Willingness to Accept Compensation for Railway-Induced Displacement: Insights from the Amhara Region, Ethiopia

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Posted Date: 27 February 2024

doi: 10.20944/preprints202402.1501.v1

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Article

Willingness to Accept Compensation for Railway-Induced Displacement: Insights from the Amhara Region, Ethiopia

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Abstract: This research study examined the compensation requirements for households facing involuntary displacement caused by a railway development project in Ethiopia's Amhara Region. Using the contingent valuation approach, researchers estimated compensation needs, taking into account ecosystem services and household characteristics. Surveys and questionnaires were conducted with 170 affected households to gather data on compensation preferences and experiences using double-bounded dichotomous method. The collected data were analyzed using a probit model to assess the influence of compensation amount, satisfaction, marital status, religion, and education on the satisfaction levels of affected households. The findings emphasized the significant impact of these factors and the necessity of fair compensation policies in development projects. The study revealed that the Minimum Willingness to Accept (MWTA) for households was - 2.274 billion Ethiopian Birr, significantly surpassing the compensation amount provided. The study highlighted the importance of considering household possessions and the ecosystem in designing tailored compensation strategies. The research revealed strong opposition to displacement, underscoring the need for customized compensation schemes that address preferences and non-monetary aspects. The discontent expressed by the respondents emphasized the importance of designing compensation schemes that ensure the sustenance of livelihoods without further disruptions. The study provided valuable guidance to stakeholders involved in addressing involuntary displacement, empowering them to make informed decisions and implement context-specific compensation policies. These findings contribute to the formulation of more effective and equitable compensation schemes, emphasizing comprehensive strategies for the welfare of affected households.

Keywords: ecosystem services; involuntary displacement; railway development; contingent valuation; compensation strategies

1. Introduction

Ecosystem services play a pivotal role in upholding economies and societies by bestowing indispensable advantages such as unpolluted water, air, carbon sequestration, recreation, and sustenance [1,2]. The effective management of privately owned forests is imperative for fulfilling the social and economic necessities of a burgeoning population [3], as underestimation frequently results in suboptimal production [2]. The production of private ecosystem services presents challenges due to the non-market nature of these services, voluntary participation, and financial constraints [4]. The difficulties faced by ecosystem services, which are indispensable for sustaining economies and societies, are substantial.

The absence of remuneration for management practices diminishes landowners' motivation [5,6], while inconsistent management costs and inadequate information impede incentive programs

 doi:10.20944/preprints202402.1501.v1

[5,7], hindering the attainment of desired service levels [8]. The lack of appropriate compensation, coupled with inconsistent cost structures and insufficient information, can present obstacles to effective ecosystem management.

The valuation of ecosystem services informs budgeting and prioritization of conservation efforts [2], necessitating monetary valuation and a combination of policy instruments to augment supply [9,10]. Methods to value ecosystem services include stated and revealed preference methodologies [11], such as the contingent valuation method (CVM), which estimates value through hypothetical scenarios [12,13]. Nonetheless, criticisms of CVM encompass neglect of budget, the embedding effect, and potential overestimations [14] underscore the necessity for validation with economic theory [15]. In Ethiopia, rapid economic growth has resulted in amplified land demand, involuntary displacement, and inadequate compensation [16,17]. Consequently, the valuation of ecosystem services plays a crucial role in budgeting and prioritizing conservation endeavors.

This study endeavors to utilize the contingent valuation approach, particularly the willingness to accept (WTA) method, to estimate the minimal compensation required to incentivize acceptance of involuntary displacement. The findings from this research furnish valuable insights into the compensation requirements linked to development projects.

2. Implications of Expropriation: Displacement and Opposition

Expropriation, denoting the obligatory acquisition of land by the government for developmental purposes, has minimal positive implications for communities and individuals. One of the primary effects entails the uprooting of numerous individuals from their residences and properties [18,19]. This displacement disrupts the lives of those affected and engenders enduring opposition to the projects, thereby resulting in heightened tensions regarding displacement and resettlement [20]. Moreover, the dearth of employment opportunities and disruption in the livelihoods of relocated households exacerbate these issues, as individuals grapple with adapting to their new circumstances [21].

In rural areas, where subsistence farming prevails, evictions prompted by development have notably significant ramifications. These evictions disrupt the conventional reliance on land for sustenance and further marginalize vulnerable populations. Regrettably, the government often fails to consider the socioeconomic shifts triggered by these evictions, thus neglecting the long-term well-being of affected communities [18].

Ethiopia's strategy for urban development and growth heavily relies on the obligatory acquisition and reallocation of land [22]. However, this process frequently gives rise to substantial discontent among those impacted [23]. Displaced farmers are compelled to seek alternative farmland, resulting in heightened competition and tensions with other farmers over limited resources. The unavailability of land through expropriation hampers the fulfillment of the public's land requirements and obstructs the protection of private property rights [24].

Moreover, forced displacement has an adverse impact on agricultural productivity. The reduced land size and labor efficiency resulting from displacement ultimately impede agricultural output [25]. This further exacerbates the challenges encountered by displaced communities since it compromises their ability to sustain themselves and make contributions to the local economy.

Recognizing the unfavorable effects of expropriation, the Ethiopian constitution of 1995 established the right to equitable compensation for individuals whose livelihoods are negatively impacted by government projects [26]. Equitable compensation plays a vital role in alleviating tensions and mitigating the adverse consequences of expropriation [27]. It ensures that affected individuals receive unbiased compensation for the losses they suffer, thus promoting a more just and sustainable approach to development projects [28].

2.1. Compensation Principles and Legal Framework in Ethiopia

Compensation pertains to the provision of commensurate value to reinstate a party that has suffered harm [29]. The Ethiopian Constitution bestows property rights and compensation for

 doi:10.20944/preprints202402.1501.v1

expropriation [26]. Expropriation, a common practice in developing nations, entails the relinquishment of land for public purposes [30,31].

The scarcity of land in Ethiopia obstructs the feasibility of adequate compensation, rendering cash or land-based compensation unworkable [32]. The lack of clear definitions for terms like "comparable" and "fertility" concerning substitute land further complicates the matter [16]. Resettlement frequently leads to the loss of cherished landscapes and sacred sites that are not appropriately remunerated [33].

Compensation challenges persist in Ethiopia, giving rise to protests and delays resulting from cash and replacement land compensation methods [34]. Insufficient compensation payments have failed to prevent impoverishment among the displaced population [35]. International guidelines strive for fair compensation; however, the quality of replacement land may not fully restore production [34,35]. Inadequate compensation has impeded the restoration of livelihoods, as monetary compensation fails to fully account for lost community resources and land value [32,36]. Valuation plays a pivotal role, influencing cash-for-land payments and project acceptance [34]. Resettlement models should prioritize the provision of adequate compensation and the revitalization of livelihoods [37]. Insufficient compensation has resulted in reduced income, instability, and social fragmentation among those involuntarily displaced by railway projects [38].

The rules governing displacement compensation give rise to concerns due to meager amounts and distress experienced by affected families [32,34,39]. The existing compensation law, Proclamation No. 1161/2019, sets forth the criteria for compensating rural landholders, which is determined by considering the highest annual income earned during the preceding three years. However, these rules exhibit shortcomings, leading to increased poverty and protests [33,34]. The selection of a fifteen-year criterion and an arbitrary three-year threshold for compensation calculation lack valid justification. In addition, the retrospective approach fails to consider the time value of money, putting landholders at a disadvantage. Local governments often lack budgetary provisions for compensation in projects necessitating land expropriation [16].

2.2. Total Economic Value and Willingness to Accept in Compensation Estimation

The government's authority to seize private land without consent is limited by the 1995 Constitution of Ethiopia, as demonstrated by Gashaw [30]. This restriction is a consequence of the collective ownership of land, which places restrictions on individuals' entitlements, as observed by Singto [34]. To ensure fairness and efficiency, it is absolutely vital for the government to provide compensation for expropriated land, as explicitly highlighted by Li [40].

The estimation of economic losses resulting from expropriation often relies on the concept of Total Economic Value (TEV), as explained by Abdelrhman [41]. Furthermore, the concept of Willingness to Accept (WTA), examined by Hasan-Basri [42], aids in determining the minimum compensation that individual require in order to accept the loss or forego a positive outcome. WTA is particularly valuable when assessing the value of goods that are not traded in markets.

The Marginal Willingness to Accept (MWTA) model offers a straightforward approach to calculating WTA. Researchers commonly employ the Contingent Valuation method, which involves surveys and hypothetical scenarios, to estimate TEV and WTA. However, it is important to consider factors such as awareness, personal beliefs, and socio-economic circumstances, as these factors can influence individuals' preferences and their willingness to accept compensation, as pointed out by Hasan-Basri [42]. According to Ginsburgh [43], MWTA provides valuable insights into individuals' preferences and values regarding intangible goods, thereby aiding policymakers and researchers in understanding the trade-offs and costs associated with different policy decisions.

Despite its benefits, MWTA has its limitations. The estimation of compensation may not accurately reflect the market value of the property, as mentioned by Abdelrhman [41]. Insufficient compensation can exacerbate the situation for individuals affected by property expropriation. Moreover, MWTA primarily focuses on the financial aspect of compensation and may overlook other dimensions of well-being or non-monetary losses experienced by individuals, as indicated by Mariel [44].

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Determining the economic value of properties presents challenges due to their diverse characteristics. The estimation of compensation can vary and may not precisely represent the market value of the property, as noted by Abdelrhman [41]. Inadequate compensation can worsen the situation for individuals affected by property expropriation, leaving them with losses that exceed the received compensation, as highlighted by Abdo [16]. Consequently, accurately appraising land and effectively restoring the livelihoods of affected communities pose difficulties for the compensation procedures, as argued by Li [40].

3. Research Methods

3.1. Study Area

The survey was conducted in the Amhara region, which shares borders with four regional states, particularly Oromia, Afar, Tigray, and Benishangul Gumuz, as well as the neighboring country of Sudan. The region exhibits a high population density, with the majority of inhabitants residing in rural areas [45]. Specifically, the study area encompasses the railway line that stretches from Kemissie to Hayk, passing through the Kombolcha section, which consists of four Woredas. This specific region is characterized by an elevation that spans from 1500 to 1840 meters above sea level, as documented by Addis et al. in 2019. Additionally, it receives an average yearly precipitation ranging from 725.1 to 1612.6mm, and the mean annual temperature fluctuates between 14.8 and 20.90°C, according to Abegaz [46]. The study area displays a diverse topography, including 14% high altitude-Dega, 34% mid-highland-Weina Dega, and 52% low altitude-kola. The district is recognized by a varied range of mountains, hills, sloping plateau areas, as well as rivers and streams [47].

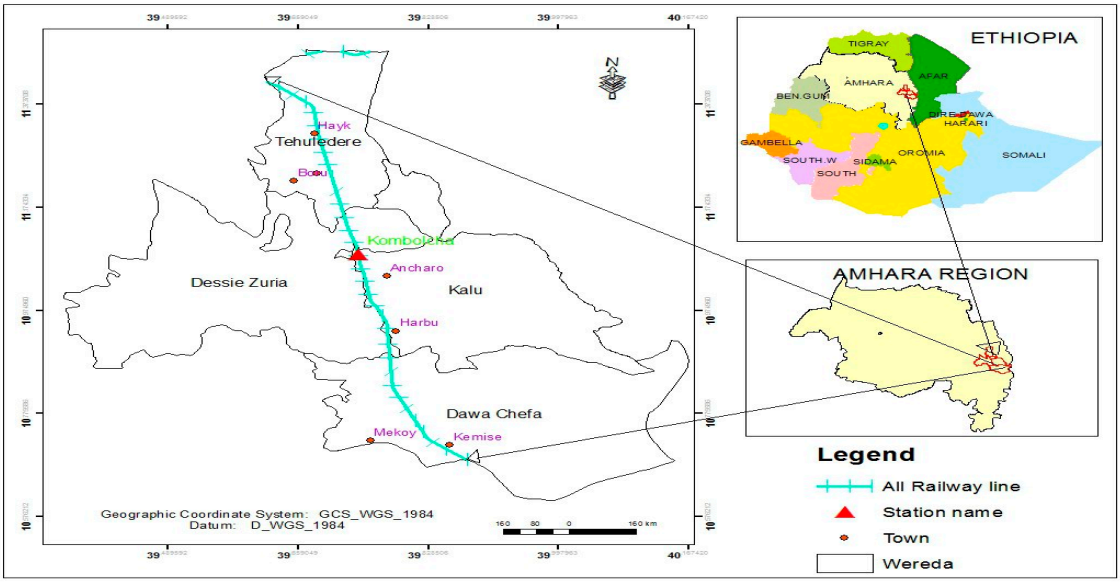

Figure 1. Map of the Study Area.

3.2. Description of the Applied Model

Diverse methods are utilized to gauge individuals' preparedness to pay (WTP) and willingness to accept (WTA) [48]. The contingent valuation method (CVM) is the prevailing technique employed to estimate WTP [41]. CVM is a technique based on stated preferences that enables the assessment of the value of non-market goods and services [49]. Studies conducted by Mutandwa et al. (2019), Nyongesa et al. (2016), Chien et al. (2005), Cooper et al. (2002), and Murphy & Stevens (2004) have employed CVM to evaluate environmental resources.

The minimal compensation amount that households are willing to accept represents an alternative measure of well-being and environmental benefit for displaced households [51]. In valuation studies, respondents are typically inquired about their satisfaction with the compensation

 doi:10.20944/preprints202402.1501.v1

received upon displacement [49]. By means of the monetary attributes of a utility function, non-monetary attribute compensation can be monetized through the marginal willingness to accept [50,51].

In the study area, a contingent valuation analysis was carried out to acquire data on households that had been displaced due to a railway development project. The data encompassed information regarding respondents' willingness to accept compensation, as well as their educational attainment, gender, marital status, compensation amount, household expenditure, and employment situation. The study employed a "double-bounded" dichotomous contingent valuation survey method, which presents two possible responses (Yes or No) and allows for accurate estimations of WTP with smaller sample sizes [52].

The probit model was employed to analyze the willingness of displaced households to accept paid compensation, which is a binary variable taking on two values (1 and 0) that represent willingness or unwillingness, in conjunction with other explanatory variables such as educational attainment, gender, marital status, compensation amount, household expenditure, and employment situation. The model was formulated as follows:

$$P(Y = 1 \mid X) = \Phi\ (\beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_k X_k)$$

In this context, we are examining the relationship between the dependent variable, represented by $P(Y = 1 \mid X)$, and the independent cost variables X_1, X_2... and X_k. This equation allows us to determine the probability of individuals accepting compensation based on the values of these independent variables. The coefficients β_0, β_1, β_2... and β_k are applied in the model to quantify the impact of each independent variable.

The dependent variable in this study captures the discrete choice made by households regarding their level of satisfaction. Specifically, a value of 1 is assigned if the individual is delighted with the amount received as compensation, while a value of 0 is assigned for a negative response.

To estimate the dependent variable, the model incorporates various elements such as estimated dependent variables, a constant term within the estimated function, and coefficients corresponding to significant explanatory variables. These components collectively contribute to the overall estimation process.

To determine the marginal willingness to accept compensation (MWTA) in the context of involuntary displacement caused by a railway development project, a formula is employed. This formula calculates the ratio between the coefficient of household characteristics and the compensation amount. The MWTA formula, expressed as $MWTA = -\beta_i/\beta_c * C$, allows us to estimate the minimum compensation required in situations of displacement. Here, βi represents the estimated coefficient for the paid compensation amount, βc represents the coefficient associated with the expected compensation for displacement, and C denotes the value of the cost of loss or inconvenience.

To gain insights into households' attitudes towards displacement and assess their willingness to accept compensation, a probit model is utilized. This model employs probit regression analysis using the STATA statistical software. By employing this approach, we can empirically estimate households' Willingness to Accept (WTA) for the compensation offered during displacement induced by railway development.

Generally, this research methodology allows us to quantify the relationship between independent cost variables and the dependent variable of accepting compensation. By employing a probit model, we can analyze households' attitudes and estimate the minimum compensation required in cases of involuntary displacement caused by railway development projects.

3.3. Sampling and Data Collection

The scholar performed an investigation on the remuneration of households that were displaced due to the construction of the Kemissie to Hayk railway section in Ethiopia. The Ethiopian Railway Corporation reported a total of 295 households that were completely displaced. In order to determine the appropriate sample size, the researcher utilized Yamane's formula, resulting in the selection of a random sample of 170 households.

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The assortment of data was performed using two primary procedures. Firstly, a thorough assessment of existing literature was executed to identify key elements of compensation during displacement. This involved examining previous research, reports, and publications that were related to compensation for displaced households in similar projects. The aim was to obtain a comprehensive understanding of the factors that influence preferences for compensation.

The second methodology employed was the administration of surveys and questionnaires to the selected displaced households. The surveys were created to collect data on the preferences, viewpoints, and experiences of the households regarding their compensation for displacement. These questionnaires contained both closed-ended and open-ended questions, facilitating both quantitative and qualitative answers.

The questionnaires likely included demographic questions to gather information about the characteristics of the households. These inquiries might have discussed facets such as age, gender, household size, and job. In addition, questions specific to the identified compensation factors were included, such as monetary compensation, alternative housing options, access to basic services, restoration of livelihoods, and community support. The closed-ended questions provided response options for the households to select from, which may have included Likert scale ratings or multiple-choice options. These questions aimed to assess the importance of different compensation factors or measure the level of satisfaction with the compensation received.

On the other hand, the open-ended questions empowered the households to furnish exhaustive qualitative responses. These questions encouraged the households to describe their specific needs and concerns regarding compensation, share their expectations, or provide additional comments and suggestions. The questionnaires were given to the selected households either personally or through mail or electronic means. The households were given a specific timeframe within which to complete and return the surveys.

3.4. Data Analysis

Upon receiving the completed surveys, the researcher analyzed the data, both quantitative and qualitative, to identify common themes, patterns, and correlations. Statistical analysis techniques may have been used to quantify and compare responses to closed-ended questions. Thematic analysis or content analysis was likely employed to identify recurring themes and insights from the open-ended responses.

By following this research methodology, the study aimed to gain insights into the preferences of households affected by the railway development project regarding compensation for their displacement. The combination of literature review, surveys with questionnaires, and contingent valuation allowed the researcher to explore the factors influencing these preferences and determine how the characteristics of the displaced households influenced their compensation preferences.

4. Result and Discussion

4.1. Descriptive Analysis WTA Compensation

A total of 154 completed questionnaires were analyzed in this study, representing a response rate of 90.58% out of the distributed 170 questionnaires. All respondents had experienced land loss and its impact on their livelihoods due to the railway development project. The compensation payment process was overseen by the local government, ensuring transparency and addressing claims from displaced households. The research aimed to explore the perceptions and satisfaction levels of the affected individuals regarding the compensation they received. By comparing the expected value of their property with the actual compensation amount, the study examined the adequacy of the compensation in addressing their losses. The findings contribute to understanding the fairness and effectiveness of the compensation process in mitigating the negative consequences of involuntary displacement, quantifying the gap between expected and actual compensation.

 doi:10.20944/preprints202402.1501.v1

Table 1. Description of Dependent and Independent Variables to Measure the Willingness to Accept (WTA) Compensation for Railway Development Based on a Survey Conducted in 2023.

Variables	Descriptions
age	Age of the respondent
comamt	Amount of paid compensation
comform	Compensation form (cash, kind & both)
compaid	Compensation paid (Dummy, 1 if yes, 0 if no)
disp	Displaced households (Dummy, 1 if yes, 0 if no)
edu	Level of education (1 = no formal education)
empy	Employment status of the respondent
exp	Expenses of the respondent
fam	Family size of the respondent (1 = Below 3)
incom	Income level of the respondent
lcomamt	Log forms of amount of given compensation
lincom	Log forms of respondent's income
lsatcom	log forms of expected amounts of fair compensation by the respondent
marl	Marital status of the respondent
relg	Religion of the respondent
repl	Forms of kind compensation for replaced land
satcom	Compensation that would satisfy the respondent
satis	Compensation Satisfaction level of the respondent (Dummy, 1 if yes, 0 if no)
sex	Sex of household head (Dummy, 1 if male, 0 if female)

4.1.1. Demographic Information of the Respondents

Table 2 presents the demographic characteristics of the survey participants, including gender, marital status, religious affiliation, employment status, educational attainment, family size, and age distribution. The majority of respondents were male (81.82%), possibly influenced by cultural or societal factors affecting women's participation in surveys. The dominant religious affiliation was Muslim (94.81%), reflecting the prevailing religious composition in the surveyed region.

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Table 2. Demographic Information of the respondents (Head of the household).

	Types of the Variable	Frequency	Percentage (%)
Sex	Male	126	81.82%
	Female	28	18.18%
Marital status	Single	30	19.48%
	Married	124	80.52%
	Widowed	0	0.0%
	Divorced	0	0.0%
Religion	Muslim	146	94.81%
	Orthodox	8	5.19%
Employment status	Farmer	76	49.35%
	Private organization employee	11	7.14%
	Government employee	14	9.09%
	Own business	10	6.49%
	No job	43	27.92%
Education	No formal education	22	14.29%
	Primary education	83	53.90%
	Secondary education	39	25.32%
	Diploma	10	6.49%
Family Size	Below 3	19	12.34%
	4-7	116	75.33%
	Above 7	19	12.34%

Source: Sample Survey Analysis, 2023.

A significant proportion of participants identified as farmers (49.35%), indicating their reliance on agriculture as their primary source of income. This highlights the potential impact of losing their land plots on their livelihoods, as smallholder farms are often overlooked in development policies, making them a vulnerable group. The high percentage of unemployed respondents (27.92%) suggests challenges in finding alternative sources of income after displacement.

Educational attainment was relatively low among the displaced households, with more than half (53.90%) having completed only primary education. This lower level of education may affect their ability to negotiate better compensation packages or explore alternative livelihoods post-displacement. The larger family sizes (4-7 members) among the majority of respondents (75.33%) indicate that displacement may have a significant impact on a larger group of people, extending beyond the individual surveyed.

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The age distribution of the respondents reveals that most were below 50 years old (65%), suggesting that displacement may particularly affect young people in the early stages of their careers. This group may be more susceptible to economic shocks and face long-term consequences on their economic prospects and human capital development. Additionally, respondents in their 40s and 50s may find displacement more disruptive to their established livelihoods. The relatively small percentage of respondents aged above 61 (10%) may be due to mobility constraints or health issues. However, this age group could be particularly vulnerable to adverse effects of displacement, such as the loss of social support networks or reduced access to healthcare. Therefore, the age distribution provides valuable information about the potential repercussions of displacement on different age groups within the population.

4.2. Compensation Measures and Adequacy for Displaced Households

The data from Table 3 reveals that compensation was given to households affected by displacement, with 64.3% of them receiving replacement land. This indicates that a significant portion of the displaced households was provided with an alternative piece of land to mitigate the impact of their displacement. However, it is worth noting that 35.7% of the households did not receive any replacement land, suggesting that a substantial number of affected households were not adequately compensated.

Table 3. Description about Paid Compensation.

		Frequency	Percentage (%)
Got replacement land	Yes	99	64.3%
	No	55	35.7%
Get compensation due to involuntary resettlement	Yes	154	100.0%
	No	0	0.0%
Satisfaction with compensation	Satisfied	27	17.6%
	unsatisfied	126	82.4%
Compensation form	In cash only	23	14.9%
	In Kind only	0	0.0%
	Both	131	85.1%

Source: Sample Survey, 2023.

The primary form of compensation provided was in-kind benefits, with only a small proportion (14.9%) of the compensation being paid in cash. This finding is consistent with the results of Bereket's [53] study, which also expressed concerns about the effectiveness of compensation for involuntary displacement. In Bereket's study, a significant majority (82.4%) of the respondents expressed dissatisfaction with the compensation they received. This suggests that the compensation measures implemented may have been inadequate or insufficient to meet the needs and expectations of the displaced households.

Aboda [54] conducted a study in which households were given the option to choose between cash compensation and a relocation site with another plot of land. The rationale behind this approach may have been to provide flexibility and cater to the diverse needs of the affected households. However, Shaw & Saharan's [55] research highlighted that displaced households, particularly those who were already economically disadvantaged, faced significant challenges in their livelihoods. This

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suggests that the compensation measures, regardless of the options provided, may not have effectively addressed the underlying livelihood problems faced by the affected households.

The low satisfaction rate expressed by the respondents in relation to the compensation received indicates that there might have been underlying issues contributing to their dissatisfaction. Inadequate replacement land, insufficient compensation amounts, or a lack of consultation during the design of the compensation package could all be potential reasons for their discontent. These factors may have hindered the effectiveness of the compensation measures in addressing the losses and hardships experienced by the displaced households. Therefore, further examination and potential improvements to the compensation process are warranted to ensure that the needs and concerns of the affected households are adequately addressed.

4.3. Inferential Analysis of WTA Compensation

4.3.1. Normality Test for Continuous Data

In Table 4, the Shapiro-Wilk W test was conducted on the variables "satcom" (estimated compensation) and "comamt" (paid compensation amount) with a sample size of 154 observations. This test, as described by Mishra [56], is used to assess whether these variables follow a normal distribution. The results of the Shapiro-Wilk test showed that the W statistic for "satcom" was 0.645, with a corresponding p-value of 0.916. Similarly, for the variable "comamt," the W statistic was 0.519, and the associated p-value was 0.916. In both cases, the computed test statistics were higher than the predetermined significance level of 0.05.

Table 4. Shapiro-Wilk W test for 3-parameter lognormal data.

Variable	Obs	W	V	z	Prob>z
satcom	154	0.645	42.239	-1.380	0.916
comamt	154	0.519	57.299	-1.380	0.916

As a result, the null hypothesis, which assumes that both "satcom" and "comamt" conform to a normal distribution, could not be rejected. This suggests that there is insufficient evidence to indicate deviations from normality in these variables. Therefore, based on the results of the Shapiro-Wilk W test, it can be concluded that both "satcom" and "comamt" exhibited normal distributions. For a more detailed analysis of the test output, please refer to Appendix number 1.

4.3.2. Significant Predictors of Compensation Acceptance

Household characteristics have been recognized as influential factors in determining the decision to accept compensation, reflecting an individual's desire for satisfaction [57]. However, the significance of compensation factors may vary based on the level of confidence. In order to investigate the willingness of displaced households to accept paid compensation, Ahiale [58] adopted probit analysis, which involves responses in the form of "yes" or "no." The characteristics of a household, including household income, education, age, gender, family size, and location, play a significant role in shaping their inclination to accept compensation in cases of loss or damage [59]. For instance, households with higher income levels may not be interested in accepting low compensation, whereas those with lower income levels may be more inclined to accept the same amount of compensation [57]. Similarly, the age and gender of household members can also exert an influence on their decision to accept compensation [60].

Probit analysis is a suitable statistical method employed to establish the relationship between a binary response (yes or no) and various independent variables, such as household income, education, age, gender, family size, and marital status. This type of analysis assists in identifying which household characteristics serve as significant predictors of the willingness to accept compensation.

 doi:10.20944/preprints202402.1501.v1

The dependent variable in probit analysis assumes a value of 0 or 1, indicating the absence or presence of a specific feature or outcome of interest [61]. By utilizing probit analysis, researchers can gain insights into the significant determinants of households' acceptance of compensation.

The findings from the probit regression analysis presented in Table 5 provide valuable insights into the relationship between household satisfaction levels and various independent variables. The analysis reveals that compensation amount (lcomamt) and reported satisfaction with compensation (lsatcom) have significant impacts on satisfaction levels.

Table 5. Probit regression.

satis	Coef.	St.Err.	t-value	p-value	[95% Conf Interval]		Sig
lcomamt	2.854	.628	4.55	0	1.624	4.085	***
lsatcom	-2.818	.651	-4.33	0	-4.094	-1.543	***
sex	-.905	.582	-1.55	.12	-2.046	.236	
marl	2.334	.846	2.76	.006	.676	3.993	***
relg	2.326	.829	2.81	.005	.701	3.951	***
empy	.084	.512	0.16	.869	-.92	1.089	
age	.002	.021	0.08	.938	-.04	.044	
edu	.791	.304	2.61	.009	.196	1.386	***
fam	-.013	.193	-0.07	.947	-.392	.366	
lincom	.003	.137	0.02	.981	-.265	.271	
repl	.893	.567	1.58	.115	-.218	2.005	
Constant	-8.889	4.4	-2.02	.043	-17.512	-.265	**

Mean dependent var	0.182	SD dependent var	0.387
Pseudo r-squared	0.635	Number of obs	154
Chi-square	92.798	Prob > chi2	0.000
Akaike crit. (AIC)	77.237	Bayesian crit.(BIC)	113.680

*** *p<.01*, ** *p<.05*, * *p<.1*

Note: P-values for statistical implications are denoted by *** for 1%, and ** for 5% significance levels.
Source: Own estimates (2023), (Please see Appendix number 2 for the Stata output.).

The coefficient for compensation amount (lcomamt) is 2.854, with a standard error of 0.628. This suggests that a one-unit increase in the logarithm of compensation amount is associated with a 2.854 increase in the probability of satisfaction. The coefficient is statistically significant (t-value = 4.55, p <

 doi:10.20944/preprints202402.1501.v1

0.001), indicating a strong positive impact of compensation amount on satisfaction levels. This finding highlights the importance of providing adequate compensation to ensure satisfaction among affected households.

On the other hand, reported satisfaction with compensation (lsatcom) has a coefficient of -2.818, with a standard error of 0.651. This implies that a one-unit increase in the logarithm of reported satisfaction with compensation leads to a 2.818 decrease in the probability of satisfaction. The coefficient is statistically significant (t-value = -4.33, $p < 0.001$), indicating a negative relationship between reported satisfaction and overall satisfaction. This suggests that if individuals are dissatisfied with the compensation they receive, their overall satisfaction levels are likely to be lower.

Marital status (marl) and religious affiliation (relg) also demonstrate significant associations with satisfaction. The coefficients for marl and relg are 2.334 and 2.326, respectively, indicating that being married or having a religious affiliation increases the probability of satisfaction. Both coefficients are statistically significant ($p < 0.01$). These findings suggest that demographic characteristics such as marital status and religious affiliation play a role in determining satisfaction levels.

Education level (edu) is another significant factor influencing satisfaction. It has a coefficient of 0.791, with a standard error of 0.304. This suggests that a one-unit increase in the logarithm of education level is associated with a 0.791 increase in the probability of satisfaction. The coefficient is statistically significant (t-value = 2.61, $p = 0.009$), indicating a positive correlation between higher education and satisfaction. This finding highlights the importance of educational attainment in determining satisfaction levels.

In contrast, variables such as gender (sex), employment status (empy), age, family size (fam), land income (lincom), and replaced land (repl) do not exhibit significant effects on satisfaction levels. Their non-significant coefficients and p-values suggest that these factors do not have a strong influence on overall satisfaction.

The pseudo R-squared value indicates that the model explains over 63% of the variation in satisfaction levels, suggesting its robustness. The chi-square value confirms the strong fit of the model, further validating its statistical significance.

The significant variables identified in this analysis can inform policymakers in designing displacement compensation policies. Adequate compensation amounts, along with ensuring satisfaction with the compensation received, are crucial factors in promoting household satisfaction. Additionally, considering demographic characteristics such as marital status, religious affiliation, and education level can help policymakers tailor compensation policies to better meet the needs and preferences of different groups within the affected community.

It is important to note that variables achieving significance at different confidence levels provide nuanced insights into the decision-making process related to accepting compensation. Factors such as compensation amount, marital status, religion, education, and expected amounts of fair compensation, which achieve significance at the 99% confidence level, are likely to have a substantial impact on the decision to accept compensation. Variables achieving significance at the 95% confidence level, including respondent gender, replaced land, and forms of compensation, may also influence the decision, although their impact may be slightly weaker or more variable.

Therefore, these findings offer valuable guidance for policymakers in understanding the determinants of household satisfaction with compensation. By considering the significance of compensation amount, satisfaction with compensation, marital status, religious affiliation, and education level, policymakers can design more effective and tailored compensation policies that address the specific needs and preferences of the affected community.

4.3.3. Impact of Compensation Amount on Satisfaction Likelihood

Table 6 provides insightful information about the relationship between compensation-related variables and household satisfaction levels. It demonstrates how satisfaction likelihood changes when predictors increase by one unit, while holding other variables constant. The results reveal that

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higher compensation amounts have a positive impact on satisfaction, whereas higher reported satisfaction with compensation decreases overall satisfaction probability.

Table 6. Marginal effect of the Variable.

Average marginal effects Number of obs = 154

Model VCE : OIM

Expression : Pr (satis), predict ()

dy/dx w.r.t.: lcomamt lsatcom sex marl relg empy age edu fam lincom exp repl

	Delta-method					
	dy/dx	Std.Err.	z	P>z	[95%Conf.	Interval]
lcomamt	0.276	0.046	6.050	0.000	0.186	0.365
lsatcom	-0.272	0.049	-5.600	0.000	-0.367	-0.177
sex	-0.086	0.055	-1.550	0.122	-0.194	0.023
marl	0.233	0.087	2.670	0.008	0.062	0.403
relg	0.223	0.067	3.330	0.001	0.092	0.355
empy	0.005	0.053	0.080	0.932	-0.100	0.109
age	-0.000	0.002	-0.010	0.989	-0.005	0.005
edu	0.075	0.026	2.840	0.004	0.023	0.127
fam	-0.001	0.019	-0.030	0.978	-0.038	0.037
lincom	0.001	0.014	0.070	0.945	-0.026	0.028
exp	-0.000	0.000	-0.170	0.861	-0.000	0.000
repl	0.089	0.055	1.620	0.105	-0.019	0.197

Source: Own estimates (2023), (Please see Appendix Number 3 for the Stata output.).

Specifically, an increase of one unit in compensation amount (lcomamt) is associated with a significant 0.276 increase in the probability of satisfaction ($z = 6.050$, $p < 0.001$, 95% CI: 0.186 to 0.365). Conversely, a one-unit increase in reported satisfaction with compensation (lsatcom) corresponds to a significant 0.272 decrease in the probability of satisfaction ($z = -5.600$, $p < 0.001$, 95% CI: -0.367 to -0.177).

Furthermore, marital status (marl), religious affiliation (relg), and education level (edu) also exhibit positive associations with satisfaction likelihood. A one-unit increase in marital status leads to a significant 0.233 increase in the probability of satisfaction ($z = 2.670$, $p = 0.008$, 95% CI: 0.062 to 0.403). Similarly, a one-unit increase in religious affiliation corresponds to a significant 0.223 increase in the probability of satisfaction ($z = 3.330$, $p = 0.001$, 95% CI: 0.092 to 0.355). Additionally, a one-unit increase in education level is associated with a significant 0.075 increase in the probability of satisfaction ($z = 2.840$, $p = 0.004$, 95% CI: 0.023 to 0.127).

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However, the impact of income (lincom) on satisfaction likelihood is not statistically significant (z = 0.070, p = 0.945, 95% CI: -0.026 to 0.028). Similarly, variables such as gender, employment, age, family size, income, expected fair compensation, and replaced land show no significant effects.

Based on the regression analysis, compensation amount, satisfaction level, marital status, religion, and education are identified as crucial factors influencing household satisfaction.

These findings have significant implications for displacement compensation policies, aiming to provide adequate reimbursement, ensure perceived fairness, and consider recipient characteristics such as marriage and religion in program design. Policymakers can use these empirical insights to develop data-informed strategies that promote equitable outcomes after displacement, tailoring compensation schemes to meet the specific needs and preferences of the affected community.

4.4. Minimum Acceptable Compensation

The examination adopts an approach that calculates the minimum acceptable remuneration by comparing household characteristics with the compensation amount required for contentment. Previous studies by Tadesse [50], Li [40], and Sangkapitux [62] have utilized this approach. Contentment is evaluated using a binary term, and additional factors influencing contentment are considered when estimating the marginal willingness to accept compensation (MWTA). This involves dividing the coefficient of the compensation amount by the projected compensation and multiplying it by the cost of the loss or inconvenience.

To assess households' readiness to accept compensation, the study employs the contingent valuation (CV) approach, which provides a method for evaluating welfare estimates associated with accepting monetary compensation. The findings indicate that the Minimum Willingness to Accept (MWTA) for households is -2.274 billion Ethiopian Birr, ETB. This value significantly exceeds the actual amount paid, indicating substantial opposition to displacement among the majority of households. It is important to note that the displayed value appears larger due to logarithmic transformation, but the actual number is smaller as non-monetary aspects are not captured. However, this highlights the need for compensation strategies that consider households' preferences and needs, including non-monetary forms of compensation.

The research calculates the minimum acceptable compensation by comparing household characteristics, revealing a substantial amount of money that reflects their preference to retain their possessions rather than accepting cash. This strong opposition to displacement emphasizes the necessity of compensation schemes tailored to preferences and non-monetary aspects, in addition to cash options. The widespread discontent among respondents underscores the importance of designing compensation schemes based on specific circumstances and factors, ensuring livelihood sustenance without further disruptions.

The data further reveal widespread discontent among respondents regarding the compensation received, particularly in relation to replacement land that does not match the unique characteristics of the relinquished property. Consequently, the study highlights the significance of designing compensation schemes that are specific to the circumstances and requirements of diverse households and populations. Policymakers and officials should consider various household characteristics and factors that influence willingness to accept compensation when formulating compensation schemes for development projects. The CV approach used in this investigation provides valuable insights into households' willingness to accept compensation, thereby facilitating the development of more effective and equitable compensation schemes for all affected households.

5. Conclusions

The study conducted a survey among 154 households that experienced displacement to identify key factors influencing their willingness to accept compensation. Results revealed that compensation amount, satisfaction level, marital status, religious affiliation, and education level significantly influenced household satisfaction and willingness to accept compensation. These quantified factors provide valuable insights for policymakers to design tailored compensation schemes for affected households.

 doi:10.20944/preprints202402.1501.v1

Furthermore, the study highlighted a significant mismatch between compensation paid and the value of expropriated properties, leading to widespread dissatisfaction among respondents regarding their involuntary resettlement. The study estimated that the Minimum Willingness to Accept (MWTA) compensation levels exceeded the actual amounts paid. This emphasizes the need for compensation schemes that accurately assess and value losses, considering relocation and livelihood rebuilding costs.

Using the Contingent Valuation Method (CVM), the study calculated minimum acceptable compensation amounts based on household characteristics. The results clearly demonstrated that MWTA compensation levels surpassed actual payments. Policymakers can utilize these findings to establish fair and adequate compensation practices, addressing losses from development projects more equitably.

In conclusion, this study highlights the importance of data-driven, needs-based compensation approaches for achieving equitable outcomes in involuntary displacement cases. Incorporating these findings into policy decisions enables policymakers to address the needs and rights of affected individuals. The study sheds light on minimum compensation requirements and preferences, emphasizing the need for fair and customized compensation policies. By considering household possessions, ecosystem services, and non-monetary aspects, more effective and equitable compensation schemes can be developed to address the specific circumstances of affected households.

Author Contributions: Conceptualization, Methodology and Software, Adane Egze; Validation, Tesfaye Zeleke and Abrham Seyoum; Investigation, Resources and Original Draft, Adane Egze; Writing—review & editing, Tesfaye Zeleke and Abrham Seyoum. All authors have read and agreed to the published version of the manuscript.

Funding Information: This research received no external funding.

Data Availability Statement: The data presented in this study are available on request from the corresponding author.

Acknowledgment: The authors demonstrate their profound appreciation to all the enthusiastic participants who actively engaged in this investigation, recognizing the immense significance of their time and readiness to cooperate. Furthermore, the authors extend their heartfelt gratitude to the research team for granting them the chance to carry out interviews, and to the community members inhabiting the research areas for their warm reception and collaborative endeavors.

Conflict of Interest: The authors declare no conflict of interest.

Appendix

1. Normality test

```
. swilk comamt satcom incom exp , lnnormal

          Shapiro-Wilk W test for 3-parameter lognormal data

    Variable |        Obs       W           V          z       Prob>z
-------------+-------------------------------------------------------
      comamt |        154    0.51854     57.299     -1.380    0.91613
      satcom |        154    0.64509     42.239     -1.380    0.91613
       incom |        154    0.49798     59.746     -1.380    0.91613
         exp |        154    0.79744     24.107     -1.380    0.91613
```

 doi:10.20944/preprints202402.1501.v1

2. Probit Regression

```
. probit satis lcomamt lsatcom sex marl relg empy age edu fam lincom repl

Iteration 0:   log likelihood = -73.017454
Iteration 1:   log likelihood = -36.359305
Iteration 2:   log likelihood = -28.604335
Iteration 3:   log likelihood = -26.680277
Iteration 4:   log likelihood =  -26.61851
Iteration 5:   log likelihood = -26.618374
Iteration 6:   log likelihood = -26.618374

Probit regression                                 Number of obs     =        154
                                                  LR chi2(11)       =      92.80
                                                  Prob > chi2       =     0.0000
Log likelihood = -26.618374                       Pseudo R2         =     0.6355
```

satis	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
lcomamt	2.854211	.6278795	4.55	0.000	1.62359	4.084832
lsatcom	-2.818253	.6508868	-4.33	0.000	-4.093967	-1.542538
sex	-.9050793	.5822652	-1.55	0.120	-2.046298	.2361395
marl	2.334335	.8462185	2.76	0.006	.6757768	3.992893
relg	2.325933	.8290091	2.81	0.005	.7011049	3.950761
empy	.0843167	.5123773	0.16	0.869	-.9199244	1.088558
age	.0016604	.0213528	0.08	0.938	-.0401904	.0435112
edu	.7912911	.3035946	2.61	0.009	.1962567	1.386326
fam	-.0127437	.193274	-0.07	0.947	-.3915537	.3660663
lincom	.0032125	.1366867	0.02	0.981	-.2646884	.2711134
repl	.8934091	.566958	1.58	0.115	-.2178081	2.004626
_cons	-8.888688	4.399682	-2.02	0.043	-17.51191	-.2654707

3. Marginal Effects

```
. margins, dydx (lcomamt lsatcom sex marl relg empy age edu fam lincom exp repl)

Average marginal effects                          Number of obs     =        154
Model VCE    : OIM

Expression   : Pr(satis), predict()
dy/dx w.r.t. : lcomamt lsatcom sex marl relg empy age edu fam lincom exp repl
```

	dy/dx	Delta-method Std. Err.	z	P>|z|	[95% Conf.	Interval]
lcomamt	.2758022	.0455848	6.05	0.000	.1864576	.3651468
lsatcom	-.2718646	.0485631	-5.60	0.000	-.3670466	-.1766826
sex	-.0855208	.0553275	-1.55	0.122	-.1939606	.0229191
marl	.2325379	.0871197	2.67	0.008	.0617865	.4032892
relg	.2234822	.0671583	3.33	0.001	.0918543	.3551101
empy	.0045359	.0534997	0.08	0.932	-.1003215	.1093933
age	-.000031	.0023305	-0.01	0.989	-.0045988	.0045367
edu	.0752633	.0264551	2.84	0.004	.0234122	.1271143
fam	-.0005176	.0189287	-0.03	0.978	-.0376172	.036582
lincom	.000937	.013557	0.07	0.945	-.0256342	.0275082
exp	-5.59e-08	3.20e-07	-0.17	0.861	-6.84e-07	5.72e-07
repl	.0892955	.0550879	1.62	0.105	-.0186749	.1972659

 doi:10.20944/preprints202402.1501.v1

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