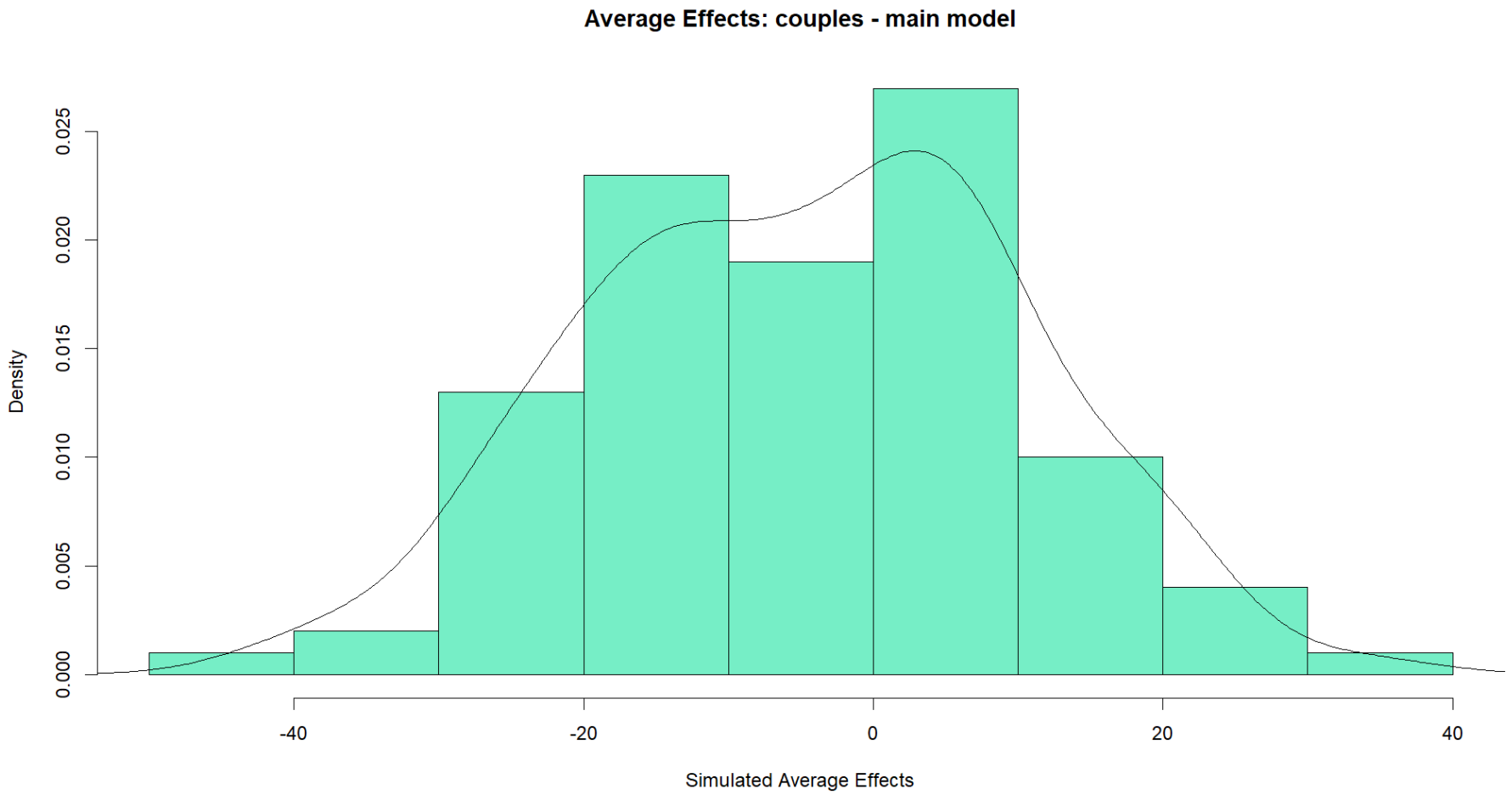


Fig. 6. Average effects simulated from the Probit-Probit bivariate models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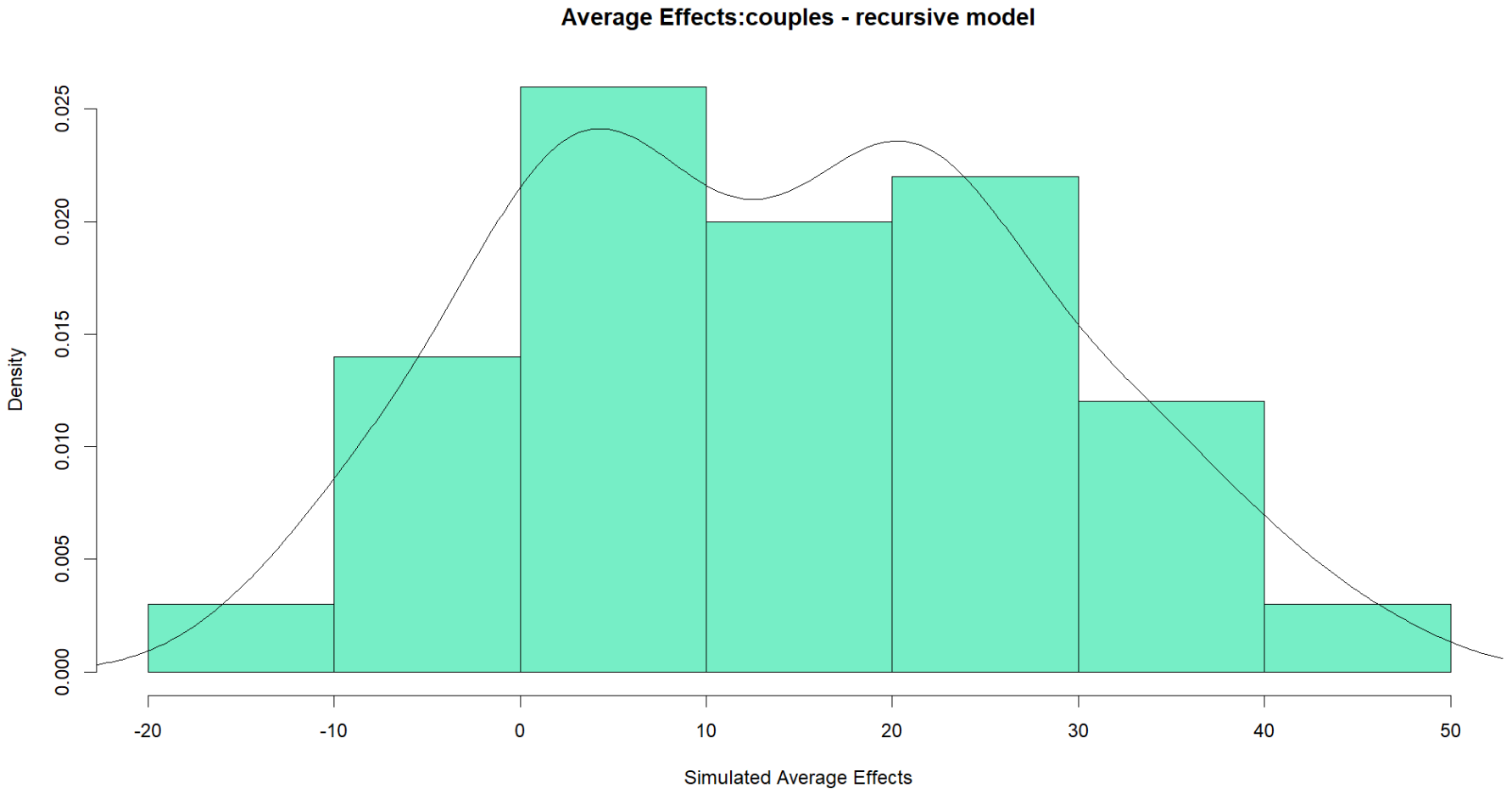
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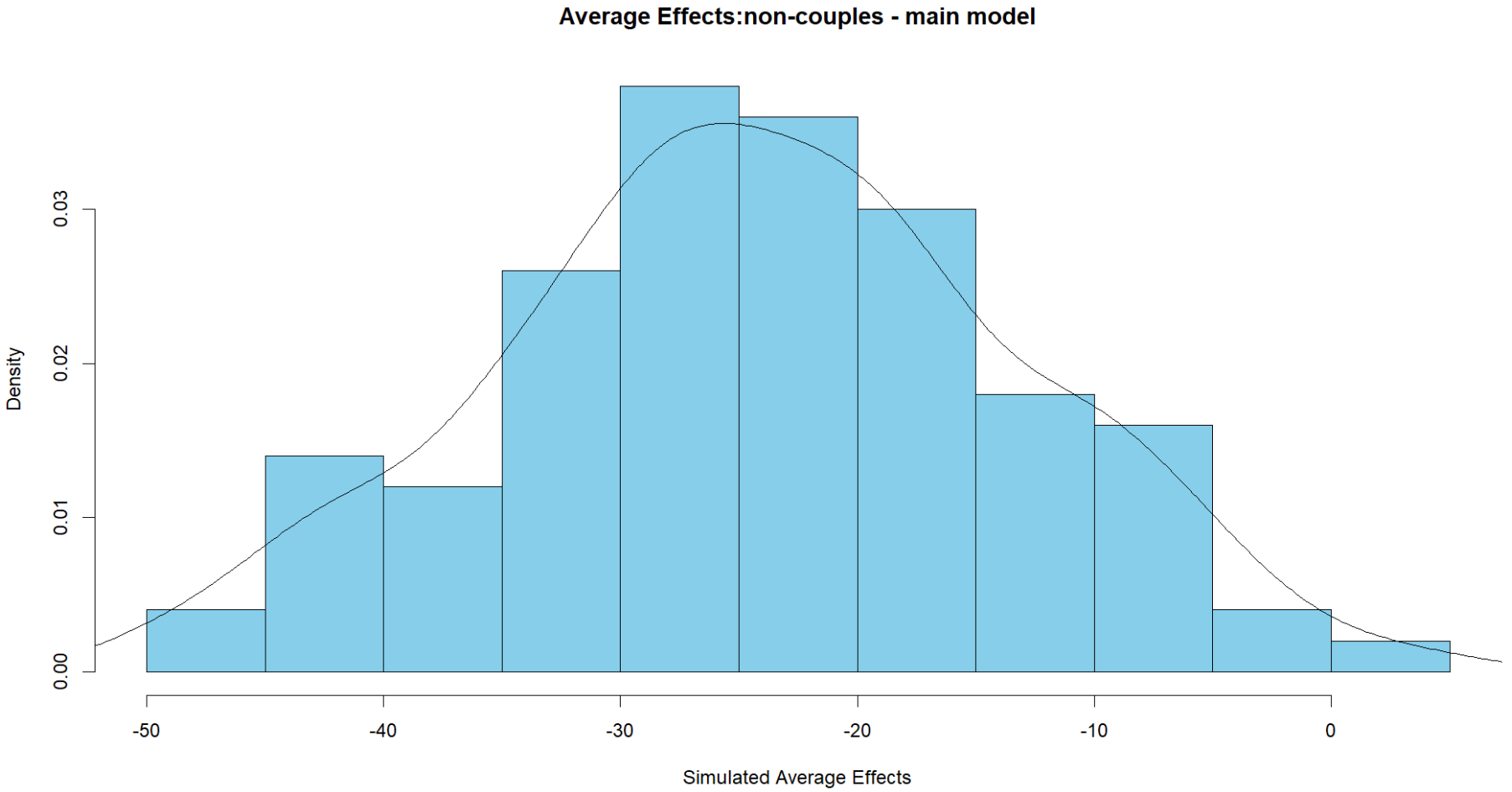
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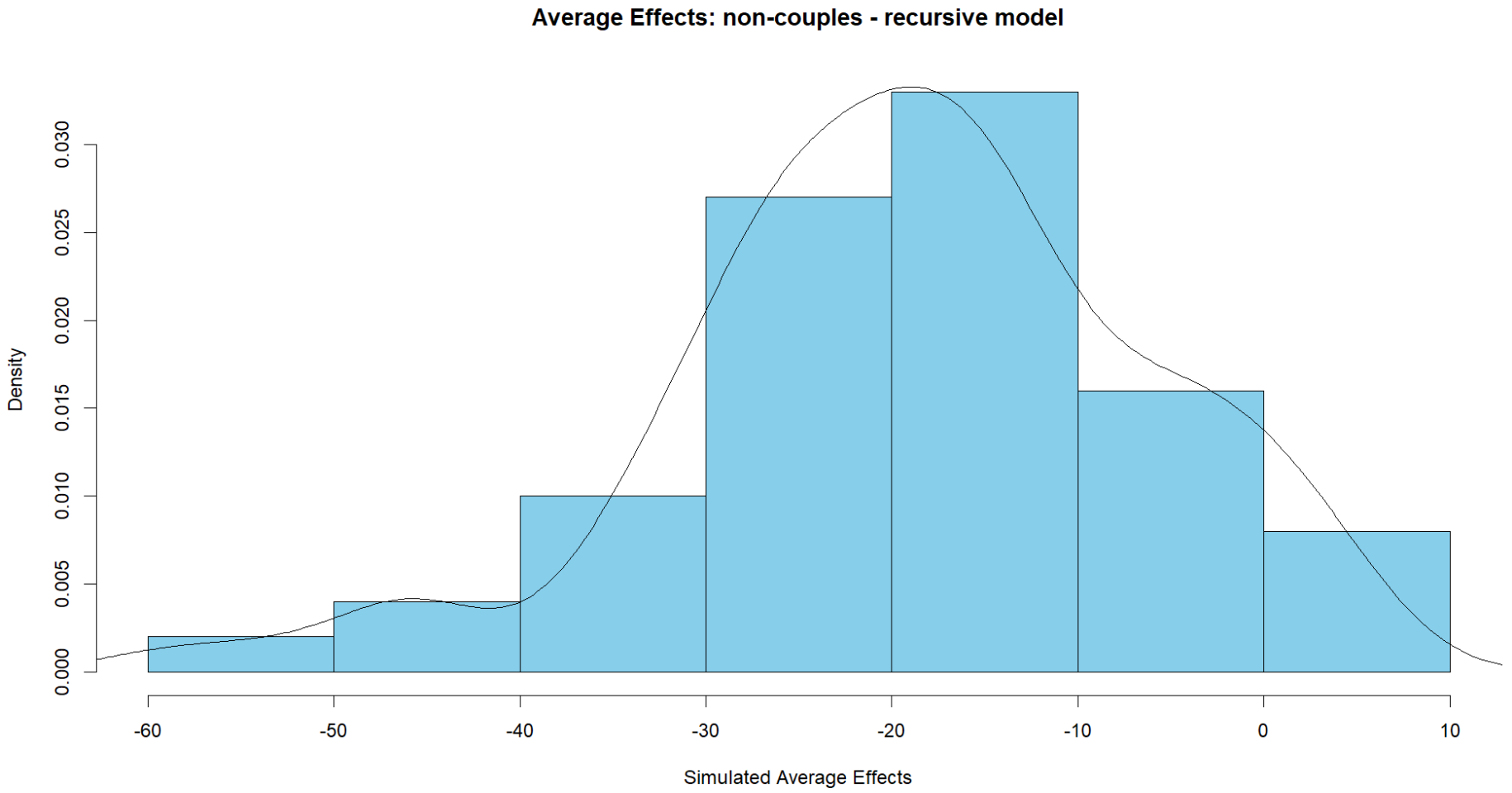
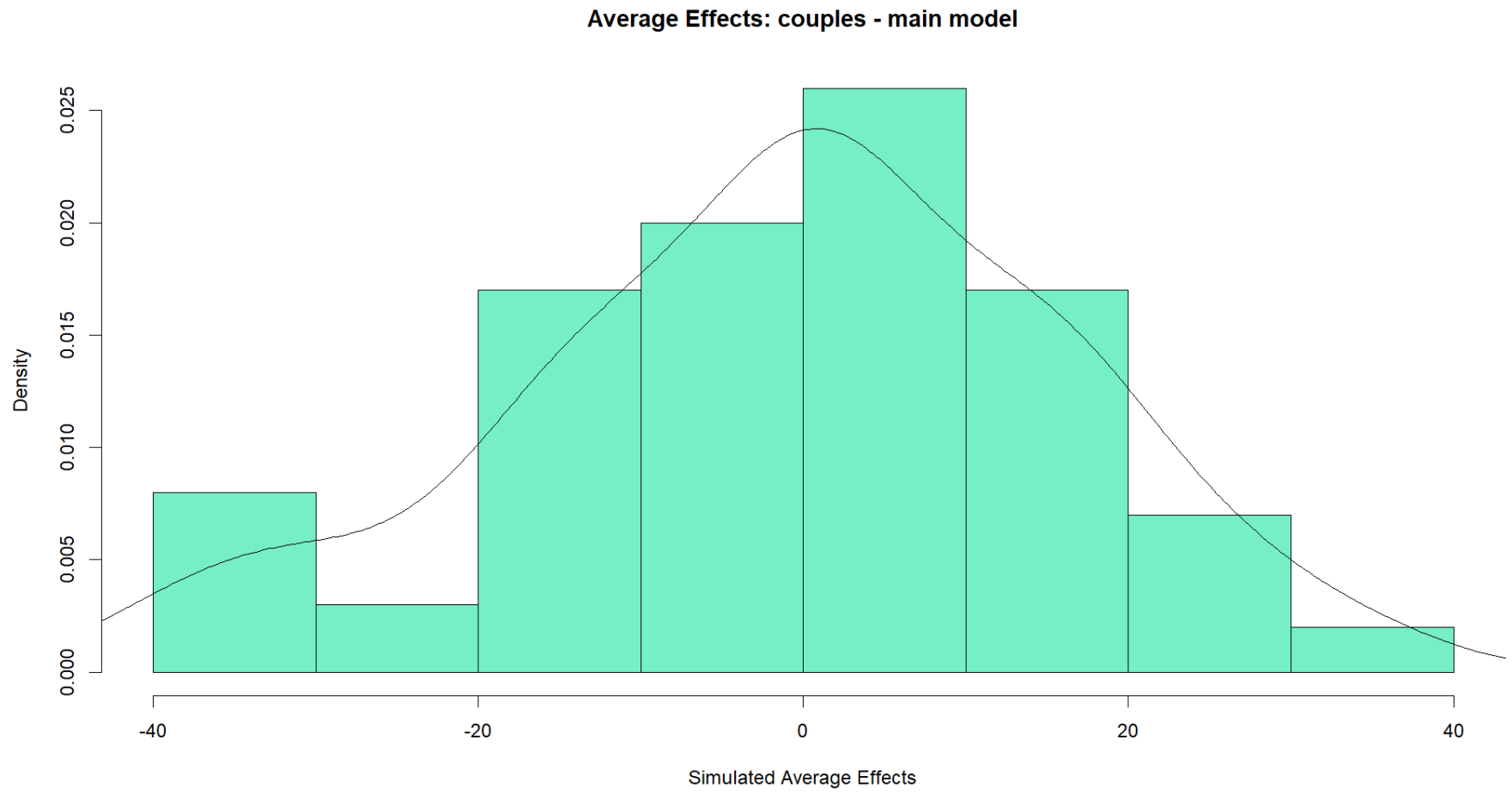


Fig. 7. Average effects simulated from the Probit-Logit bivariate models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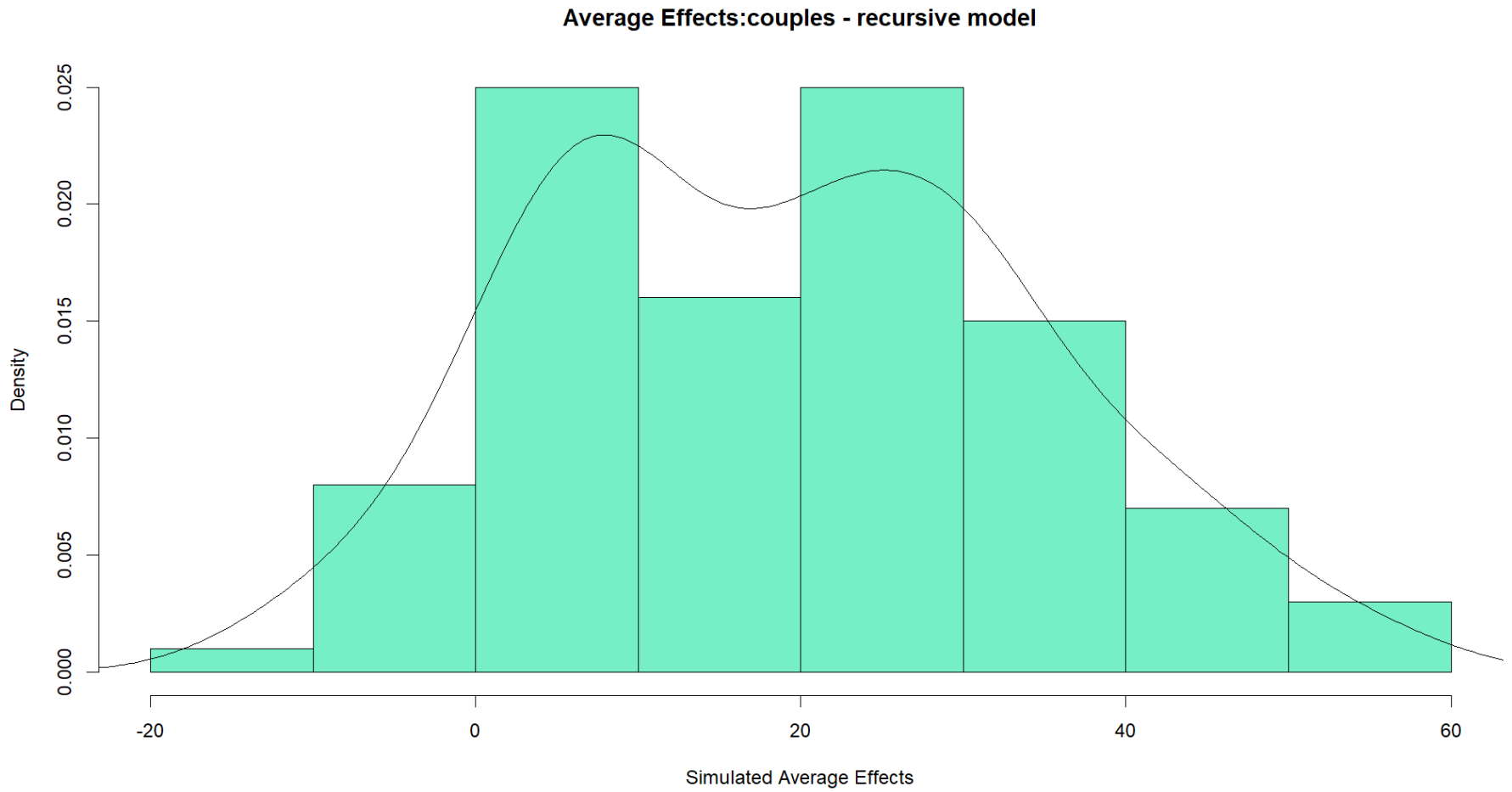
Simulated Average Effects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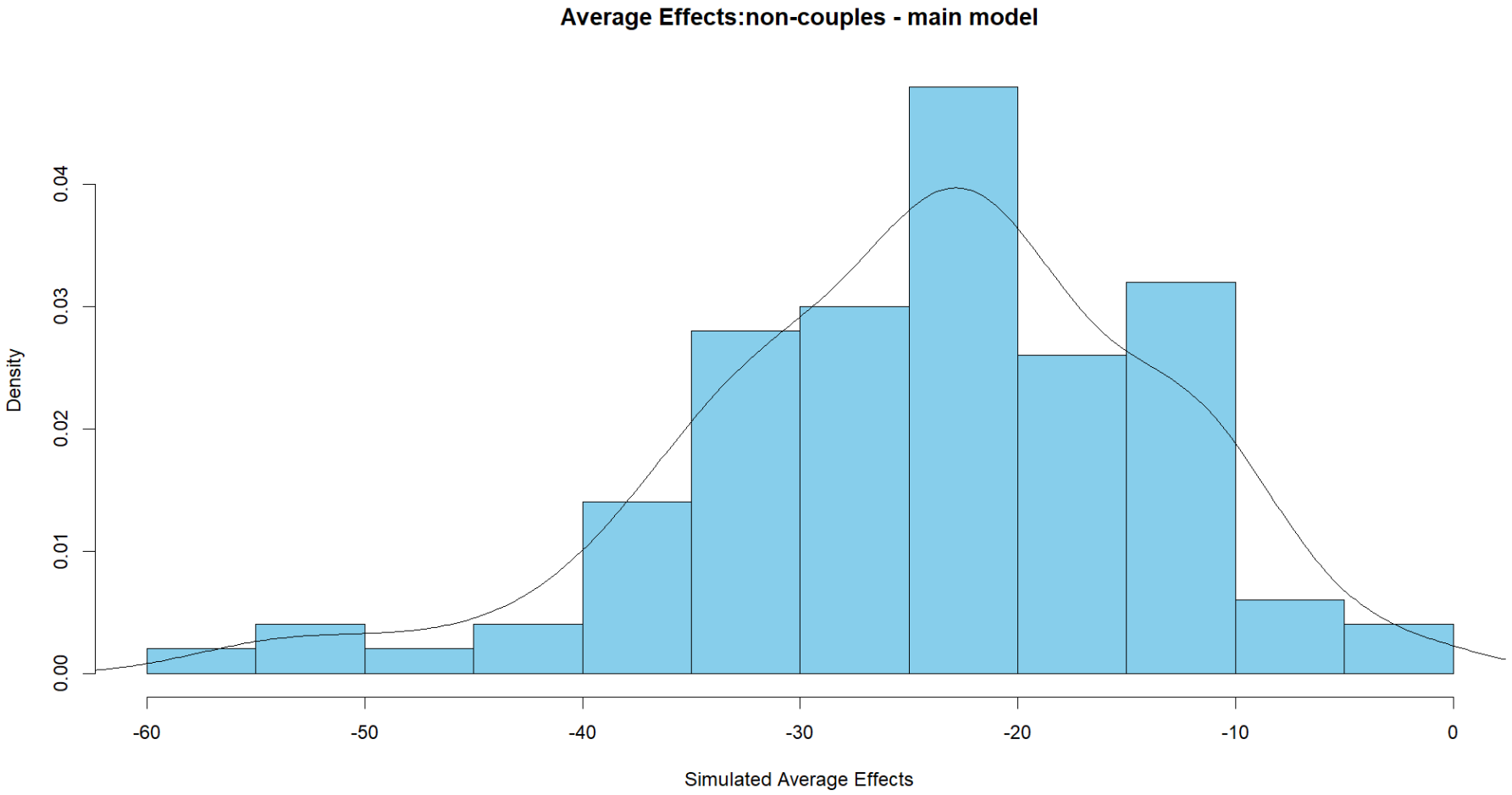
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Simulated Average Effects

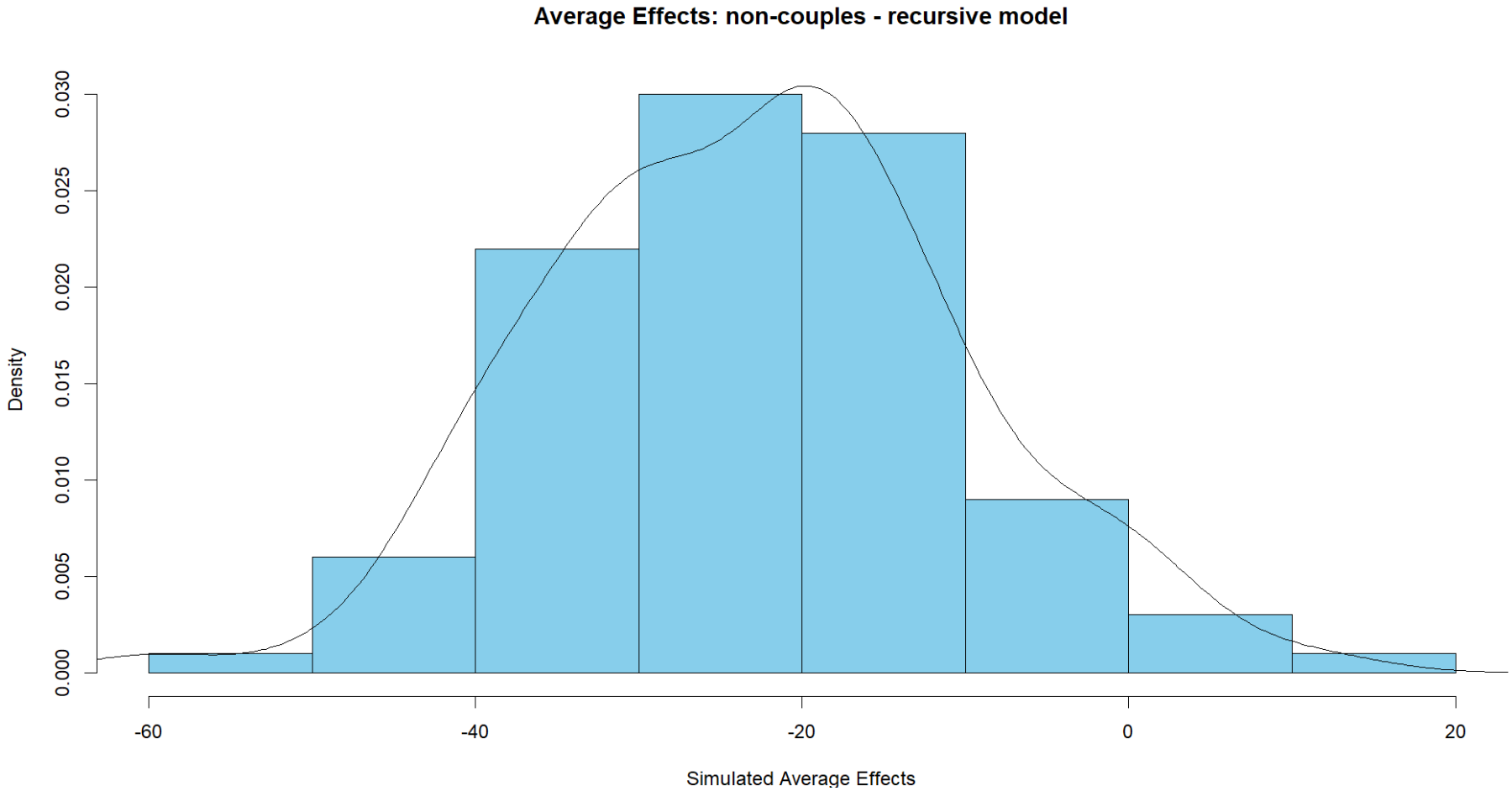
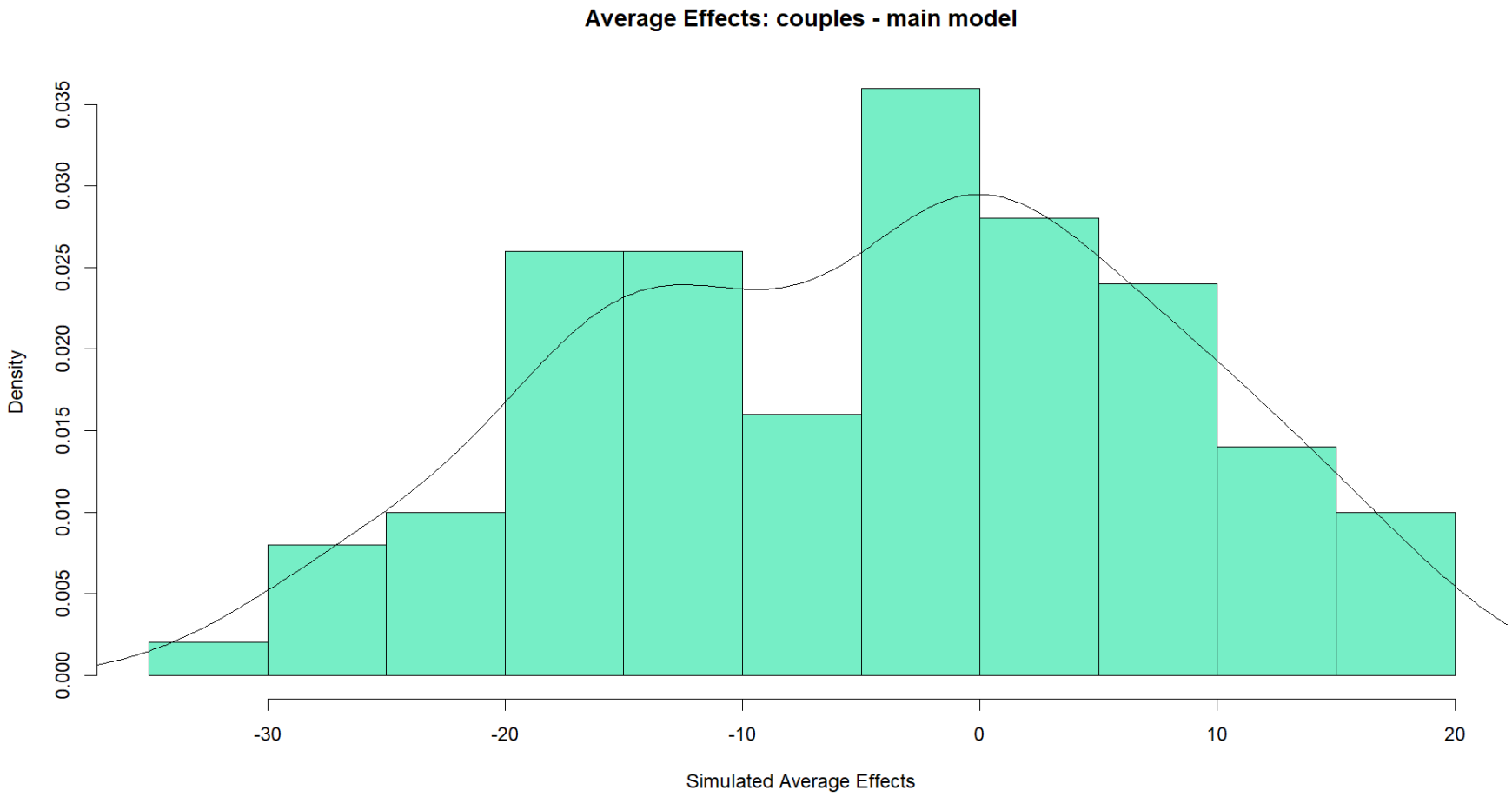


Fig. 8. Average effects simulated from the Logit-Logit bivariate models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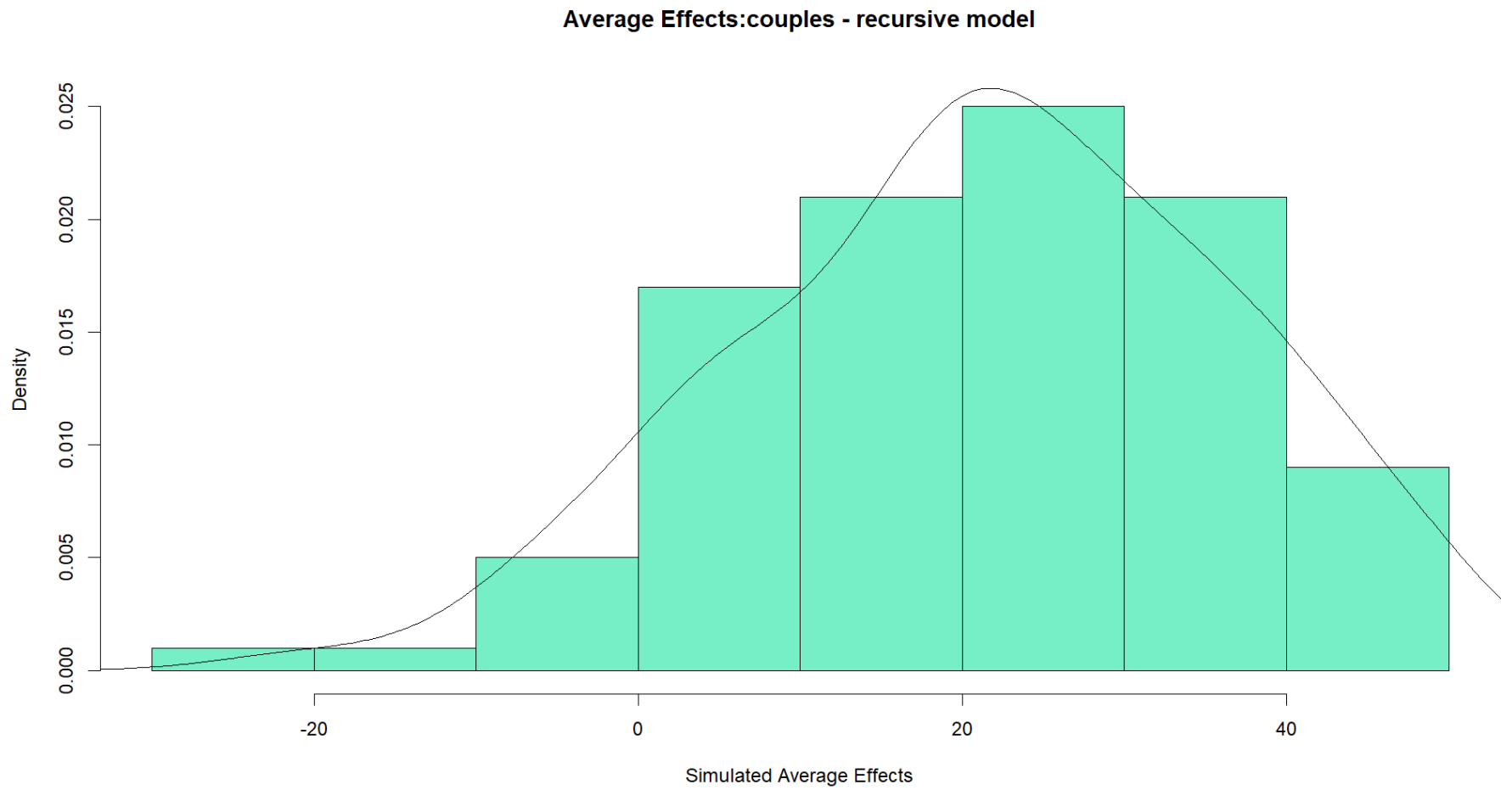
Simulated Average Effects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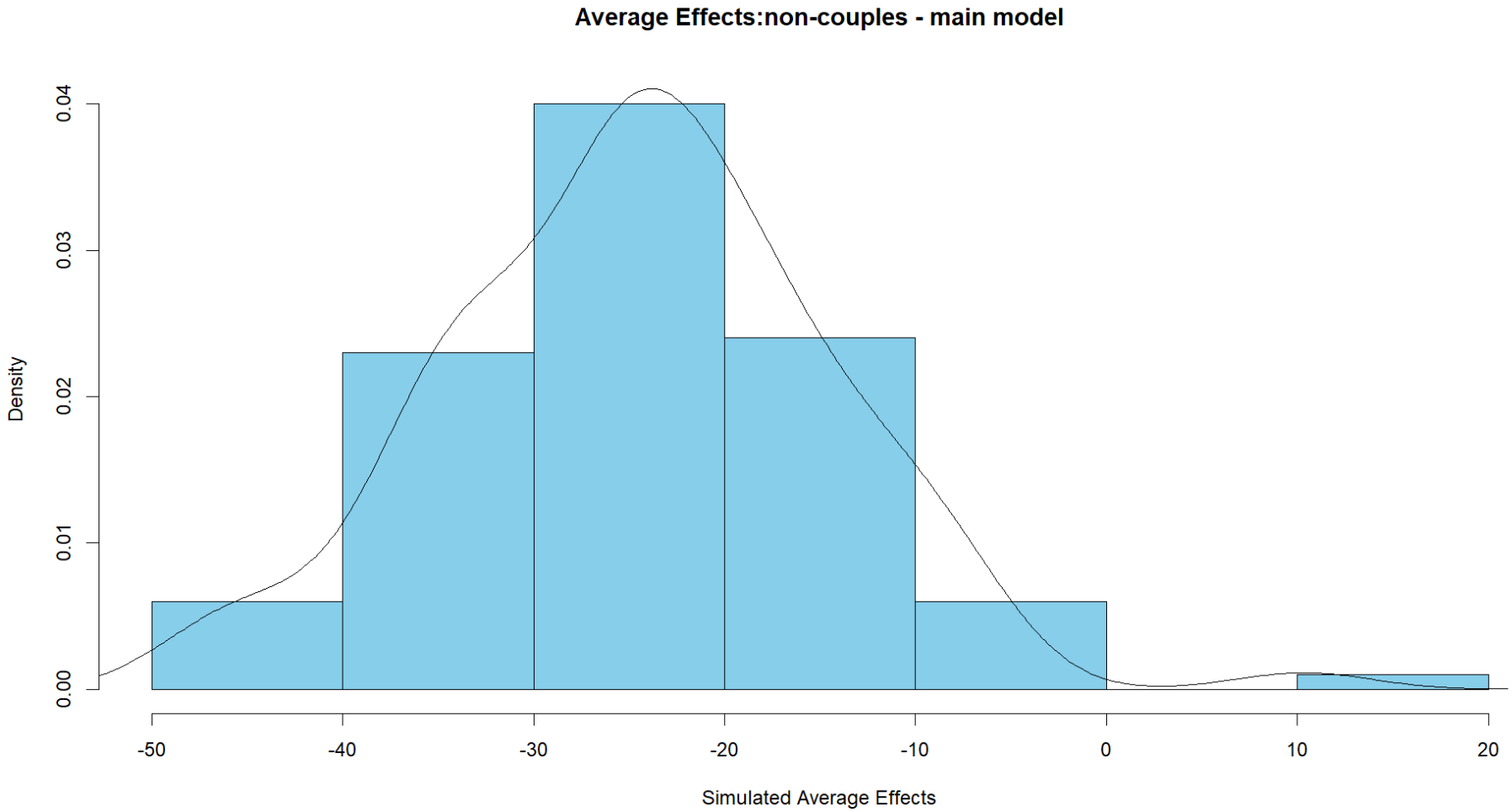
Simulated Average Effects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Simulated Average Effects

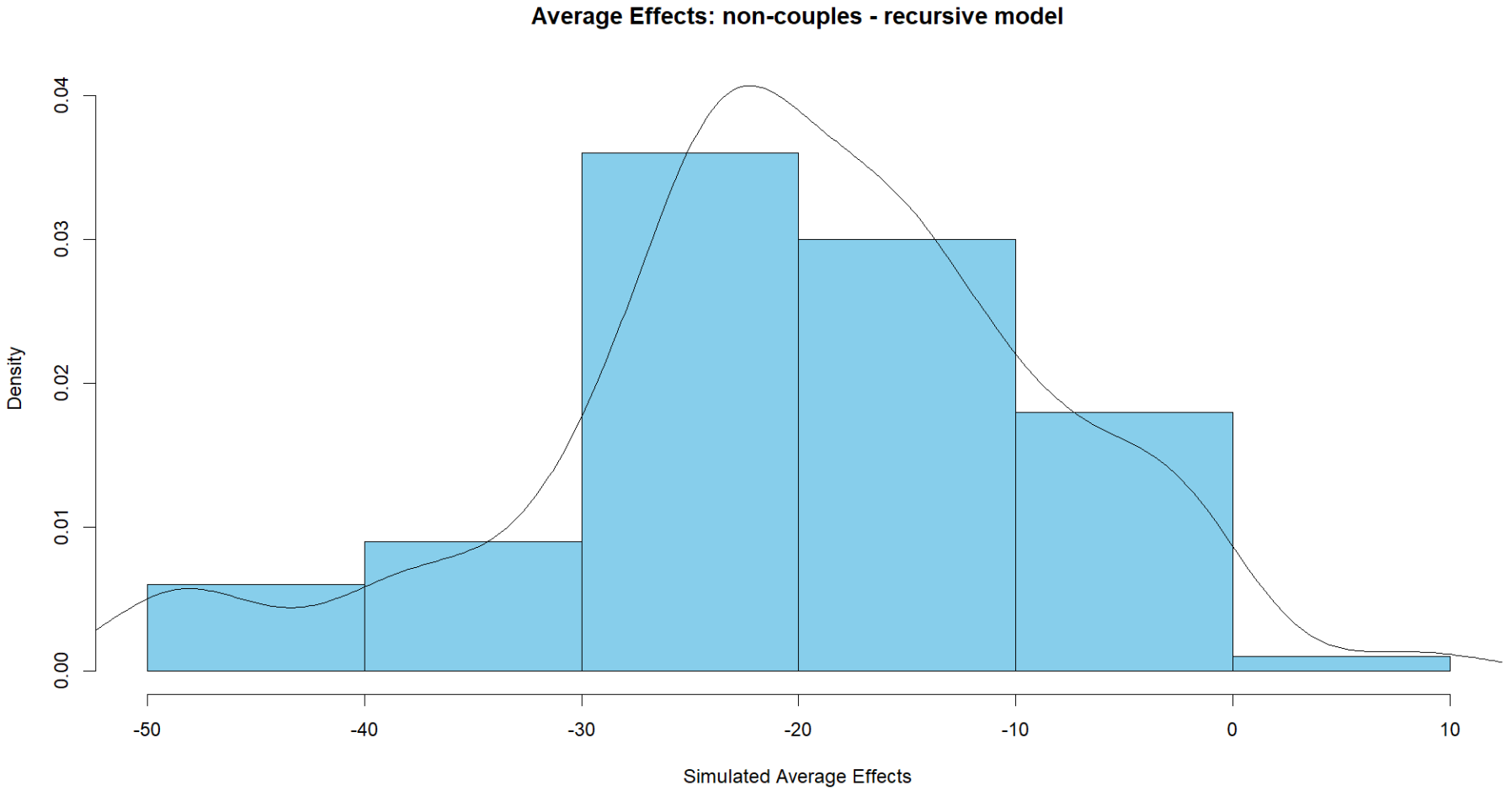

Fig. 9. Average effects simulated from the Logit-Probit bivariate models

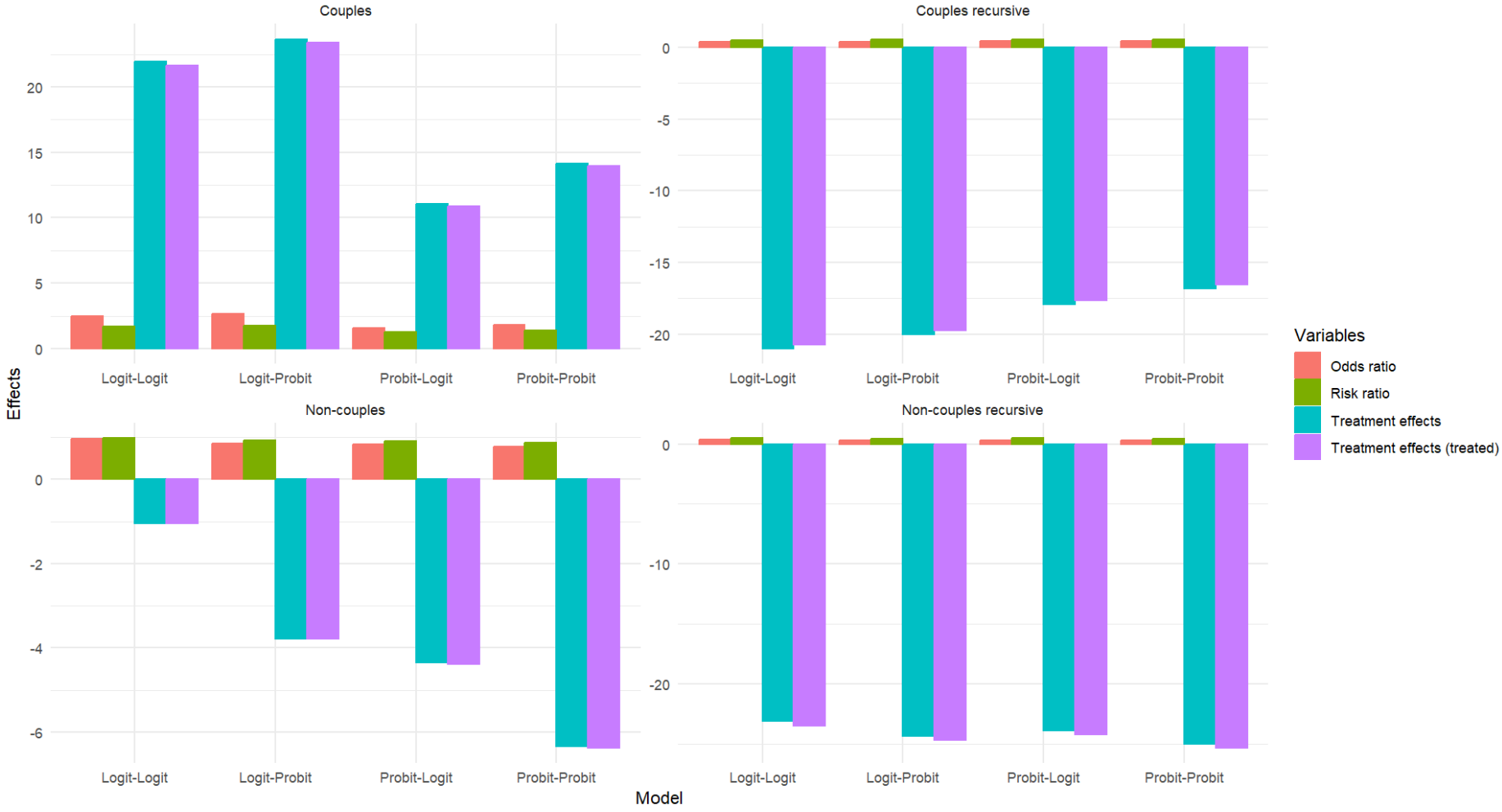

Fig. 10. Estimated treatments effects and various ratios from the various bivariate models

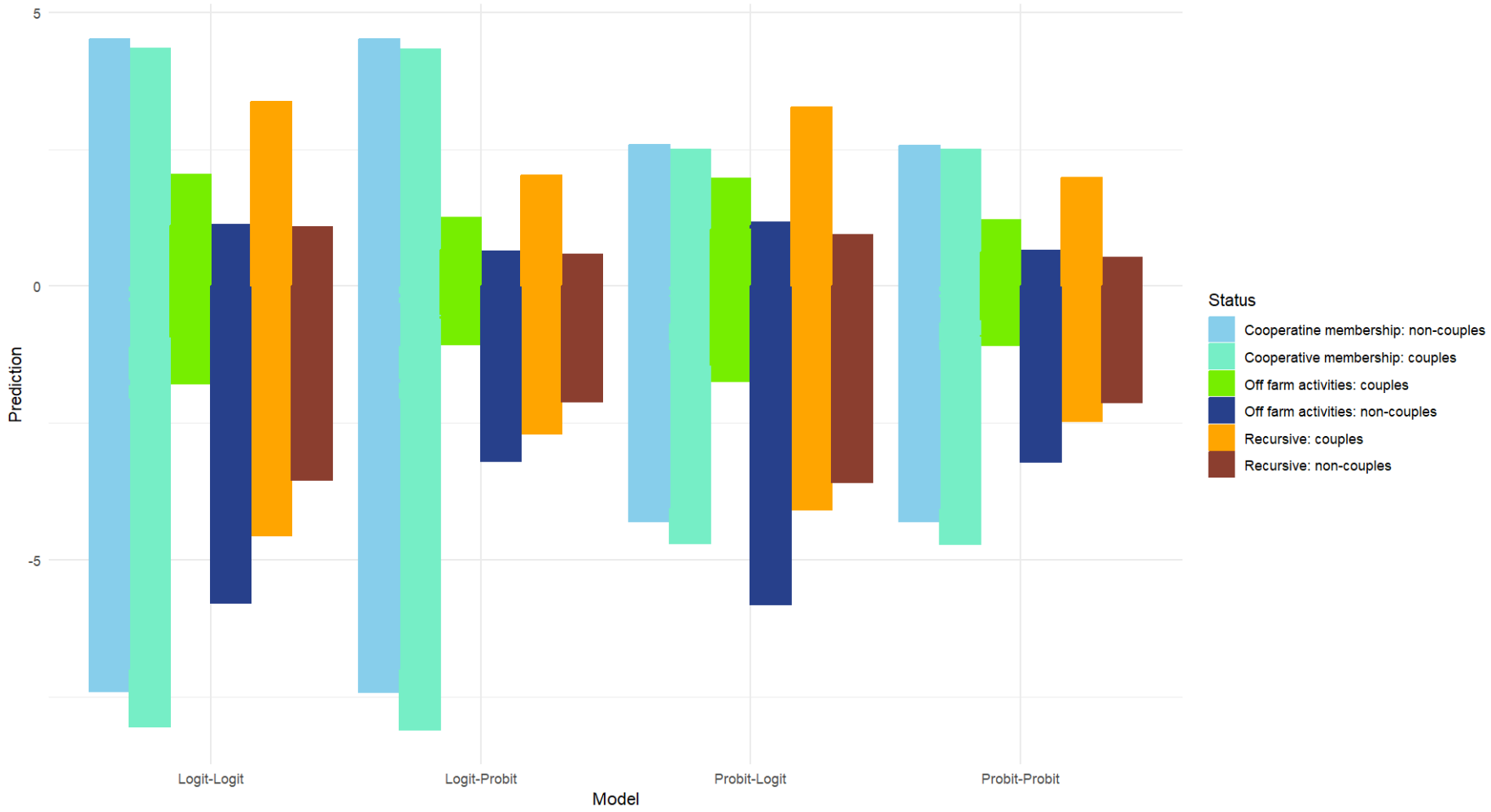

Fig. 11A. Predictions from the various models

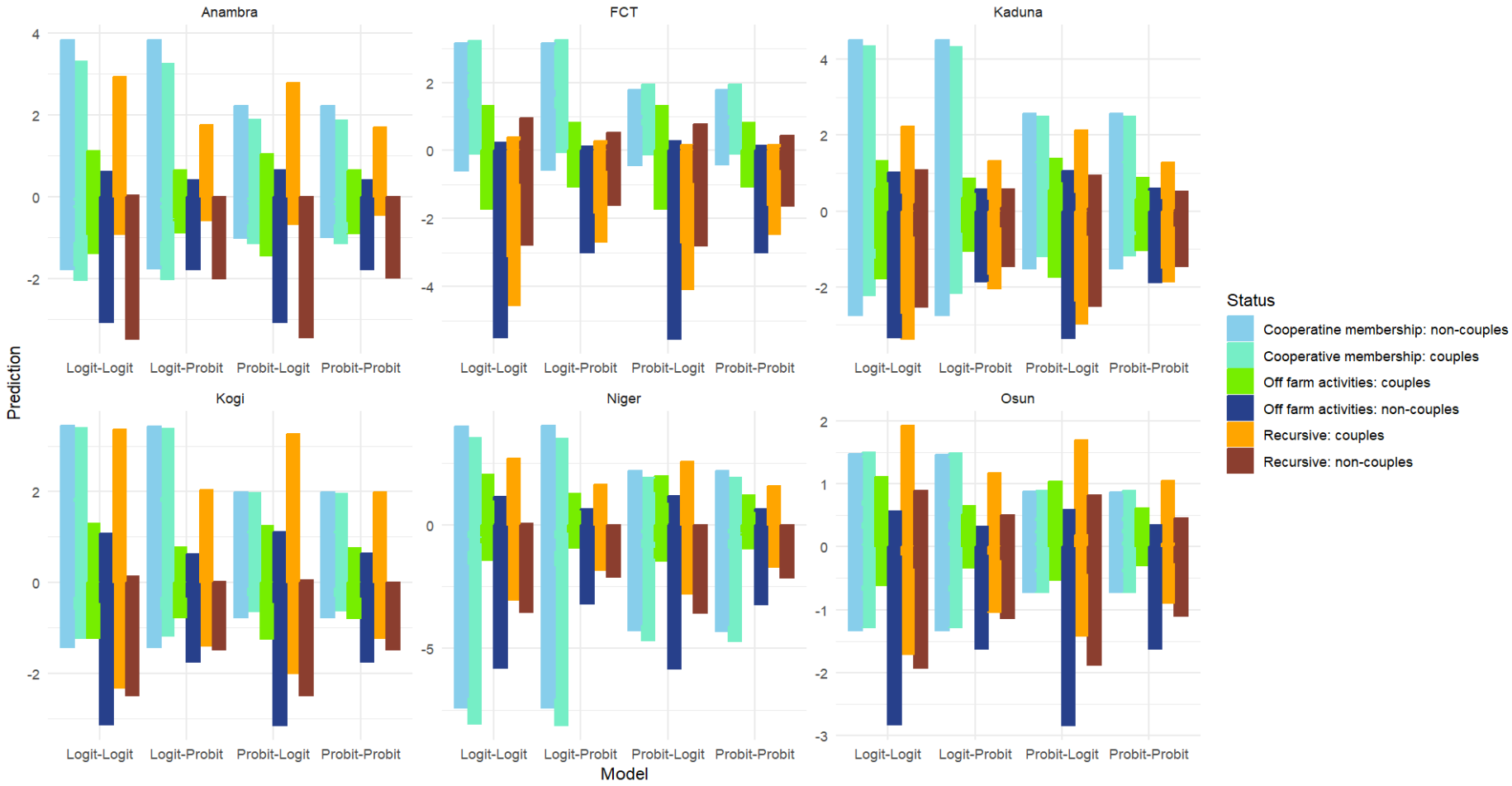

Fig. 11B

Fig. 11. Predicted membership status and off-farm activities participation from the various bivariate models pooled (A) and disaggregated by states (B)

suggest that off-farm activities might have adverse effects. The consistent negative predictions across all models indicate a need for reevaluation of such activities. Negative predictions in recursive models highlight potential long-term drawbacks when feedback loops are considered. Both couples and non-couples are predicted to experience negative outcomes, suggesting that interventions need to account for these long-term effects.

3.1 Discussion

The results on Fig. 2 and Fig. 3 suggests a significant gender disparity, with adult males being the predominant group in both membership and non-membership categories. This trend aligns with existing literature that often finds men more involved in formal memberships and organizational activities, possibly due to sociocultural roles and economic opportunities (Kabeer, 1999). The variations across states could be attributed to different socioeconomic factors and the presence of institutions or programs that encourage membership. For instance, states like Kogi and Osun showing higher counts might have more active community programs or agricultural cooperatives that attract more members (IFAD, 2009). The lower counts of youth and elderly individuals highlight potential areas for intervention. Programs targeting youth and elderly participation could enhance community engagement and provide inclusive growth opportunities. Literature supports the need for inclusive policies that encourage participation across all age groups to foster balanced development (UNDP, 2015).

Distance to cooperative meeting point is a key variable in the bivariate models as such needs further investigation as found in Table 8. Quite alarming is the fact that female respondents travel longer distances in all the states except Anambra and Niger contrary to Hanson and Pratt (1995), although the pooled average shows that males travel longer. This difference might be influenced by various factors such as gender roles, societal expectations, or access to transportation (ILO, 2008).

These results seem to confirm why there are more male members and that distance variable discourages membership subscription which could impact the effectiveness and inclusivity of cooperative programs. It also reflects underlying socioeconomic factors such as infrastructure quality, availability of transportation, and geographic spread of communities which can be explored in the context of gender roles within cooperative activities. Are females more likely to participate in or have responsibilities that require longer travel? Understanding the policy implications of these distances can help in planning and implementing more accessible

Table 8. Average distance to the meeting point for cooperative activities in parts of Nigeria

State	Sex	Frequency	%	Min	Max	Range	Mean	Variance
Anambra	Female	64	58.18	2	30	28	9.35	42.73
	Male	46	41.82	1	30	29	11.18	51.67
Sub-Total		110	100	1	30	29	10.26	47.20
FCT	Female	57	38.00	2	7	5	4.07	1.89
	Male	93	62.00	2	8	6	3.79	1.81
Sub-Total		150	100	2	8	6	3.93	1.85
Kaduna	Female	55	36.67	1	17	16	4.93	13.79
	Male	95	63.33	1	20	19	4.72	9.66
Sub-Total		150	100	1	20	19	4.82	11.72
Kogi	Female	7	5.83	2	19	17	11.30	2.90
	Male	113	94.17	2	20	18	9.83	1.85
Sub-Total		120	100	2	20	18	10.57	2.38
Niger	Female	35	25.74	1	20	19	10.46	24.21
	Male	101	74.26	1	20	19	12.73	22.68
Sub-Total		136	100	1	20	19	11.60	23.45
Osun	Female	42	27.27	4	5	1	4.59	0.21
	Male	112	72.73	3	5	2	4.33	0.21
Sub-Total		154	100	3	5	2	4.46	0.21
Total All States		820	100	1	30	29	7.61	14.47
Female		260	31.71	1	30	29	7.45	14.29
Male		560	68.29	1	30	29	7.76	14.65
Total		820	100	1	30	29	7.61	14.47

meeting points for cooperative activities. Most cooperatives provide incentives through corporate governance, better infrastructure and localized services to enhance inclusivity, ensuring that women and youth are given level-playing ground for membership subscription (World Bank, 2016). For example, instead of having a fixed meeting point, creating more localized or rotating meeting points could encourage greater participation. Policymakers and development practitioners can design more effective and inclusive cooperative programs that consider the unique needs and challenges of different groups within the population.

Based on the findings on Fig. 4 & Fig. 5, there is need for adequate infrastructure, particularly in rural areas to engender full participation in cooperative and off-farm activities absence of which severely limits economic growth and poverty alleviation (World Bank, 2020). Good infrastructure is crucial for accessing markets and services, which drives development. In addition, effective communication networks are essential for modern agriculture as they enable farmers to access market information, weather forecasts, and extension services (FAO, 2017), poor communication services can isolate communities and limit their economic potential. UNESCO (2015) also mentioned education as a critical factor for development. A well-educated workforce is more productive and innovative. Limited availability of education restricts skill development and can perpetuate cycles of poverty. In the same vein, UN Women (2018) also opined that cultural and religious practices can significantly impact economic activities. For example, norms around gender roles may restrict women's participation in the workforce or limit the types of activities deemed acceptable.

The differences between logit and probit models in estimating treatment effects (Fig. 6 – Fig. 11), prediction accuracy and effect size are well-documented (Greene, 2018; Shadish, Cook, & Campbell, 2002; Hosmer, Lemeshow, & Sturdivant, 2013), emphasizing that the short-term and long-term effects of interventions can differ significantly hence the need for longitudinal studies. The impact study on different groups (couples vs. non-couples) and cooperative membership can enhance economic outcomes, particularly for rural households and requires tailored approaches to ensure effective outcomes (Rosenbaum, 2017; Bernard, Spielman, & Taffesse, 2014). The effectiveness of off-farm activities varies widely, with some studies indicating negative impacts due to lack of resources or access to markets (Barrett, Reardon, & Webb, 2001). In the line of argument, recursive models often reveal long-term effects that are not immediately apparent in non-recursive models, emphasizing the importance of dynamic modelling (Wooldridge, 2010; Greene, 2018). Recursive models are crucial for understanding long-term impacts, as they incorporate feedback loops and dependencies. Negative long-term predictions in recursive models suggest that interventions need to be carefully designed to avoid unintended consequences (Heckman, 2000). The differential impacts of treatments across various models and groups are crucial for designing effective and sustainable interventions. This highlights the importance of model choice and the need for considering long-term effects in policy and practice. The differential impacts of cooperative membership, off-farm activities, and recursive elements across various models and statuses is crucial for effective policy design and implementation. The results show the importance of model choice and the need for considering long-term effects in policy planning.

4. CONCLUSION

This study discusses the impact of gender roles on participation in community activities and organizations, providing insights into how regional programs and socioeconomic conditions influence participation in agricultural and community groups. This result emphasizes the importance of inclusive policies to encourage participation from all demographic groups, including youth and elderly. The results further shows significant gender disparities and regional variations in membership across different states in Nigeria. Adult males dominate membership and non-membership categories, with notable regional differences. Addressing the lower participation rates among youth and elderly through targeted programs could enhance overall community engagement and development. These findings align with broader literature on gender roles, regional socioeconomic factors, and the importance of inclusive development strategies. Furthermore, the determined latent variables provided a comprehensive set of constraints impacting development. By focusing on the highlighted major constraints and integrating efforts across various domains, sustainable development and improved livelihoods can be achieved. Collaboration between government bodies, NGOs, and the

private sector will be essential in addressing these multifaceted challenges.

The study also indicated that membership commitment is crucial for cooperatives' success, the absence of which is evidenced by challenges in collective decision-making, pooling resources, and executing plans. But the organization should be run in a transparent manner giving due diligence to the issue of accountability to ensure that cooperative operations are fair and trustworthy. A lack of these can lead to corruption, mismanagement, and member distrust. Once this is achieved, there would be no Economic fragility which restricts a cooperative's ability to function effectively, limiting investment in infrastructure, technology, and member services. In addition, this would remove inefficiency among cooperatives employees thus speeding up operations, increasing service quality, and reducing dissatisfaction among members. The results also recognized critical constraints that cooperatives face, highlighting the need for improved member commitment, transparent governance, economic stability, and efficient operations. Addressing these issues requires comprehensive strategies involving policy interventions, member engagement, training programs, and financial management improvements. By tackling these challenges, cooperatives can enhance their resilience, effectiveness, and contributions to economic development.

In view of the stated findings and results of this study, the following recommendations would be useful to encourage membership of cooperatives and provide means of livelihood through off-farm participation by couples and non-couples all over Nigeria and beyond.

- Cooperatives leadership should create more localized or rotating meeting points to encourage greater participation.
- Governments and development practitioners can design more effective and inclusive cooperative programs that consider the unique needs and challenges of different groups within the population and create policies that improve infrastructure, enhance education systems, and provide incentives for private sector investments.
- Addressing norms and religious practices requires sensitive community engagement, promoting inclusive practices that consider the local cultural context.
- Improving terms of trade and market access through better infrastructure, credit facilities, and fair-trade policies can enhance economic opportunities for rural populations.
- Governments should also implement member engagement strategies, offering incentives, and fostering a sense of ownership can enhance commitment.
- Adopting clear governance policies, regular audits, and transparent communication can improve accountability.
- Strengthening financial management, seeking external funding, and improving member economic activities can enhance economic stability.
- Training programs, performance evaluations, and better recruitment processes can improve employee efficiency.

To strengthen the results of this study, a follow-up study in other parts of Nigeria as well as other parts of developing countries would provide a robust policy base to support policies on membership engagements and off-farm participation. Also, a longitudinal study in this subject matter is imperative.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declared that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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