WHAT SHAPES ACCEPTANCE DURING WAR? A MACHINE LEARNING ANALYSIS OF ATTITUDES TOWARD LGBT INDIVIDUALS IN UKRAINE

by

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Abstract

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What are the main determinants of the attitudes toward LGBT community in Ukraine during wartime? Prior literature identifies several socio-demographic predictors of such attitudes—age, sex, educational attainment, religiosity, and the broader political, legal, and economic context—but reveals critical gaps. These include a limited distinction between general attitudes and support for equal rights, a lack of research in developing and transitioning economies, and the absence of comprehensive models that integrate occupational and regional factors. Addressing these gaps, this study examines how professional and regional characteristics—such as occupation, poverty levels, democratic development, and degree of urbanization—influence perceptions of the LGBT community in wartime Ukraine. Attitudes are analysed across four dimensions: general acceptance of LGBT people, support for their civil and human rights, and perceptions of LGBT Ukrainian soldiers. Using contemporary machine learning techniques, including Gradient Boosting and Random Forest, the analysis draws on survey data from 2022–2024 provided by the Kyiv Institute of Sociology and the LGBT Human Rights NASH SVIT Centre. The findings indicate that women, younger individuals, students, those with higher education and income, and residents of urban areas are generally more accepting of LGBT individuals. Conversely, manual labourers, military personnel, and housekeepers exhibit higher levels of scepticism. Additionally, the results propose an unexpected positive correlation between adherence to Orthodox Christianity and LGBT acceptance. These insights are valuable for policymaking in low- and middle-income countries and can support Ukraine's efforts to promote diversity and equality on its path toward EU integration.

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LIST OF ABBREVIATIONS

EU European Union

KIIS Kyiv International Institute of Sociology

LGBM Light Gradient-Boosting Machine

LGBT Lesbian, Gay, Bisexual and Transgender

ML Machine Learning

NGO Non-Governmental Organization

SMOTE Synthetic Minority Oversampling Technique

PDP Partial Dependence Plot

CHAPTER 1. INTRODUCTION

Despite significant progress in the overall tolerance with respect to LGBT[1] (lesbian, gay, bisexual and transgender) individuals, there are a plethora of actions to be implemented, especially for countries, which have not yet fully embraced anti-discrimination policies. This study seeks to identify and explore the main predictors of attitudes toward LGBT people in Ukraine during the full-scale Russian invasion over the period from 2022 to 2024, with a specific focus on regional and occupational determinants.

The topic of equality in Ukraine among different strata of society can be considered pressing in light of Ukraine's European Union (EU) candidate status and its human rights policy implications. While the percentage of Ukrainians in 2024, who have negative attitudes toward the LGBT community (32,1%), has decreased almost twofold since 2016 (60,4%), the group continues to face legal and social discrimination (Kyiv Institute of Sociology, “Perception of LGBT People”). During the past few years, there were numerous recorded acts of aggression and discrimination based on homophobic and transphobic beliefs (LGBT Human Rights NASH SVIT Center, “Ukrainians Have Dramatically Improved”). At the same time, Ukrainian legislation does not provide any form of legal recognition of same-sex relationships, while also failing to accept the Bill №9103 on registered same-sex civil partnerships and adopt the amendments of the Bill №5488 concerning discrimination grounding on homo-/transphobic beliefs (LGBT Human Rights NASH SVIT Center, “LGBTQ Situation”). This creates a significant gap between societal progress in attitudes toward the LGBT community and the existing legislative and policy measures ensuring their full legal and social equality. This also highlights the necessity for timely and comprehensive implementation of anti-

[1] This paper uses the term “LGBT” rather than the more inclusive “LGBTIQ+” (which encompasses intersex, queer, and questioning identities) to maintain consistency with the survey instrument and ensure coherence in the methodology and analysis.

discrimination laws to align Ukraine's policies with its commitments as an EU candidate country and its aspirations toward human rights advancement.

The theory on attitudes toward LGBT people explores various socio-demographic determinants, including *sex, age, education, political preferences, religiosity* and *other contextual settings*. Despite the abundance of studies, only a handful cover attitudes toward the rights of the LGBT community. Furthermore, there is a significant shortage of studies devoted to emerging, developing and transitioning economies on this issue. Such countries require heightened attention as they tend to face persistent challenges in terms of reducing intolerance of various minority groups. The theoretical framework lacks sufficient sophisticated analyses that integrate all the predictors. Specifically, regional discrepancies, economic and political instability are often omitted despite their capacity to shift attitudes in various directions. These arguments altogether indicate that there is a significant gap in the existing body of knowledge on the attitudes toward LGBT individuals, which ought to be addressed.

The current research attempts to eliminate the aforementioned drawbacks by focusing on Ukraine as a case study, and grasping on a wide range of determinants in the analysis. The analysis seeks to offer a unique viewpoint on this matter by incorporating variables accounting for regional differences in various features, and the state of economic and social instability caused by the Russian full-scale invasion of Ukraine. Besides common predictors discussed in the literature, our model accounts for the democratic orientation of the regions in Ukraine, the occupation of the respondents, and urbanisation, additionally controlling for the fact of internal displacement caused by the war, the language (Ukrainian or Russian) the respondent prefers to speak and others. Moreover, the attitudes toward equal rights provision are explored in the light of the multidimensionality in equality, such as the attitude toward LGBT community in general, the support of their fundamental rights, and the attitude toward LGBT Ukrainian soldiers, which will result in a comprehensive evaluation of attitudes toward LGBT people in Ukraine.

The analysis is based on unique data collected by the Kyiv International Institute of Sociology (KIIS) by request of the LGBT Human Rights Center "NASH SVIT" during the course of 2022-2024. The dataset ensures a representative sample of the Ukrainian population, excluding residents of territories that are temporarily uncontrolled by Ukrainian authorities, capturing necessary socio-demographic characteristics of the respondents. Several lacking variables: religion and religiosity, the support of the democratic values and regional poverty, were separately derived from two other KIIS surveys as regional approximates.

The novelty of this study lies in the application of several machine learning (ML) algorithms - Gradient Boosting and its variations, Random Forest, and Logistic Regression, as the primary methodological approach. Unlike some previous studies that rely on simple linear or logistic regressions, these algorithms are more adept at capturing complex, nonlinear relationships between predictors and the outcome variable. This makes them suitable for analysing societal attitudes, which are often shaped by a range of interrelated factors. Moreover, both Gradient Boosting and Random Forest allow for the identification of feature importance, providing valuable insights into the key determinants of attitudes, particularly among the most sceptical social groups. By employing this robust and multi-faceted approach, this study aims to deliver more accurate, reliable, and meaningful results.

The contribution of this study is twofold: on the one hand, our results will provide valuable insights for the global research community by advancing the understanding of attitudes formation toward LGBT individuals in middle-income economies with traditionally guided mentalities. On the other hand, the findings are expected to help foster equal rights in Ukraine by identifying the most sceptical strata of society, enabling the government and Non-Governmental Organisations (NGOs) to focus on developing targeted policies and initiatives to promote greater tolerance.

CHAPTER 2. LITERATURE REVIEW

To begin with, we define the concept of an *attitude* in terms of social psychology as evaluations of objects in our social world, including people, social groups, physical objects, behaviours, and abstract concepts based on a relatively enduring organisation of affective, behavioural, and cognitive information (Taylor et al. 133; Baumeister and Finkel 177; Arima 24; Hogg and Vaughan 154; Myers and Twenge 73).

When analysing attitudes toward LGBT individuals, the concept of *sexual prejudice* is widely used in the literature, referring to negative attitudes based on sexual orientation. It differs from attitudes toward institutionalised sexual stigma, such as laws restricting marriage equality or adoption rights. For instance, one may support civil rights for a group they personally disapprove of. Sexual prejudice is shaped by emotional factors (fear, disgust, anger) and stereotyping, which frames LGBT people as predatory, hypersexual, or conspiratorial (Herek 356–64). This distinction sets the foundation for understanding how attitudinal predictors may vary across different dimensions of attitude—such as general sentiment toward LGBT individuals, support for their civil rights, and attitudes toward specific equal rights policies—since emotional responses, stereotypes, and personal values may influence each dimension differently.

The literature offers three models for analysing attitude formation. The one-component model defines attitudes as affect toward or evaluation of an object. The two-component model views attitudes as a mental readiness to act, guiding judgmental responses (Hogg and Vaughan 155). The most comprehensive, the three-component model, includes affective (emotions toward a stimulus), behavioural (tendencies to act), and cognitive (beliefs and knowledge) elements. While some debate the behavioural component's role, all three contribute to attitude formation (Fiske et al. 353–82; Myers and Twenge 74; Taylor et al. 133). Given this study's focus on demographic and socio-economic predictors, the three-component model is most relevant, as it captures the interplay of

cognitive (e.g., beliefs shaped by education, gender norms and religion), affective (e.g., language preference linked to one's identity), and behavioural (e.g., political, occupational, urbanisation- and sex-related behavioural patterns) factors.

Irrespective of the number of components behind the attitudes' formation, theory recognizes that socio-demographic characteristics play an important role in defining an individual's attitudes. In general, researchers consider *sex, religiosity and religion, education, age, political ideologies, economic, social and legal contexts* and *other factors*. It is important to note that in the following section, the terms "homosexual individuals" and "homosexuality" are used to maintain consistency with the terminology employed in the reviewed literature, even though more contemporary and inclusive terms may be preferred in other contexts.

2.1 SEX

The majority of studies suggest that *females* have more positive attitudes toward homosexuality than males (Andersen and Fetner; Daniels; Slenders et al.; Paradela-López et al.; Roggemans et al.; Rudenko; Adamczyk and Pitt; Collins et al.; Ayoub and Garretson; Hooghe and Meeusen; Pampel; Smith et al.; Marsh and Brown). The primary reason is that men are more concerned about gender norms violation (Slenders et al. 350). Additionally, men are less capable of adopting feminine behavioural patterns due to the strictness of gender roles and, thus, are less in favour of gay men, who violate their perception of such norms (Roggemans et al. 259). From the social psychology perspective, sexual prejudice can also strengthen interpersonal relations with valued groups, where men seek to gain acceptance by heterosexual males (Nelson 372).

However, several studies have failed to find any statistically significant difference in attitudes between men and women, like in the case of Chile panel data analysis (Paradela-López et al.). Yet, Ukraine is likely to fall in the category of countries characterised by the presence of gender-specific attitudes. For instance, a psychological study on gender and homophobia in high-school students in

the Rivne region revealed strongly gendered patterns in many attitudes or emotions: A significant correlation was established between intolerance and aggression for males, along with the values of conformity, power, and dependence. As for females, there was a positive relationship with hedonism and universalism, while traditionalism was related to higher levels of intolerance toward homosexual individuals (Rudenko). Considering these findings, we can a priori anticipate that in our study male sex will be associated with more negative attitudes toward LGBT community.

2.2 RELIGION AND RELIGIOSITY

Many authors find *religion* and *religiosity* important when it comes to forming attitudes toward homosexuality (Andersen and Fetner; Ayoub and Garretson; Roggemans et al.; Slenders et al.; Collins et al.; Adamczyk and Pitt). Religious members of society advocate for conservative values and are most commonly against homosexual individuals. One reason for this is the fear of divine punishment and a threat of being excluded from their communities. Hence, expressing adverse attitudes against same-sex relationships is seen as a way of affirming the individual's self-concept as a religious and moral person (Nelson 372). Furthermore, intrinsic feelings about religion form more negative attitudes toward LGBT individuals than extrinsic ones, like security, comfort, and status (Slootmaeckers and Lievens). Commonly, religious people, as responsible citizens, tend to encourage others to adopt their homophobic views and advocate for the implementation of anti-LGBT policies, which may lead to the spread of negative attitudes among others (Adamczyk and Pitt 339).

However, the ultimate impact of religiosity depends on the type of one's religious denomination. More hierarchical religions, such as Muslims, have been found to negatively influence individuals' attitudes toward homosexual people (Slenders et al. 350; Roggemans et al. 265; Collins et al. 433; Hooghe and Meeusen). Similarly, Orthodox Christianity has been identified as a negative factor in forming attitudes toward homosexuality (Slenders et al. 350). This finding is relevant for our analysis since Ukraine's population can be considered highly religious with Orthodox Christianity

being predominant (approximately 70% of the population) (KIIS, “Religious self-identification”). This suggests that as Orthodox majority, Ukrainians are likely to hold negative attitudes toward the LGBT community.

2.3 EDUCATION

The majority of studies have discussed the role of *education* in determining the attitudes toward same-sex relationships, with the vast majority finding a positive relationship (Hooghe and Meeusen; Roggemans et al.; Slenders et al.; Paradela-López et al.; Zhang and Brym; Seligson et al.; Ohlander et al.). Education, through its normative function, promotes liberal values and accelerates assimilation of new ideas and progressive views, ensuring tolerance is formed (Slootmaeckers and Lievens; Paradela-López et al. 579; Slenders et al. 350; Ohlander et al.). However, some authors note that the impact of education varies depending on countries’ development levels: while in progressive economies, higher education contributes to open-mindedness, in authoritarian regimes, the effect seems to be the opposite (Seligson et al.; Zhang and Brym).

The empirical evidence regarding educational effects on attitudes toward homosexual individuals remains, however controversial. For instance, Daniels’ study on the attitudes in the USA during 1988-2014 did not discover any statistical evidence for education being influential, while Pampel's research on cohorts and attitudes toward various sexual behaviours in the USA, including homosexual individuals, has found a large positive effect of education (Daniels 1661; Pampel).

The effect of education in Ukraine may differ from the literature due to the societal expectation that everyone obtains higher education. This implies that even if an individual in Ukraine has high educational attainment, it does not necessarily suggest that the person has the benefits of broader exposure to diverse perspectives, critical thinking development, or the liberalising effects typically associated with higher education in other contexts. Nevertheless, considering these studies and the context, education is expected to affect attitudes toward LGBT people in Ukraine positively.

2.4 AGE

Age is a common predictor for determining attitudes toward homosexual individuals. Generally, older people tend to be more sceptical about this group, which has been supported by a wealth of cross-sectional and national studies (Andersen and Fetner 952; Hooghe and Meeusen; Adamczyk and Pitt; Smith et al.; Slenders et al.; Dunn). The negative impact of age is often explained by the fact that older individuals have experienced times when homosexuality was illegal and sinful (Pampel).

Apart from age, the birth cohort and the historical period are also valued as impactful (Paradela-López et al. 579). Specifically, attitudes are believed to evolve during the lifetime, as living through major social events and movements can affect one's attitudes significantly. Furthermore, over time, groups having more tolerant attitudes reinforce more tolerant attitudes overall by becoming the population majority, as long as the determinants of sexual attitudes stay constant (Pampel).

Ukraine's demographics is well-known to consist of an aging population with the median age being 40.8 as of 2020 (Statista). This implies that the majority of the population has lived under the Soviet Union, known for its social prejudice and persecution of the LGBT individuals (Healey). Overall, this suggests that age will be a negative predictor of attitudes in the case of Ukraine, with older respondents having more negative attitudes toward LGBT people.

2.5 POLITICAL IDEOLOGIES

Conservatism is often assumed to be a negative determinant of attitudes toward homosexual people, as acceptance, tolerance and support for such communities is essentially a *liberal* and modern value (Van Der Toorn et al.; Smith et al.; Daniels 1661). Additionally, right-wing affiliation can become a source of prejudice toward homosexuality (Paradela-López et al.). Similarly, citizens of

former Communist countries have been shown to report hostility toward the group under study (Smith et al.)

Nowadays, Ukraine does not have a clear division into left and right wing within the political parties but is rather characterised by pro-Russian and pro-western parties, with the prevalence of the latter. Furthermore, a survey conducted in the end of 2023 reveals that Ukrainians tend to prioritise democracy over having a strong leader, which further indicates that Ukraine's population strongly favours democratic and hence egalitarian values (Kyiv International Institute of Sociology, "To What Extent"). Hence, one can expect that respondents holding more pro-western values are likely to have more positive attitudes toward LGBT individuals in Ukraine.

2.6 LEGAL AND ECONOMIC SETTINGS

The *legalization of same-sex marriage* positively influences societal attitudes by incentivizing the normalization of such partnerships (Slenders et al. 358; Smith et al.). Countries with same-sex marriage laws show lower disapproval of homosexuality than those without, and tolerance is higher in nations with full marriage rights compared to those with only registered partnerships (Hooghe and Meeusen). In Ukraine, same-sex partnerships are not legalised yet. As mentioned previously, the relevant bill is awaiting parliamentary review, while the process has been repeatedly postponed and is currently stalled with no significant changes over the analysed period of 2022-2024.

In addition to the legal context, *economic settings* can influence one's attitudes toward homosexual individuals. Developed economies that have completed industrialization and modernization tend to foster more tolerant views, as rising living standards shift priorities from survival to self-expression (Adamczyk and Pitt 340). GDP per capita is a key predictor of national attitudes, with lower income levels and higher poverty rates linked to greater intolerance (Slenders et al.; Smith et al.; Paradela-López et al.). As a result, societies can be categorized as "survival-oriented" or "self-expression-oriented," with the former, such as Moldova and Zimbabwe, displaying less

acceptance of LGBT than nations like the USA and Japan (Adamczyk and Pitt). Applied to Ukraine, current economic instability, high inflation (13.4% as of February 2025), and emigration crisis, caused by the ongoing war, can be expected to retain the country in a "survival-oriented" state, hindering the shift toward more progressive attitudes (National Bank of Ukraine).

2.7 OTHER FACTORS

Urbanisation has been demonstrated to be a positive factor in changing beliefs in the case of several countries (Paradela-López et al.; Collins et al.). Collins et al, argue, for instance, that people living in highly urbanised London were the most tolerant to LGBT community, which might be explained by the diversity of the capital, higher education and younger population in such areas (Collins et al.). Even if Ukraine is less urbanised than the USA or the EU, the country is more urbanised than the world's average (World Bank Open Data). This suggests that while major cities like Kyiv, Kharkiv, and Lviv may foster greater tolerance, similar to London, rural areas and smaller towns—where nearly a third of Ukrainians reside—may remain more conservative.

Profession and *employment* were also found important for attitudes formation, with unemployed and unskilled manual labourers being more homophobic than professionals, office workers, and students (Zhang and Brym). Anderson and Fetner attribute this to a strong correlation between the working class and authoritarianism. Their recent findings confirm that professionals are the most tolerant, followed by routine non manual workers, managers, and the working class (Andersen and Fetner). In Ukraine, according to official statistics, employment is heavily concentrated in trade, agriculture, industry, and public services, with fewer workers in professional and technical fields (State Statistics Service of Ukraine). Such employment patterns may contribute to occupational differences in LGBT people acceptance. The dominance of trade and industry, alongside a smaller share of professionals, suggests that societal attitudes may be slower to change compared to other developed economies.

2.8 RESEARCH QUESTION AND HYPOTHESES

The literature on the attitudes toward LGBT community presents a comprehensive overview of the possible predictors. While the existing research provides numerous findings on the relationship between these predictors and attitudes toward homosexual individuals, it is characterized by the existence of certain gaps and controversiality among authors. Firstly, only a few works focus on LGBT community rights and mainly consider attitudes toward the group itself. Nevertheless, attitudes toward the provision of equal rights may not be equivalent to the attitudes in general. Individuals may have negative perceptions of the LGBT people but still support the legalisation of their human and civil rights. At the same time, rights are more reflective of the equality toward the LGBT community since they tend to formalize the existing attitudes through laws.

Secondly, the majority of studies on homosexuality perception have been conducted in economically developed countries. As a result, there is a significant lack of research in this field for emerging, developing and transitioning economies. They are only briefly mentioned in the cross-sectional studies on the relationship between economic development factors and the attitudes toward homosexual individuals. This creates a significant gap in the existing body of knowledge on LGBT people since the findings from the developed world cannot always be generalized to societies of less developed economies.

Thirdly, research lacks an integral analysis that would simultaneously include all the factors in one model. The majority of studies include only several predictors while omitting others from the analysis. The investigation of factors such as regional discrepancies within the country, economic and political instability are usually not considered while they may shift attitudes in any direction. Moreover, income, occupation and urbanisation variables have not explicitly been evaluated and require further assessment in their impact on attitude formation.

This study attempts to eliminate the above gaps by focusing on Ukraine while covering a wide range of predictors by the analysis. The research question is: *what are the main determinants of the attitudes toward LGBT community in Ukraine during wartime?* The analysis seeks to offer a unique perspective on this matter by including several variables accounting for the state of economic and social instability caused by the Russian full-scale invasion of Ukraine. Furthermore, we will measure the attitude variable through several metrics, such as the attitude toward LGBT people in general, the support of their human and civil rights, and the attitude toward LGBT Ukrainian soldiers, which will contribute to a complex evaluation of multiple dimensions of equality, existing in the attitudes toward LGBT people in Ukraine.

Drawing upon the existing understanding of attitude formation, our expectations can be formulated as follows:

Hypothesis 1: Age is expected to have a negative impact on the attitudes to LGBT individuals and their rights;

Hypothesis 2: Women are anticipated to have more positive attitudes to LGBT people and their rights than men;

Hypothesis 3: People supporting democratic or modern values are expected to have more positive attitudes to LGBT individuals and their rights than those in favour of authoritarian or traditional values.

Hypothesis 4: People working in high esteemed professions, like specialists, and students are expected to have more positive attitudes LGBT individuals and their rights than housekeepers, the unemployed, labourers and agricultural workers;

Hypothesis 5: Soldiers are expected to have more negative attitudes to LGBT people and their rights compared to others;

Hypothesis 6: People living in regions with a larger share of Orthodox Christians are expected to have more negative attitudes to LGBT individuals and their rights than those living in regions with a lower share of Orthodox;

Hypothesis 7: Individuals living in urban areas are envisioned to have a positive effect on the attitudes to LGBT people and their rights;

Hypothesis 8: More educated respondents are anticipated to have more positive attitudes to LGBT individuals and their rights than the less educated;

Hypothesis 9: People living in regions with high poverty rates are anticipated to have more negative attitudes toward the LGBT individuals and their rights.

Hypothesis 10: Higher income is expected to create more positive attitudes toward LGBT individuals and their rights.

CHAPTER 3. DATA AND METHODOLOGY

3.1 DATA SOURCE

The study relies on yearly data collected between 2022 and 2024 by KIIS. The sample includes Ukrainian citizens aged 18 and above. The number of observations amounts to 2,011 in 2024, 2,013 in 2023, and 2,000 in 2022. The survey covers a reliable and representative sample of the Ukrainian population, excluding residents of territories temporarily occupied by Russia. It includes a range of socio-demographic characteristics of the respondents, along with several war-related variables.

3.2 VARIABLES CHOICE

The dependent variable in this study is the attitude toward LGBT individuals measured through four survey questions, each addressing a distinct aspect of equality. The first question captures the *general perception* of LGBT individuals and is operationalised by asking respondents to rate their overall attitude toward LGBT people. Responses are provided on a 5-point Likert scale ranging from 1 "Strongly Negative" to 5 "Strongly Positive" with 3 being an "Indifferent" option.

The second dependent variable measures *support for equal rights* for LGBT individuals operationalised through a question asking respondents whether LGBT people in Ukraine should have the same rights as other citizens. The response options are binary: "Yes, all should have equal rights" and "No, there should be some restrictions."

The third dependent variable gauges *support for registered partnerships for same-sex couples*. Respondents are asked whether they support the introduction of a registered partnership, similar to marriage but without the right to jointly adopt children. The response options are: "Yes," "No," and "Indifferent."

The fourth dependent variable assesses the level of support for the *participation of LGBT individuals in defence efforts*. This is measured through a question asking respondents their views on LGBT people's involvement in defending Ukraine against Russian aggression. The responses are provided on a 5-point Likert scale, ranging from 1 "Strongly Negative" to 5 "Strongly Positive" with 3 being an "Indifferent" option.

For each of these questions, respondents had the option to select "Hard to say" or "Refusal to respond," which were not read aloud by the surveyor. These options are treated as missing values in the analysis. Additionally, the four questions are not combined into a single composite variable. Instead, each question is treated individually to capture the distinct dimensions of attitudes, including general perception, equal rights, civil rights, and military service, resulting in four dependent variables. This approach allows for the identification of separate predictors for attitudes toward different aspects of equality for LGBT individuals.

The set of predictors includes key socio-demographic characteristics of respondents and the year the survey was conducted. *Age* is measured by asking individuals to state their age. *Gender* is captured by a question asking respondents to self-identify as either "man" or "woman," representing a binary variable. *Occupation* is measured by categorizing respondents into the following groups: "Labourer, agricultural worker," "Employee (non-physical labour that does not require higher education)," "Specialist (non-physical labour that requires higher education)," "Self-employed," "Entrepreneur, business owner, farmer"[2] "Military or law enforcement officer," "Housekeeper", "Retired (due to age, disability)," "Student," "Unemployed," and "Other."

[2] Farmers are included in this category due to their entrepreneurial and business-owning characteristics in the Ukrainian context.

Additionally, we measure respondents' type of residence (*Urbanisation*) including "Village", "Urban-Type Settlement", "City up to 20,000 people", "City 20,000–49,000 people", "City 50,000–99,000 people", "City 100,000–499,000 people", and "City 500,000 people and above".

Education is measured by respondents' highest level of educational attainment, categorized from 1, "Primary (less than 7 grades)", to 8, "Complete higher education", Similarly, *income* is operationalised by asking respondents to assess their family's financial situation by using a scale ranging from 1, "We don't even have enough money for food", to 5 - "At the moment, we can afford anything we want".

Non-individual measures include *poverty*, attitudes toward *democracy*, and *religion*. *Regional poverty* is a contextual variable indicating the percentage of households in each region with incomes below the legally established subsistence minimum. Poverty measures stem from the United Nations Economic Commission for Europe report, *Measuring Poverty in the Conditions of War in Ukraine*, which uses data from the Household Socio-Economic Status Survey conducted by the State Statistics Service of Ukraine in 2023 (Cherenko). *Attitudes toward democracy* are derived from a separate KIIS survey entitled "To what extent do Ukrainians consider Ukraine a democratic country and the priority of a democratic system" and conducted in 2023-2024. This variable captures the percentage of people in each region who agreed with the statement, "For Ukraine, a democratic system is more important than a strong leader." *Religion* is operationalised as the percentage of respondents in each region who selected the options "Orthodox Church of Ukraine," or "Orthodox Church (unspecified)" in response to the question, "To which denomination or religion, if any, do you belong?".

Year represents the year the survey was conducted and captures differences over time.

In addition, we control for respondents' *region* of residence, *displacement* status, and *language*. *The region* is limited to the following macro regions: Center (Kyiv, Vinnytsia, Zhytomyr, Kirovohrad, Poltava, Sumy, Cherkasy, Chernihiv regions, and Kyiv city); South (Dnipro, Zaporizhzhia, Mykolaiv, Odesa, Kherson regions), East (Kharkiv, Donetsk, Luhansk regions), and

West (Volyn, Zakarpattia, Ivano-Frankivsk, Lviv, Rivne, Ternopil, Khmelnytsky, Chernivtsi regions). *Displacement status* specifies whether or not the respondent has been displaced due to the war. Finally, *language* accounts for linguistic differences among respondents and was grouped into Russian or Ukrainian.

By including these variables in the analysis, we aim to identify primary factors influencing attitudes toward LGBT individuals in Ukraine. Each of the four attitudes will be modeled separately as outlined below:

Attitude = f(Age, Gender, Occupation, Urbanisation, Year, Education, Income, Poverty, Democracy, Year, Religion, Macroregion, Displacement, Language),

where all the predictors are operationalised as specified above.

3.3 METHOD

The present study utilizes several ML algorithms - Gradient Boosting and its variations, Random Forest, and Logistic Regression (baseline) - in order to identify the best-performing model for each of the four cases of interest. The choice of these methods is justified by their widespread utilisation for classification tasks due to their ability to capture complex, nonlinear relationships. Additionally, they effectively handle class imbalance, improving predictive accuracy while allowing for identification of the most influential factors impacting the dependent variable through feature importance analysis.

Gradient Boosting is an ensemble ML algorithm widely regarded as one of the most effective for supervised tasks such as prediction and classification. This method's strength is to combine multiple weak learners, specifically decision trees, to form a strong predictive model. The algorithm operates by sequentially adding decision trees, with each new tree being trained to correct the errors made by the previous tree. In this iterative process, the residual errors from the preceding model are targeted to refine the predictions. Key elements of Gradient Boosting include the base learner

(decision tree), a loss function to assess model performance, and a boosting mechanism that adjusts the weights of observations based on their prediction errors. By using gradient descent, the algorithm minimizes the loss function, allowing each new tree to contribute to reducing overall prediction errors. This iterative refinement enables Gradient Boosting to effectively capture complex nonlinear relationships, making it a powerful tool for analysing intricate data, such as societal attitudes. In our study, we utilize Light Gradient-Boosting Machine (LGBM) Gradient Boosting, AdaBoost and XBoost variations of the method.

Another powerful ensemble learning algorithm used is Random Forest, commonly utilised for supervised ML. It operates by constructing multiple decision trees during training and aggregating their predictions to form a more robust and accurate model. On the contrary to Gradient Boosting, Random Forest grows trees in parallel, resulting in smaller risk of overfitting. Each tree is trained on a random subset of the data and features, enhancing the model's generalization ability. The final prediction is determined through majority voting (for classification) or averaging (for regression). This method effectively captures complex patterns while maintaining stability, making it particularly useful for high-dimensional datasets, such as those involving social attitudes. In our study, we use the LGBM random forest algorithm.

Since the selected response variables are either binary or ordinal with the limited number of categories, Logistic Regression is used for model estimation. The algorithm assesses the probability that a given input belongs to a particular class by applying the logistic function to a linear combination of input features. It optimizes model parameters by minimizing a loss function. The study employs Logistic Regression as a benchmark model to compare the performance of more complex ML approaches.

In order to ensure generalisability and choose the optimal hyperparameters, cross-validation and tuning are applied. Due to the fact that the dataset is relatively small, we do 10-fold cross-validation, which splits the data into ten subsets, training the model on nine and testing it on the

remaining one, repeating this for each fold. This method helps to reduce overfitting and provides a reliable estimate of how well the model will perform on unseen data. The hyperparameters tuning is used together with cross-validation, including selecting the best number of estimators, minimum split gain, learning rate and regularization strength based on the highest cross-validation score using Randomized Search method. In our models, the iteration parameter is equal to 15.

To perform estimations, Python programming language was used along with the following main libraries: *NumPy* and *pandas* for data manipulation and preprocessing, *scikit-learn* for ML modelling, evaluation, and feature engineering, *imbalanced-learn* for handling class imbalance, *XGBoost* and *LightGBM* for gradient boosting and random forest classification, and *matplotlib* and *seaborn* for data visualization.

3.4 DATA PREPARATION AND PREPROCESSING

Firstly, the rows containing missing values in all four dependent variables were removed. The missing values in the observations, which had a valid response for at least one of the questions of interest, were treated separately prior to the ML process, ensuring that the dataset is used to its full potential. Among the predictors, only two columns, namely occupation and income, contained missing values. However, they amounted to a minute percentage of the data and were replaced with the mode and mean respectively. Lastly, due to the specifics of the ML algorithms, *all 4 dependent* and 3 independent variables (*Income, Urbanisation, Education*), were converted into a discrete numeric scale. As a result, the cleaned dataset contained 5915 observations, 11 numeric and 2 categorical (*Macroregion, Occupation)* predictors and 4 dependent variables. Table 1 summarizes the descriptive statistics for all the variables included in the analysis (*see Table 1*). The PowerBi software was utilized for the majority of data preparation.

Table 1. Descriptive Statistics

Variable	Count	Mean	Std	Min	25%	50%	75%	Max
Year	5915	2023.00	0.82	2022	2022	2023	2024	2024
Age	5915	47.73	16.69	18	34	47	61	97
Religion	5915	0.71	0.13	0.30	0.68	0.75	0.79	0.92
Poverty	5915	36.70	12.43	14.1	30.6	35	43.6	62
Income	5915	2.80	0.93	1	2	3	3	5
Democracy	5915	6.37	0.48	4.86	6.13	6.24	6.69	7.33
Education	5915	6.55	1.61	1	6	7	8	8
Being displaced	5915	0.14	0.35	0	0	0	0	1
Being female	5915	0.56	0.50	0	0	1	1	1
Urbanisation	5915	4.55	2.34	1	2	6	7	7
Ukrainian language	5915	0.84	0.37	0	1	1	1	1
General attitude	5735	2.65	1.15	1	2	3	3	5
Equal rights	5533	0.75	0.43	0	1	1	1	1
Same-sex partnerships	5544	1.92	0.84	1	1	2	3	3
Military	5607	4.16	1.17	1	4	5	5	5

Source: Author's own calculations based on KIIS survey data, 2022-2024.

CHAPTER 4. ANALYSIS AND RESULTS

We begin by comparing the median values of the four attitudinal variables. Solely for the purpose of this exercise, the response variables' values were rescaled from 0 "Strongly negative" to 1 "Strongly positive" to enable a meaningful comparison. As shown in the box plot (*see Figure 1*), the median for *Attitude_scale* (general perception of LGBT individuals) is approximately 0.4, while *Support_marriage* (support for the legalisation of the same-sex partnerships) is 0.5. In contrast, *Scale_military* (attitudes toward LGBT individuals defending Ukraine) has a significantly higher median of 0.8, and *Equal_rights* (support for equal rights) reaches nearly 0.8. This variation suggests that attitudes differ across dimensions, with individuals showing some agreement on equal rights and military participation but more division in general perceptions and policy-related questions, such as marriage rights. The discrepancies highlight that support for one aspect of LGBT attitudes does not necessarily translate to support across all dimensions. Additionally, the highly skewed distributions of *Scale_military* and *Equal_rights* indicate severe class imbalance, which could pose challenges in the ML analysis, while *Attitude_scale* and *Support_marriage* may also present imbalance issues.

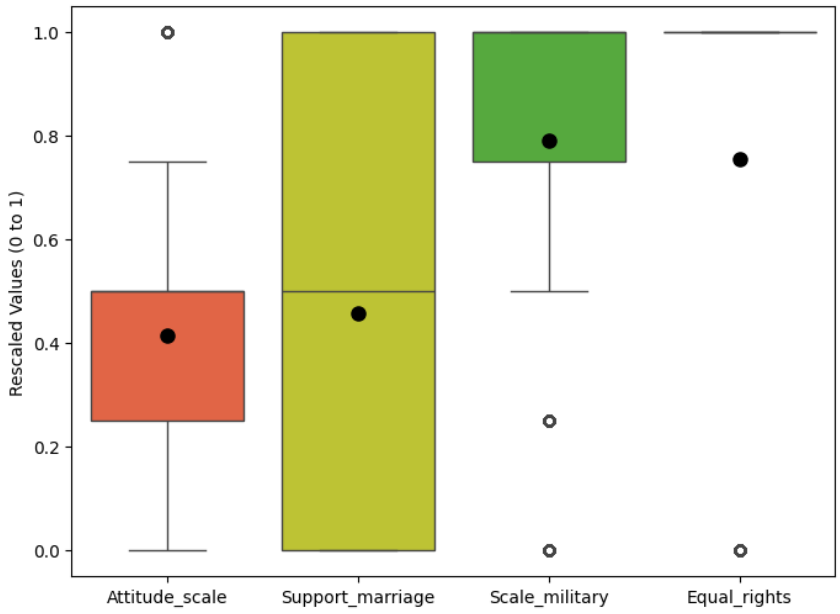

Figure 1. The box plot of the dependent variables; KIIS survey data, 2022-2024.

Before proceeding with the ML analysis, correlations among variables were examined (*see Figure 2*), including those among the selected predictors. In the case of categorical predictors, only *sex* and *occupation* (0.31), and *macro region* and *language* (0.35) exceeded the 0.3 threshold based on Cramer's V. For numerical predictors, moderate correlations were found between *poverty* and *democracy* (0.32), *poverty* and *religion* (0.23), *urbanisation* and *education* (0.26), *education* and *income* (0.21), and *year* and *language* (0.21). Despite these correlations, no variables were removed as there is no risk of multicollinearity.

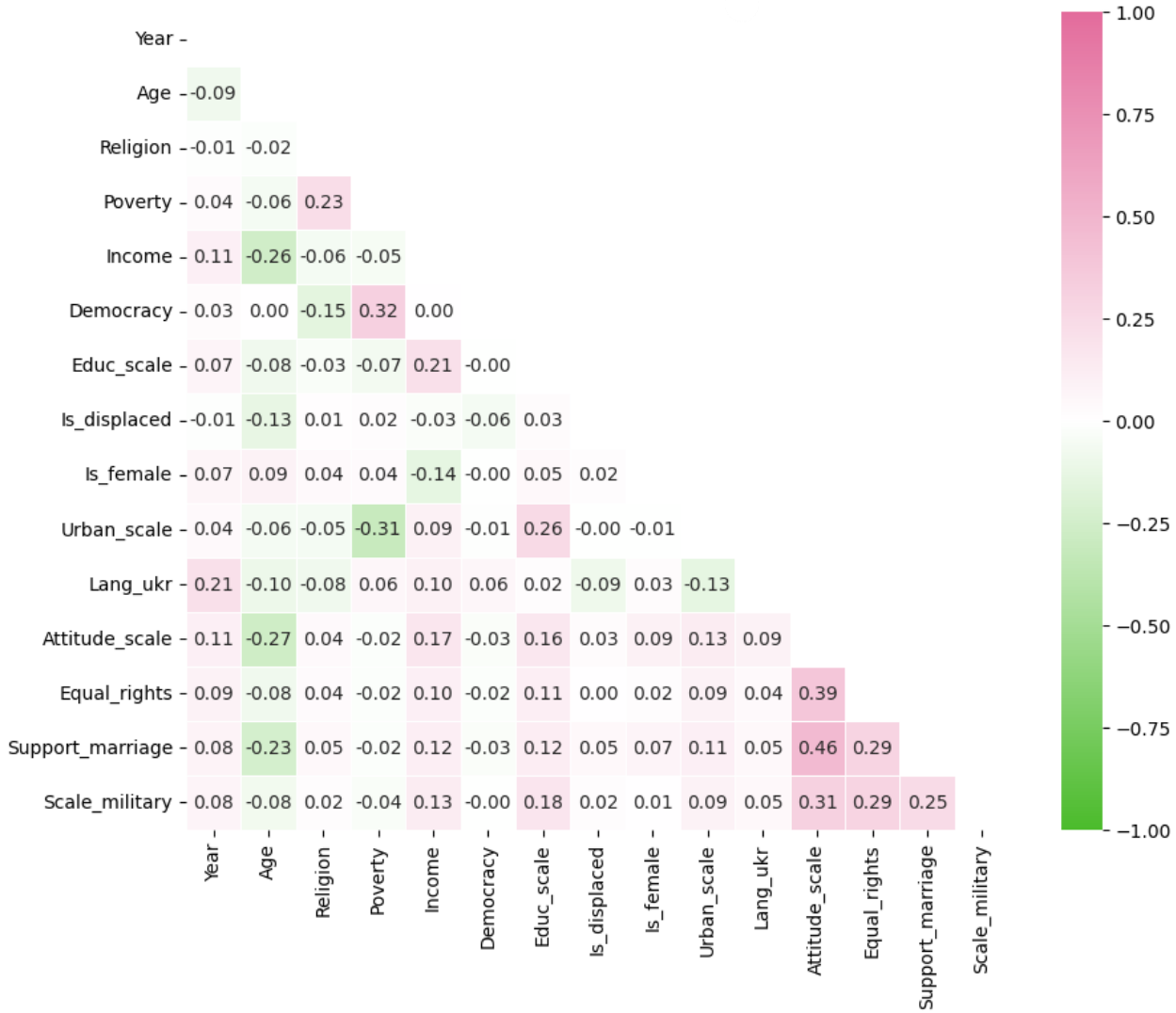

Figure 2. Correlation matrix for all variables; KIIS survey data, 2022-2024.

Regarding the relationships between *independent* and *dependent* variables, only *age* showed a notable negative correlation with *Attitude_scale* (-0.27) and *Support_marriage* (-0.23), suggesting that other predictors may have minimal direct impact. The dependent variables themselves show moderate correlation (ranging from 0.25 for *Support_marriage* and *Scale_military* to 0.46 for *Support_marriage* and *Attitude_scale*), indicating some relative consistency in attitudes. This suggests that while respondents may support general equality for LGBT individuals, they remain more conservative regarding specific civil rights. Moreover, the moderate intercorrelations imply that each dimension of equality is likely influenced by distinct predictors.

Before training the models, several techniques were tested to address the class imbalance in the dependent variables, ensuring more reliable findings. Without correction, models risk high accuracy simply by predicting the majority class, leading to biased key predictors. To mitigate this, Synthetic Minority Oversampling Technique, threshold tuning, class weight adjustments, and feature engineering were evaluated using pre-built models, tracking both overall accuracy and f1 scores for each class. Adjusting class weights proved most effective, balancing f1 scores and reducing imbalance effects. Additionally, collapsing *Attitude_scale* and *Scale_military* from five to three categories—merging negative responses into "0," positive into "2," and keeping neutral as "1"—improved model interpretability. While this slightly reduced train and test accuracy, it enhanced reliability, allowing to proceed with analysis.

4.1 RESULTS FOR GENERAL ATTITUDE TOWARD LGBT INDIVIDUALS

The best-performing model based on the test accuracy for predicting the *Attitude_score* is the AdaBoost algorithm, with the following class weights: *"Class 0"*: 1.3, *"Class 1"*: 1; and *"Class 2"*: 2.3, which were chosen by minimizing the differences in the f1 while keeping relatively high accuracy score. The train and the test accuracy are 0.51 and 0.49 respectively, with a minor overfitting. The classification report (*see Table 2),* indicates that *Classes 0 and 1* were predicted better in general, as

compared to *Class 2*, due to class imbalance. It can be concluded that the model is uncertain in classifying observations, however, identifies at least some factors, influencing the variance. Hence, further interpretations should not be taken for granted but rather treated as probable.

Table 2. The Classification Report for Predicting the General Attitude.

Class	Precision	Recall	F1-score	Support
0 (“Negative”)	0.47	0.54	0.50	389
1 (“Indifferent)	0.55	0.52	0.54	573
2 (“Positive”)	0.32	0.26	0.29	185

Source: Author’s own calculations based on KIIS survey data, 2022-2024.

As visualized in Figure 3 (*See Figure 3*), the built-in feature importance of AdaBoost suggests that *age* (0.41), *sex* (0.18), *occupation* (0.13), *education* (0.08), *income* (0.05) and *language* (0.05) are the key predictors, according to which the model makes its predictions. When individually examining the *occupation* variable in this context (*see Figure 4*), it appears that the categories of “Entrepreneur, business owner, farmer”, “Military/law enforcement officer, “Student” and “Self-employed” are significant for the model's classification decisions.

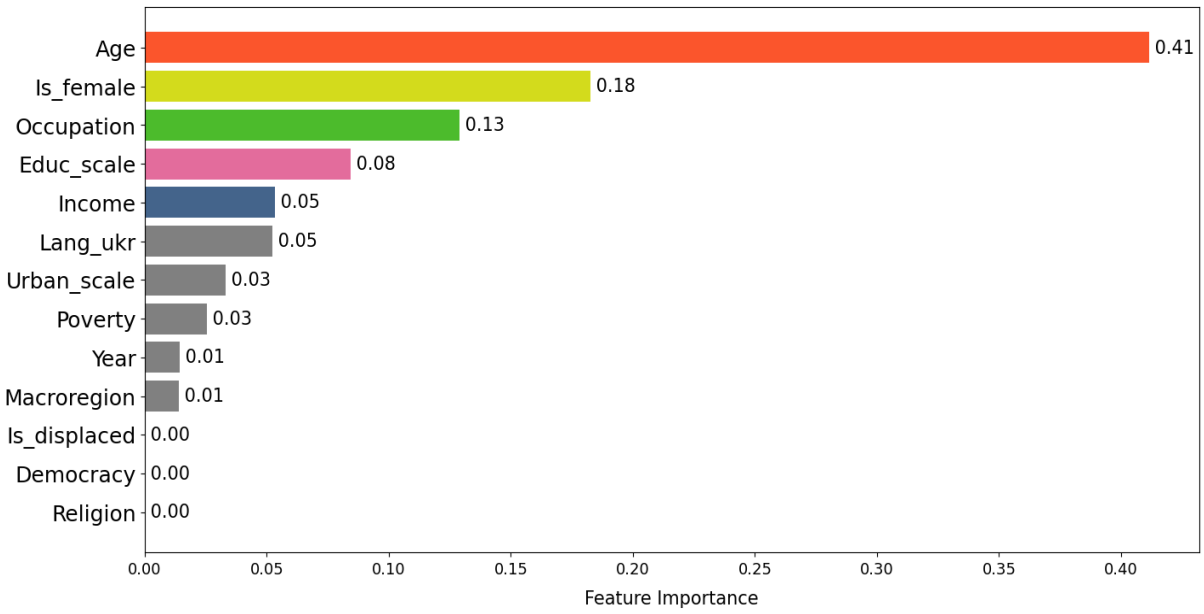

Figure 3. Feature importance of the model for predicting the general attitude; KIIS survey data, 2022-2024.

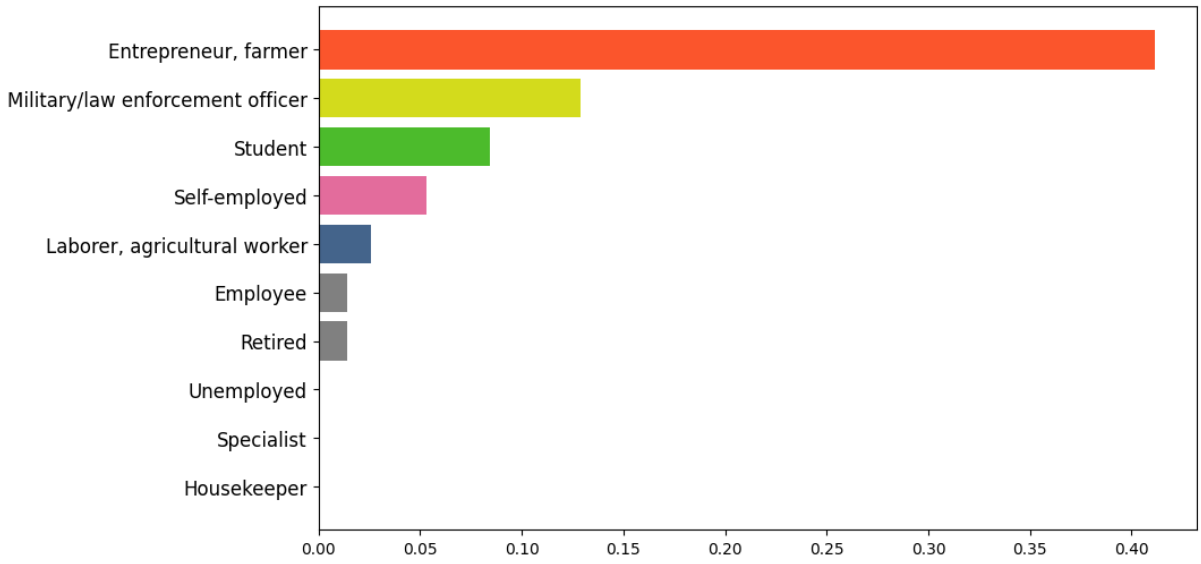

Figure 4. Feature importance of the model for predicting the general attitude by occupation; KIIS survey data, 2022-2024.

Another measure, that captures the key predictors of the dependent variable, is the permutation importance. The graph that illustrates this measure (*see Figure 5*) is consistent with the built-in feature importance in terms of the key predictors, except for *Income,* which has low permutation importance.

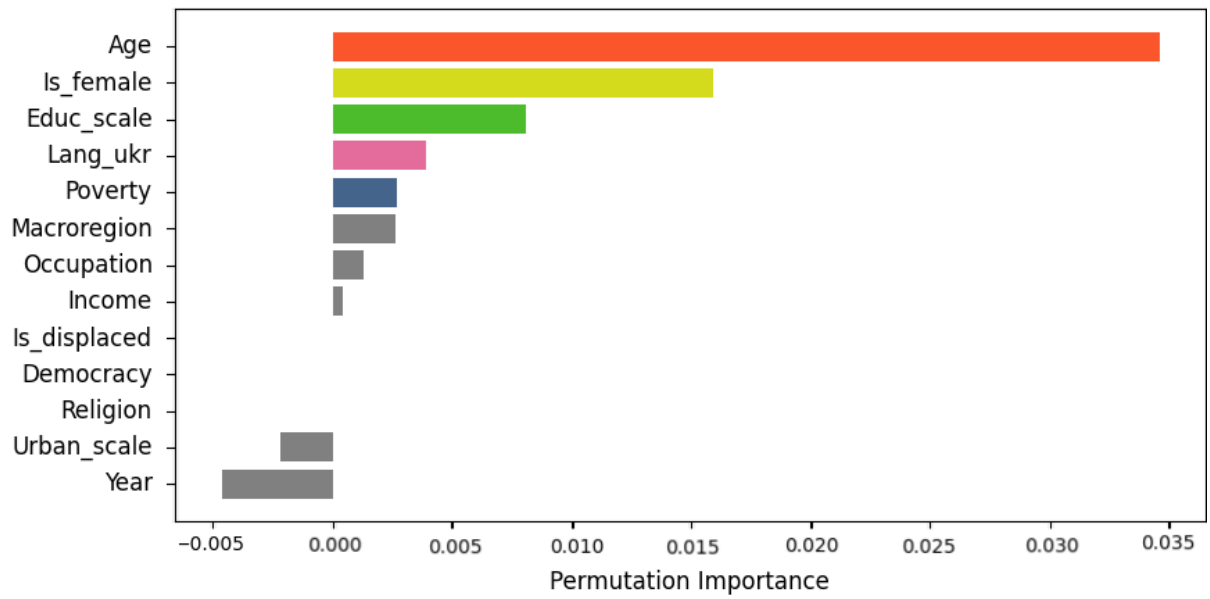

Figure 5. Permutation importance for predicting the general attitude; KIIS survey data, 2022-2024.

The last interpretation measure is partial dependence, which captures the marginal effect of a selected feature on the model's predictions while averaging out the effects of other variables. For *Class 0* (negative responses), *age* is positively correlated with the likelihood of a negative attitude, with other key factors like *being male, lower income, speaking Russian,* and *lower education* also increasing the probability of a negative response (*see Appendix A, Figure A.1*). For *Class 1* (indifferent responses), the model suggests that individuals aged 30-60, females, and those with average income, Ukrainian language, and higher education are more likely to choose the indifferent response (*see Appendix A, Figure A.2*). The Partial Dependency Plot (PDP) for poverty shows two peaks, indicating both poorer and wealthier individuals contribute more to this category. For *Class 2* (positive responses)*, age, sex, income, and education* are most influential. Older *age* decreases the likelihood of a positive response, while *females, higher income, and higher education* increase it. The plots for *language* and *poverty* show little impact (*see Appendix A, Figure A.3*). However, due to the moderately small model accuracy, these interpretations should be taken with caution, as the results may not be fully reliable.

Lastly, we also examine the partial dependence for *occupation*, which is a categorical variable and requires a separate plot *(see Appendix A, Figure A.4*). The PDP suggests that participants who identified as "Specialist", "Student", "'Unemployed", or "Self-employed" have a higher probability of expressing a positive attitude compared to those in other professions.

4.2 RESULTS FOR ATTITUDE TOWARD EQUAL RIGHTS FOR LGBT INDIVIDUALS

Similarly to the previous dependent variable, out of the five models fitted, the best-performing one according to the test accuracy for predicting the *Equal_rights* is the AdaBoost algorithm, with the "balanced" class weights. The train and the test accuracy are 0.86 and 0.63 respectively, with an acute overfitting. The classification report (*see Table 3*), depicts that *Class 1* was predicted with a greater accuracy, as compared to *Class 0*, due to the drastic class imbalance in favour of *Class 1*.

Although the accuracy score is relatively high, it cannot be stated that the model is certain in its predictions due to severe overfitting. Therefore, the interpretation may be meaningful yet the conclusions should be treated with caution.

Table 3. The Classification Report for Predicting the Attitude Toward the Equal Rights for LGBT Individuals.

Classes	Precision	Recall	F1-score	Support
0 (“No”)	0.32	0.43	0.37	272
1 (“Yes”)	0.79	0.7	0.74	835

Source: Author’s own calculations based on KIIS survey data, 2022-2024.

The information regarding the build-in feature importance, illustrated in Figure 6 (*see Figure 6*), indicates that *age* (0.25) is the most impactful predictor, followed by *religion* (0.14), *occupation* (0.10), *urbanisation* (0.09) and *education* (0.08). The same measure, visualised by *occupation* (*see Figure 7*), shows that the categories “Entrepreneur, farmer”, “Housekeeper”, “Military/law enforcement officer”, “Student” and “Self-employed” influence model’s decisions the most.

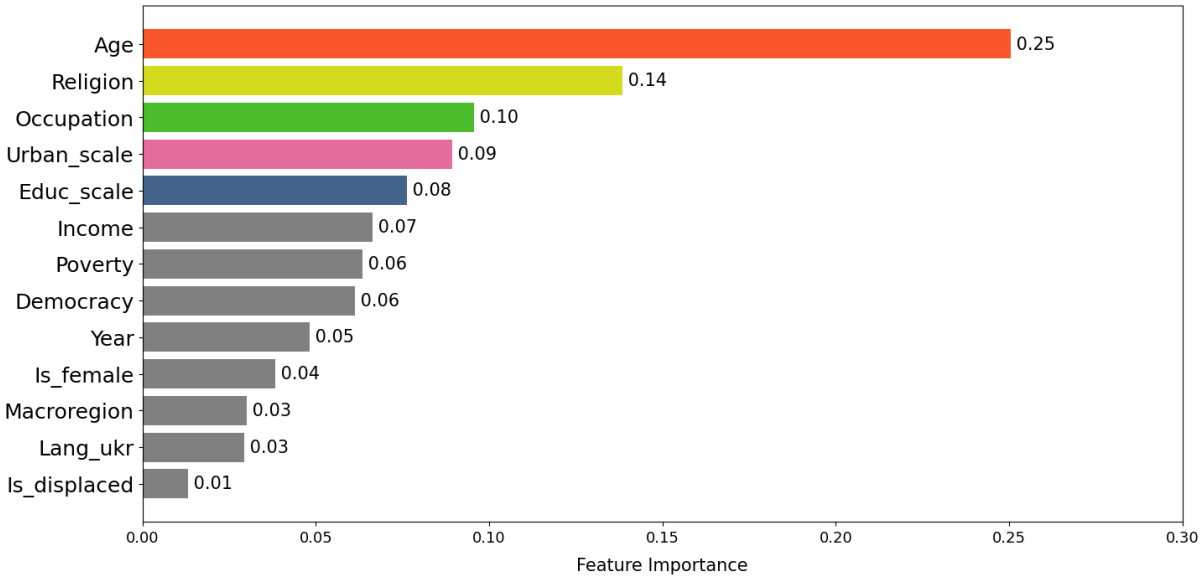

Figure 6. Feature importance of the model for predicting the attitude toward the equal rights for the LGBT individuals; KIIS survey data, 2022-2024.

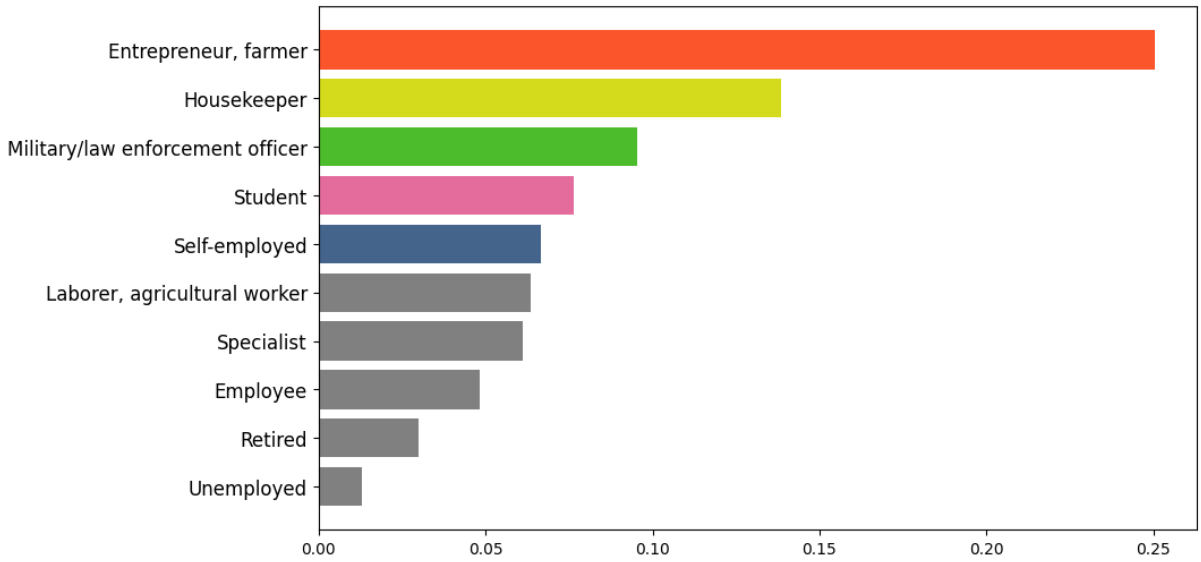

Figure 7. Feature importance of the model for predicting the attitude toward the equal rights for the LGBT individuals by occupation; KIIS survey data, 2022-2024.

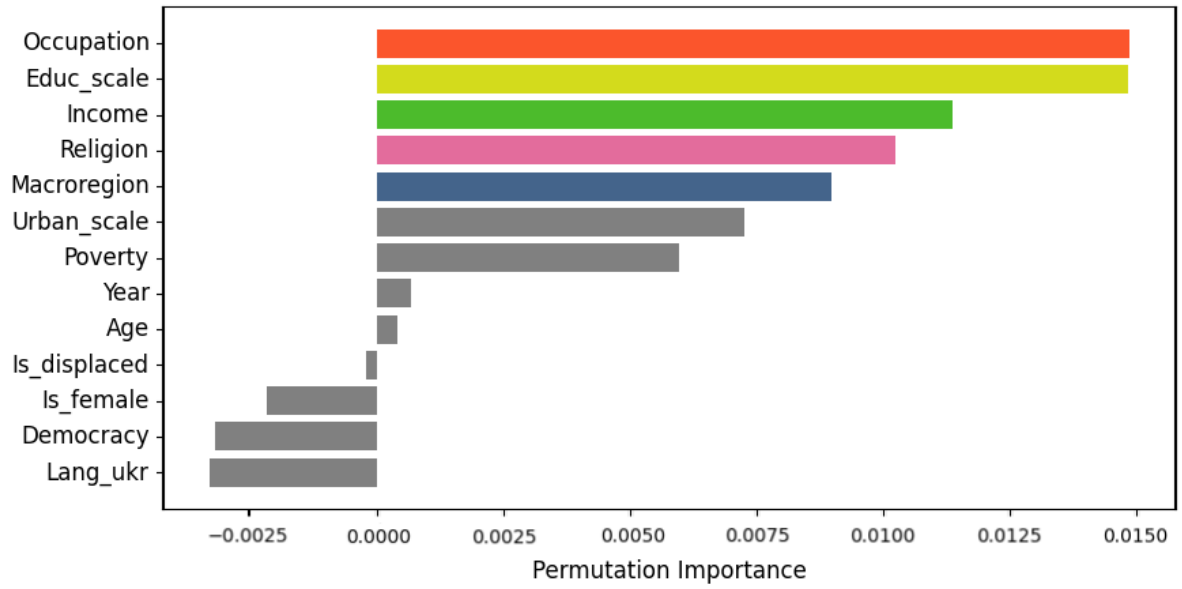

Figure 8. Permutation importance for predicting the attitude toward the equal rights for the LGBT individuals; KIIS survey data, 2022-2024.

The permutation importance also identifies *occupation*, *education* and *religion* as important predictors of the attitude toward the equal rights for the LGBT community, but, on the contrary, also categorises *income* and *macro region* as significant (*see Figure 8*).

The PDP for the attitude toward the equal rights for the LGBT individuals revealed some idiosyncratic findings. For example, while people of younger *age* (18-25) show more likelihood of

responding “Yes” to the question of interest among other ages, which aligns with expectations, the lowest probability appears to be not among the elderly population but for the respondents aged 35-40 (*see Appendix A, Figure A.5*). For the *ages* above 40, the likelihood varies and is approximately in between the values for the youngest population and middle-aged participants. The plot also revealed that the people from the regions with 40-60% of the population *being Orthodox*, have, on average, lower probability of responding “Yes” to the question regarding equal rights. In correspondence with the PDP for the general attitude, *higher income, level of urbanisation, orthodox percentage* and *education* increase the likelihood of a positive answer. Finally, the *poverty* variable shows little effect, as the measure is relatively similar for all values of this predictor with several minor fluctuations.

The categorical variables, *occupation* and *macro region*, were plotted separately (see *Appendix A, Figure A.6*). The bar chart displays that the following occupations are more prone to answering positively to the question regarding equal rights: “Self-employed”, “Student”, “Unemployed” and “Specialist”, while “Military/law enforcement officer” and “Retired” represent the lowest probability. As for the regions, people from the western region of Ukraine are shown by the model to be more likely to respond negatively to the question of interest.

4.3 RESULTS FOR ATTITUDE TOWARD LGBT INDIVIDUALS IN THE UKRAINE’S ARMED FORCES

In terms of predicting the attitudes toward the LGBT military, LGBM gradient boosting algorithm exhibited the best performance indicators among all models. Nevertheless, this model had even greater overfitting than the previous dependent variables, due to the major prevalence of the positive responses. To be precise, the train and test accuracy were 0.83 and 0.56 respectively, with the “balanced” class weights parameter. The classification report (*see Table 4*) highlights the aforementioned class imbalance. The efforts to evenly distribute model predictions through various combinations of class weights resulted in greater accuracy loss in comparison to the minute gain in

accuracy for underrepresented classes. Therefore, the interpretation of the model's outcome is likely to be biased and cannot be considered reliable.

Table 4. The Classification Report for Predicting the Attitude Toward LGBT Individuals in the Ukraine's Armed Forces.

Classes	Precision	Recall	F1-score	Support
0 ("Negative")	0.16	0.23	0.19	99
1 ("Indifferent)	0.18	0.28	0.22	176
2 ("Positive")	0.79	0.65	0.71	847

Source: Author's own calculations based on KIIS survey data, 2022-2024.

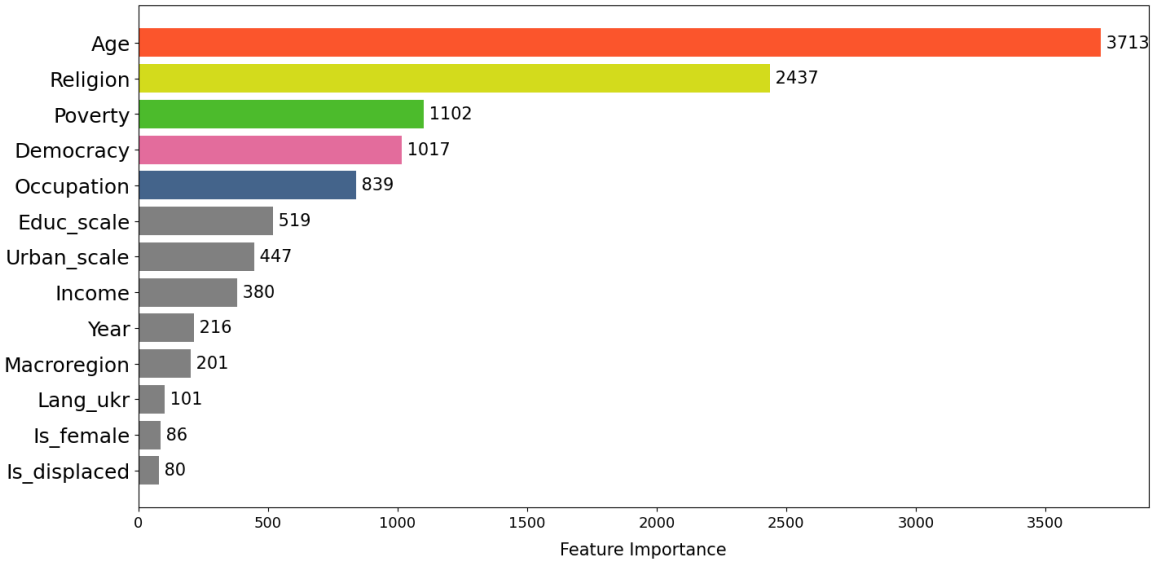

Figure 9. Feature importance of the model for predicting the attitude towards LGBT individuals in the Ukraine's Armed Forces; KIIS survey data, 2022-2024.

According to Figure 9, the model assigns the largest feature importance to *age* (3713), *religion* (2437), *poverty* (1102), *democracy* (1017) and *occupation* (839) as key predictors of the attitude towards the LGBT military (*see Figure 9*). In addition, "Entrepreneur, farmer", "Housekeeper", "Labourer, agricultural worker", "Specialist" and "Military/law enforcement officer" are identified as the most significant occupations for the model's decision choices (*see Figure 10*).

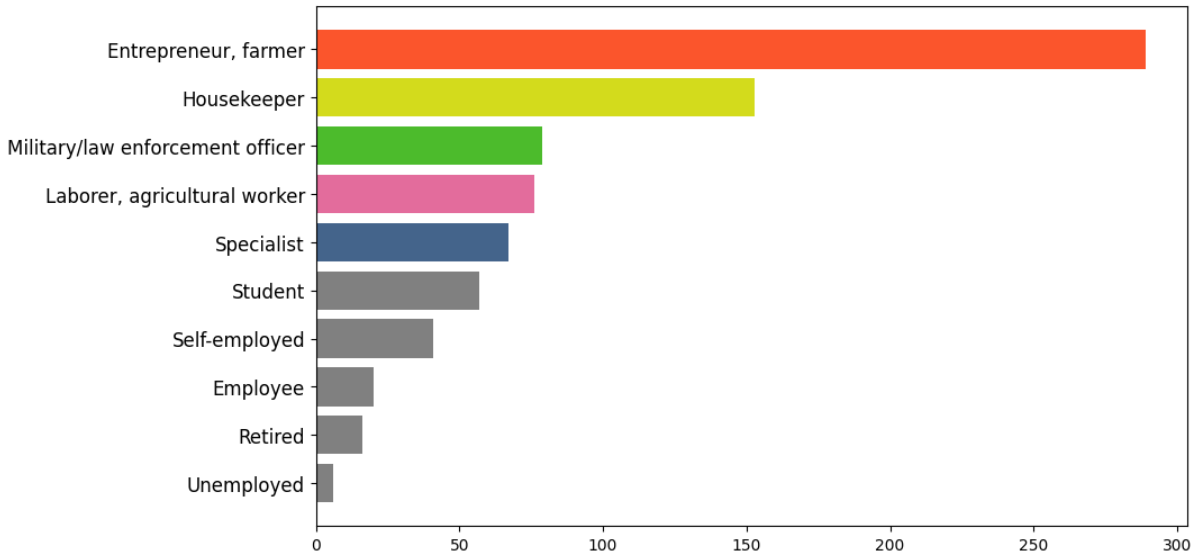

Figure 10. Feature importance of the model for predicting the attitude towards LGBT individuals in the Ukraine's Armed Forces by occupation; KIIS survey data, 2022-2024.

The permutation importance measure selects somewhat different predictors as the most influential (*see Figure 11*). The most significant variable determined is *occupation*, followed by *age*, *urbanisation*, *sex* and *income*, while *poverty* and *religion* appear to have a negative effect on the model's performance.

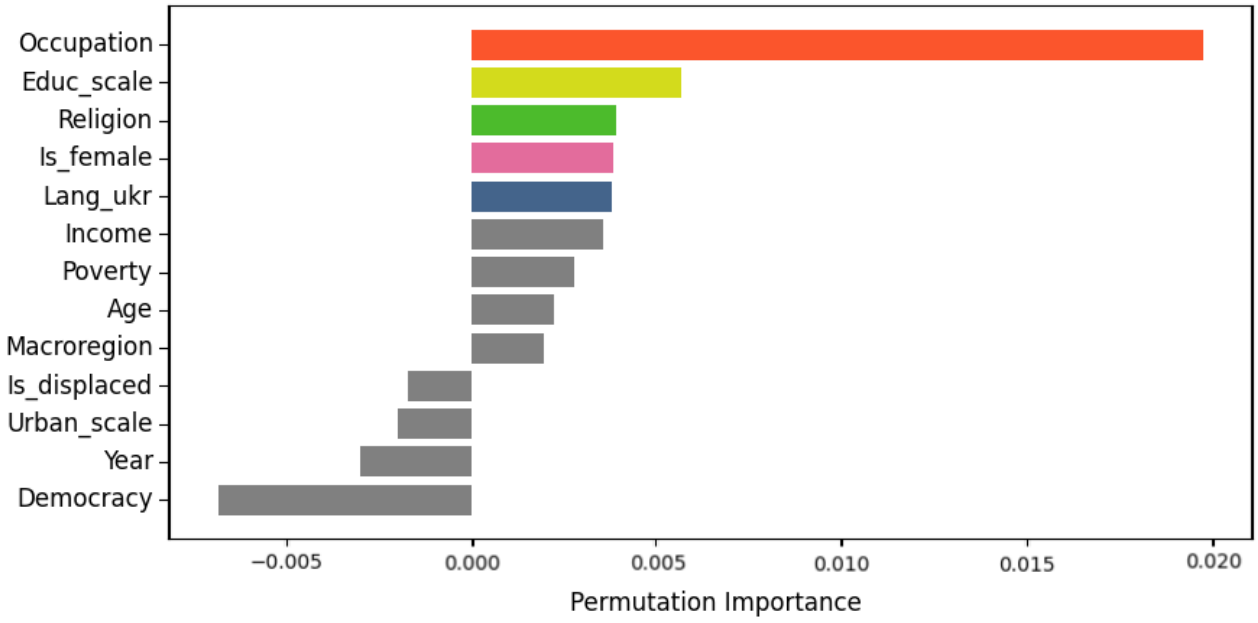

Figure 11. Permutation importance for predicting the attitude toward LGBT individuals in the Ukraine's Armed Forces; KIIS survey data, 2022-2024.

The PDP for *Class 0* (negative attitudes) shows a positive relationship with *age*, suggesting older individuals are more likely to hold negative views *(see Appendix A, Figure A.7*). Although fluctuating due to severe overfitting, the *religion* variable indicates that higher percentages of Orthodox Christians in a region increase the likelihood of a negative response. *Income* decreases until moderately high values, then slightly increases at high income, while *democracy* shows a minor drop between values 6-7, indicating that people agreeing with the importance of democracy are less likely to respond negatively. *Urbanisation* shows a negative relationship, and *sex* has little impact.

For *Class 1* (indifferent responses), individuals aged 20-40 are most likely to choose this response (*see Appendix A, Figure A.8*). Higher *democracy* values are linked to a slightly higher probability of indifference, while being *female* decreases the likelihood. *Urbanisation* peaks at both high and low values, and income behaves similarly to *Class 0*. The *religion* variable remains inconsistent.

In *Class 2* (positive attitudes), *younger* and *older individuals* (ages 18-20 and 40-65) are more likely to respond positively (*see Appendix A, Figure A.9*). *Income* shows a positive trend up to moderately high levels, then sharply decreases at high income. Those in *less urbanised areas* are less likely to show positive attitudes, while *females* are more likely to respond positively. The *religion* and *democracy* variables are inconsistent.

Regarding occupation, PDPs suggest that *retired, housekeeper,* and *employee* categories are associated with negative attitudes, while *self-employed, specialist,* and *student* are more likely to be indifferent. *Unemployed and entrepreneurs/farmers* are more likely to have positive attitudes, with *retired* individuals and *military/law enforcement* showing less positivity (*see Appendix A, Figure A.10*).

Nevertheless, due to the severe overfitting of the model, these findings should be interpreted with caution.

4.4 RESULTS FOR ATTITUDE TOWARD THE LEGALISATION OF THE SAME-SEX PARTNERSHIPS

The fourth and final analysis of the attitudinal variable is for the attitude towards the legalisation of the same-sex partnerships, similar to marriage, but without the right to jointly adopt children. The best model in terms of the test accuracy indicator is LGBM random forest, with the following class weights: *"Class 0"*: 1, *"Class 1"*: 1.6, *"Class 2"*: 1.3, which were chosen by minimizing the differences in the f1 while keeping a relatively high accuracy score. The train accuracy is equal to 0.51, and the test accuracy appeared to be slightly lower (0.45), indicating a minor overfitting. According to the classification report (*see Table 5*), the model achieved almost identical quality of predicting classes 0 and 2, while its performance on class 1 is relatively lower. In concordance with the previous model's, the interpretation may be inaccurate and should be seen as entirely rightful.

Table 5. The Classification Report for Predicting the Attitude Toward the Legalisation of the Same-Sex Partnerships.

Classes	Precision	Recall	F1-score	Support
0 ("Negative")	0.51	0.5	0.5	446
1 ("Indifferent)	0.38	0.3	0.33	310
2 ("Positive")	0.44	0.54	0.48	353

Source: Author's own calculations based on KIIS survey data, 2022-2024.

The LGBM random forest model identifies *age* (1646), *religion* (1175), *poverty* (724), *urbanisation* (582), *democracy* (575) and *education* (563) as the most influential independent variables, with the *displacement* status, *language* and *macro region* being the least significant (*see Figure 12*). While occupation does not hold the biggest importance, according to the model, it is worth noting that entrepreneurs and farmers, housekeepers and labourers are shown to have the biggest impact on the model's decision-making process than others (*see Figure 13*).

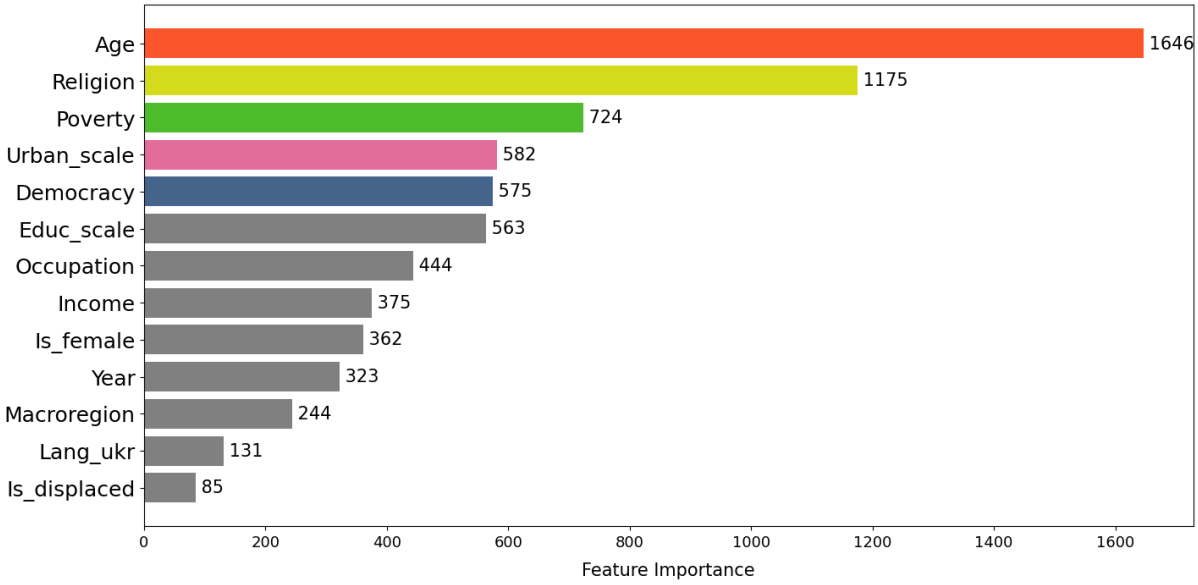

Figure 12. Feature importance of the model for predicting the attitude toward the legalisation of the same-sex partnerships; KIIS survey data, 2022-2024.

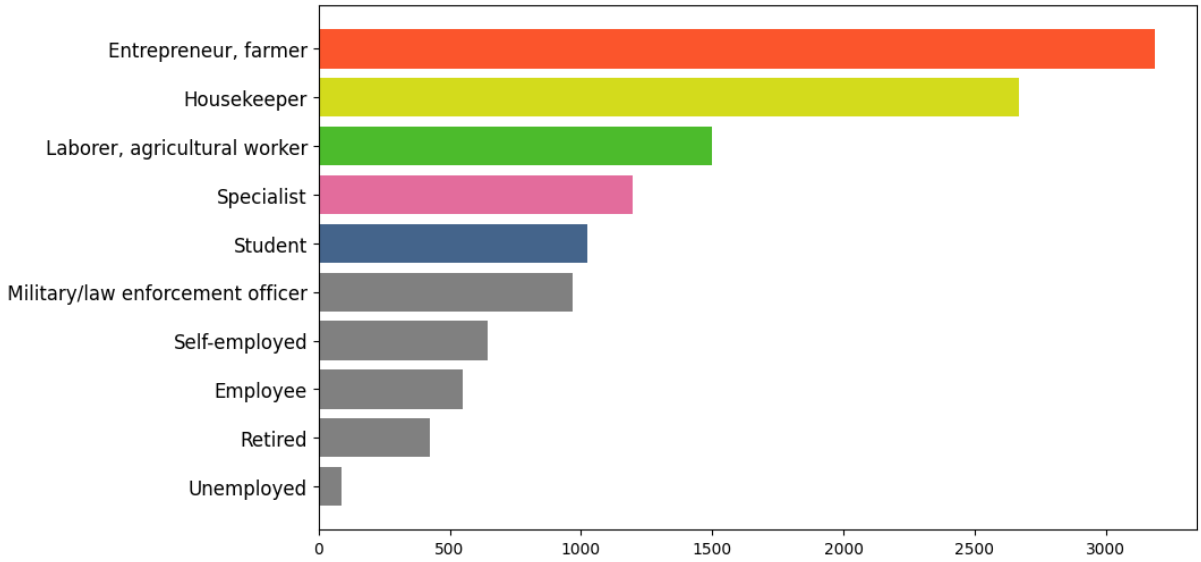

Figure 13. Feature importance of the model for predicting the attitude toward the legalisation of the same-sex partnerships by occupation; KIIS survey data, 2022-2024.

As can be seen from the plot, displaying the permutation importance, *age* is by far the most significant predictor of the attitude towards the legalisation same-sex partnerships, followed by *sex, education, religion* and *urbanisation* (*see Figure 14*). These findings are to some extent similar to those derived from the built-in feature importance.

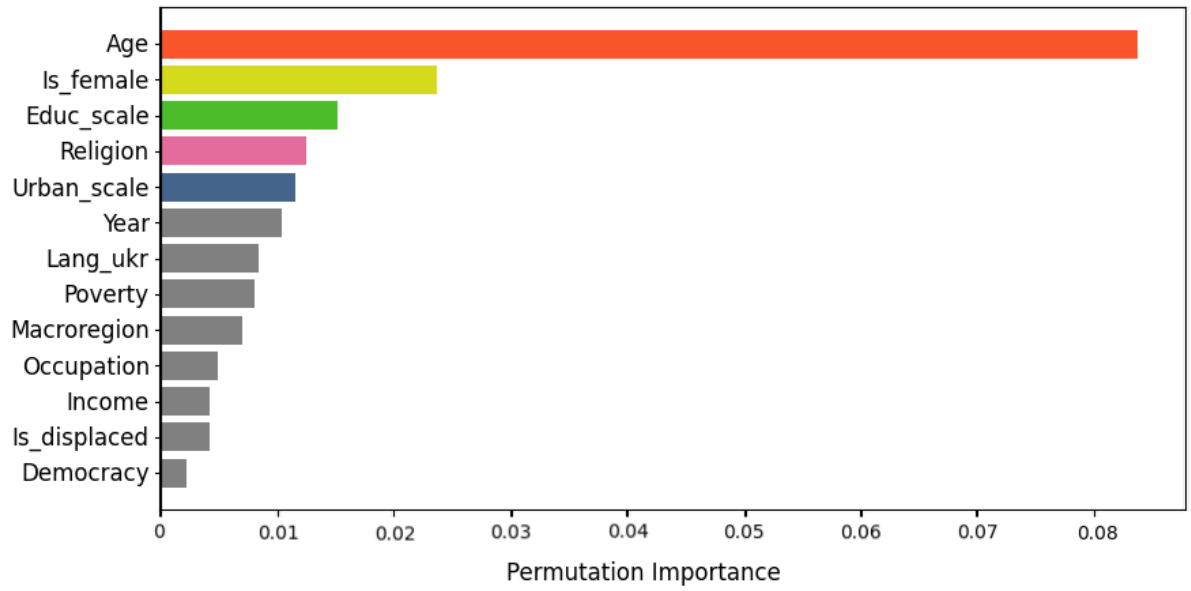

Figure 14. Permutation importance for predicting the attitude towards the legalisation of the same-sex partnerships; KIIS survey data, 2022-2024.

The PDPs for *Class 0* (negative attitudes) show a positive relationship with *age*, indicating older individuals are more likely to respond negatively. Regions with higher *poverty* also correlate with a higher likelihood of negative responses. Conversely, *urbanisation*, *education*, *female sex*, and *religion* show slight downward trends (*see Appendix A, Figure A.11*).

For *Class 1* (indifferent attitudes), *being female* and *poverty* show negative relationships, while *age* indicates that youth and those aged 50-70 are most likely to be indifferent. *Urbanisation* has minimal effect, and *religion* shows an inconsistent trend (*see Appendix A, Figure A.12*).

In *Class 2* (positive attitudes), *age* negatively affects the likelihood of a positive response, while *urbanisation, female sex,* and *higher education* increase it. Regions with 65-80% Orthodox populations also show a positive relationship, while *poverty* has no effect (*see Appendix A, Figure A.13*).

4.3 SUMMARY OF THE RESULTS

In summary, the models for each of the attitudinal variables cannot be considered reliable due to relatively low accuracy and the presence of the overfitting in several models. This suggests that the

findings should not be interpreted with high certainty and can be biased. Nevertheless, the results highlight several interesting findings that, in general, support the majority of the hypothesis.

Table 6 summarizes the effect of each independent variable on the four attitudinal variables (*see Table 6*). As can be seen, *age* is the most important predictor for all four variables, showing a negative impact on each of the attitudes, which is in line with the *Hypothesis 1*. The rest of the influential factors vary between the attitude dimensions, suggesting that each dependent variable has its own unique set of predictors. Among the most impactful independent variables are *education*, *sex*, *urbanisation*, *income* and *occupation* namely.

Table 6. The Importance and the Effect of Each Predictor Across All Dependent Variables

Predictors	General attitude	Equal rights	Military	Same-sex partnerships
Age	* negative	* negative	* negative	* negative
Education	* positive	* positive		* positive
Income	* positive	* positive	* positive	
Being female	* positive		* positive	* positive
Urbanisation		* positive	* positive	* positive
Religion		* positive	* negative	* positive
Occupation	* N/A	* N/A	* N/A	
Speaking Ukrainian	* positive			
Macro region		* N/A		
Democracy			* positive	
Poverty				* negative
Year				
Being displaced				

Source: Author's own calculations based on KIIS survey data, 2022-2024.

a. Note: The colour intensity indicates the strongness of the effect. The significance is marked with *, according to the built-in feature importance and permutation importance.

Drawing on these findings, it is possible to conclude that not all hypotheses have been substantiated by the analysis. Specifically, *Hypotheses 1, 2, 7, 8, and 10* are likely to be confirmed,

though are ought to be treated with caution due to the uncertainty of the models. *Hypotheses 3 and 6* can be regarded as partially confirmed since they were substantiated for the prediction of the attitudes towards the LGBT in the military and were rejected for the rest of the dependent variables. Similarly, *Hypothesis 9* can be interpreted as confirmed for the attitude towards the legalisation of the same-sex partnerships yet not for other variables. *Hypothesis 4* can be only partially confirmed: while specialists and students, on average, can be said to have more positive attitudes than housekeepers, labourers and agricultural workers, not all results are considered significant by the model (*see Table 7*). Regarding the unemployed population, the findings contradict the Hypothesis but were not found significant.

Table 7. The Importance and the Effect of Each Occupation Across the Dependent Variables Where it is Significant.

Occupation	General attitude	Equal rights	Military
Employee	negative	neutral	positive & negative
Entrepreneur, Business owner, Farmer	* negative	* neutral	* positive
Housekeeper	negative	* negative	* negative
Labourer, Agricultural Worker	* negative	negative	* neutral
Military/Law Enforcement Officer	* negative	* negative	* neutral
Retired	negative	negative	negative
Self-Employed	* neutral	* positive	neutral
Specialist	positive	neutral	* neutral
Student	* positive	* positive	neutral
Unemployed	positive	positive	positive

Source: Author's own calculations based on KIIS survey data, 2022-2024.

a. Note: The significance is marked with *, according to the built-in feature importance and permutation importance.

CHAPTER 5. DISCUSSION

Despite the low accuracy of the results, they still can be viewed as representative, furnishing interesting insights into the formation of attitudes towards LGBT individuals in Ukraine.

The impact of *age* is in line with the previous findings suggesting that older individuals are less positive in their attitudes to the LGBT community and the equalisation of their rights (Andersen and Fetner 952; Hooghe and Meeusen; Adamczyk and Pitt; Smith et al.; Slenders et al.; Pampel; Dunn). The model's findings on *education* also support the claims that higher educational attainment is associated with positive attitudes towards the LGBT individuals (Hooghe and Meeusen; Roggemans et al.; Slenders et al.; Paradela-López et al.; Zhang and Brym; Seligson et al.; Ohlander et al.). Similarly, *being female*, living in *more urbanised areas*, and having *higher income* are also likely to contribute to the formation of more positive attitudes to the LGBT individuals, as was suggested by previous studies (Andersen and Fetner; Daniels; Slenders et al.; Paradela-López et al.; Roggemans et al.; Rudenko; Adamczyk and Pitt; Ayoub and Garretson; Hooghe and Meeusen; Pampel; Smith et al.; Marsh and Brown). Since these patterns align with the existing research, we omit the discussion of the probable underlying causes of such findings. The existing literature provides thorough and extensive explanations.

Similarly, the impact of the *percentage of Orthodox* on the attitudes towards the integration of LGBT in Ukraine's Armed Forces has been found negative, corresponding to the existing studies (Slenders et al. 350). However, this was not the case for the other dimensions of equality: Orthodox appeared to have a positive effect on the attitudes towards equal rights for the LGBT community and the legalisation of the same-sex partnerships and was not found significant at all for the general attitudes. This can be attributed to the fact that many Ukrainians, who consider themselves Orthodox, may not explicitly follow Orthodox beliefs. Wanner introduces a term that captures this phenomenon – the "Just Orthodox", implying that for many, being Orthodox is as much about cultural belonging

and national identity as it is about religious beliefs. To support this point, the author illustrates that only 12% of Ukrainians attend church with any regularity yet far more consider themselves being religious Orthodox (70%) (Wanner 5-15; KIIS, "Religious self-identification"). On the contrary, other religions, which are present in Ukraine, like Greek Catholics and Protestants, are more prone to strictly follow religious orders, and hence, show more negative attitudes toward the LGBT community.

Occupation was found significant in the majority of the studies, in accordance with the existing literature (Andersen and Fetner; Zhang and Brym). Manual workers (labourers and agricultural workers in our case) are on average more negatively biased towards LGBT, and specialists and students are showing more positive attitudes. A conventional explanation for such results is that labourers and agricultural workers, on average, have lower educational attainment than specialists and students. This implies that they might be of more conservative views and could have limited exposure to diversity. Such workers are also often placed within the environment of traditional masculinity and live in rural areas, which correlates with negative attitudes. As for students and specialists, they are more likely to be placed in surroundings characterised by liberal and progressive values. Additionally, students are of younger age, contributing to the tendency of having more positive attitudes towards the LGBT individuals.

Contrary to the existing literature, the *unemployment status* appeared to be an insignificant, although positive, predictor of attitudes. While the results are not treated as significant by the model, they are unconventional. One possible reason for such findings is that Ukraine's unemployed population in its majority consists of the younger population, which has a positive association with the attitudes towards LGBT individuals (National Institute for Strategic Studies). Furthermore, the unemployed force mainly consists of low-skilled workers (24%) coming from the field of trade and services, with the majority of the unemployed likely being located in urbanised areas based on the number of resumes to the job openings ratio (Work Ua; State Employment Service). As of 2021,

approximately 68% of the people working in the field of trade and services were females, which combined with the urban settings, are assumed to have a positive impact on attitudes towards LGBT individuals. Therefore, the impact of unemployment on attitudes could be absorbed by other variables, rendering unemployment status insignificant.

The results obtained by our analysis on the influence of *democracy* are only partially consistent with the theory: supporting democratic values may increase the probability of having positive attitudes but only for the LGBT military in Ukraine (Van Der Toorn et al.; Smith et al.; Paradela-López et al.; Daniels). The failure to find support in the case of other equality dimensions can be explained by the imperfect measurement of democracy values resulting from the usage of regional percentages instead of individual-level data. Additionally, these findings may suggest that Ukrainians do not link political preferences to the equality issues, which is common for post-communist countries. The positive experience of equality during the authoritarian regime of the Soviet Union and vast income inequalities during democratic Ukraine could contribute to the separation of equality perceptions from political values.

In a similar manner, the findings on the effect of *poverty* are in line with the literature, yet only applies to the dimension of the attitudes towards same-sex partnership legalisation (Slenders et al.; Smith et al.; Paradela-López et al.; Adamczyk and Pitt). Equality regarding the provision of marriage rights seems to be the most sensitive to poverty levels in Ukraine while other equality dimensions appear rather independent from poverty influences. Again, this can be explained by the usage of regional percentages to capture poverty instead of individual level data. This certainly limited the variation in poverty levels among individuals reducing the likelihood of establishing statistically significant results.

Lastly, the *western regions* of Ukraine were classified as less tolerant of the possibility for the LGBT community to have equal rights. This can be explained by the prevalence of highly-religious individuals in those regions, Greek Catholics specifically, along with the significance of

traditionalism and conservatism, which decrease one's probability of having positive attitudes towards equal rights. Furthermore, *speaking Ukrainian* over Russian is linked to more positive attitudes, likely due to stronger identification with pro-European, modern values and greater exposure to Western cultural influences, especially after the revolution of dignity in 2014.. This divide may also reflect ideological differences, as Russian speakers often hold more conservative views shaped by Soviet-era stigmatisation of homosexuality.

Overall, the analysis reveals three important nuances. First, the impact of the majority of the predictors is consistent with the existing findings. This means that the model construction and estimations have been done correctly. Second, some specificities in the relationship between the selected factors and attitudes were established for Ukraine. This means that the history of territorial divisions and soviet occupation, as well as the on-going war, could create unique conditions, modifying the impact of conventional predictors or bringing in additional factors of attitude formation. Last but not least, attitudes seem to differ in their formation patterns across equality dimensions. The analysis suggests that each dimension has its own distinct set of predictors. Each of the attitude types are formed by distinct concerns, values, and societal norms, which shape how different factors influence them. The general attitude is heavily influenced by societal norms, including the gender and birth cohort norms, along with the socio-economic status (education, income, occupation). This suggests that attitudes towards the LGBT community are likely shaped by one's close surroundings on a daily basis within a similar age group - universities, workplace, community.

In addition to the previously-mentioned factors, attitudes towards the equal rights for the LGBT people are influenced in Ukraine by regional predictors such as poverty, urbanisation, and religion. It is possible that the upbringing and regional traditions, combined with the economic, social and cultural inequality within the regions of Ukraine, impact the formation of one's attitudes towards equal rights.

Regarding attitudes towards LGBT individuals serving in the military, this equality dimension is likely to be shaped by factors related to national identity, security concerns, and traditional gender norms. In addition to socio-economic factors like education and income, predictors such as religion, urbanisation, and gender have been found by the analysis to play a distinct role. The military has a certain social image, representing masculinity, patriotism, and discipline, which is not usually associated with the LGBTIQ+ community. Therefore, patriotic upbringing and surroundings are likely to determine the formation of these types of attitudes.

Finally, the attitude towards the legalisation of the same-sex partnership is influenced by the family values, moral and socio-economic environments. Unlike general acceptance or support for equal rights, which are influenced by broader democratic and human rights perspectives, attitudes toward same-sex partnerships are more closely tied to traditional beliefs about marriage, reproduction, and social stability. Factors related to religion and poverty play a stronger role here, as individuals experiencing financial hardship may view traditional family structures as a source of economic and social stability. Meanwhile, education and urbanization still contribute to more positive attitudes, as they expose individuals to diverse family models and more progressive societal norms.

In summary, Ukrainians have differing views on equality for the LGBT community. These differences likely depend on the specific aspects of equality being considered, as attitudes are shaped by various influences and contexts. As a result, equality for the LGBT individuals is not yet a universally accepted concept in Ukraine. Support for equality remains strongly influenced by prevailing ideologies and contexts in which attitudes are formed.

CHAPTER 6. CONCLUSIONS AND RECOMENDATIONS

This study aimed to explore the main determinants of attitudes toward the LGBT community in Ukraine during wartime. Relying on survey data from KIIS and employing advanced ML algorithms like Gradient Boosting and Random Forest, the analysis captures complex non-linear relationships between the predictors and four dimensions of these attitudes: general acceptance of LGBT people, support for their civil and human rights, and perceptions of LGBT Ukrainian soldiers. Several socio-demographic predictors were examined, while also accounting for regional variables. This resulted in a comprehensive ML analysis with four distinct models, specific to each compound of the dependent variable, allowing for meaningful comparison.

Drawing on the model findings, several conclusions were made regarding the significance of each independent predictor for each attitudinal dimension. The study shows that each aspect of attitude toward LGBT has a distinct set of predictors, illustrating the complex nature of attitude formation. According to the analysis, being female, earning a higher income, living in more urbanised areas, having higher educational attainment, and being a student correspond to a higher probability of positive LGBT attitudes across all dependent variables. Conversely, age—the most influential factor—along with high regional poverty levels and working in manual labour, housekeeping, or military, negatively affect these attitudes. Interestingly, affiliation with the Orthodox Church showed a positive association with support for equal rights and same-sex partnerships, but a negative one for LGBT acceptance in the military. Conversely, residence in Western Ukraine, with a higher percentage of Greek Catholics, negatively correlated with support for equal rights. Speaking Ukrainian over Russian positively impacted the general perception of LGBT people. This not only offers insights for the research community but also highlights the multifaceted nature of inequality in Ukraine.

These findings advance knowledge of how society perceives marginalised groups, especially in middle-class contexts where political and socioeconomic issues play a significant role. The

theoretical implications incorporate a complex and nuanced model while contributing to existing research on LGBT acceptance. This knowledge may support intersectional analyses in future studies and improve theoretical frameworks in social psychology. The practical applications are useful for legislators, NGOs, and advocacy groups working to advance LGBT rights in Ukraine.

Several practical applications follow. These include targeting educational initiatives in regions and workspaces with lower tolerance; utilizing communication channels to reach the elderly and sceptical groups; and counteracting harmful disinformation, which may be spread by religious organisations or conservative pro-Russian political parties. Campaigns highlighting contributions of LGBT individuals—especially military personnel defending Ukraine—can help combat stereotypes and promote inclusive narratives. Legal reforms, namely adopting Bills to enhance anti-discrimination protections and recognise same-sex relationships, would also reduce inequality on the official level. These steps are critical for the alignment of Ukraine's policies with EU democratic values, ensuring gradual integration.

Despite these findings, notable limitations remain. Several variables were merged at the regional level, limiting variance and dataset quality. This, along with the absence of clear correlations, contributed to the low model accuracy. As a result, the models did not allow for the precise estimation of such variables' impact on the selected attitudes, producing weak results. Further research could treat religion and democracy as self-reported variables, and include other factors, such as media representation. Future studies might also examine other middle-income, post-Soviet, and developing countries that face similarly high levels of inequality. Qualitative methods like focus groups and interviews would offer a deeper understanding of predictor effects. Lastly, if Bills №9103 and №5488 are adopted, a pre-post analysis could assess the policy's impact on LGBT attitudes. Many further directions remain open for exploration.

A fitting conclusion can be drawn from the LGBT Human Rights NASH SVIT Center's survey among LGBT individuals in Ukraine. When asked how their situation could improve, the three

most popular answers were: “LGBT-friendly legislation,” “tolerant public opinion towards LGBT people,” and “having a permanent partner with a harmonious relationship.” (LGBT Human Rights NASH SVIT Center, Raiduzhna Knyha [Rainbow Book] 166). Only one relates to personal life, while the others are socio-political. This signifies that by embracing diversity at the national level across all societal strata, we can achieve long-term equality and human wellbeing.

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APPENDIX A

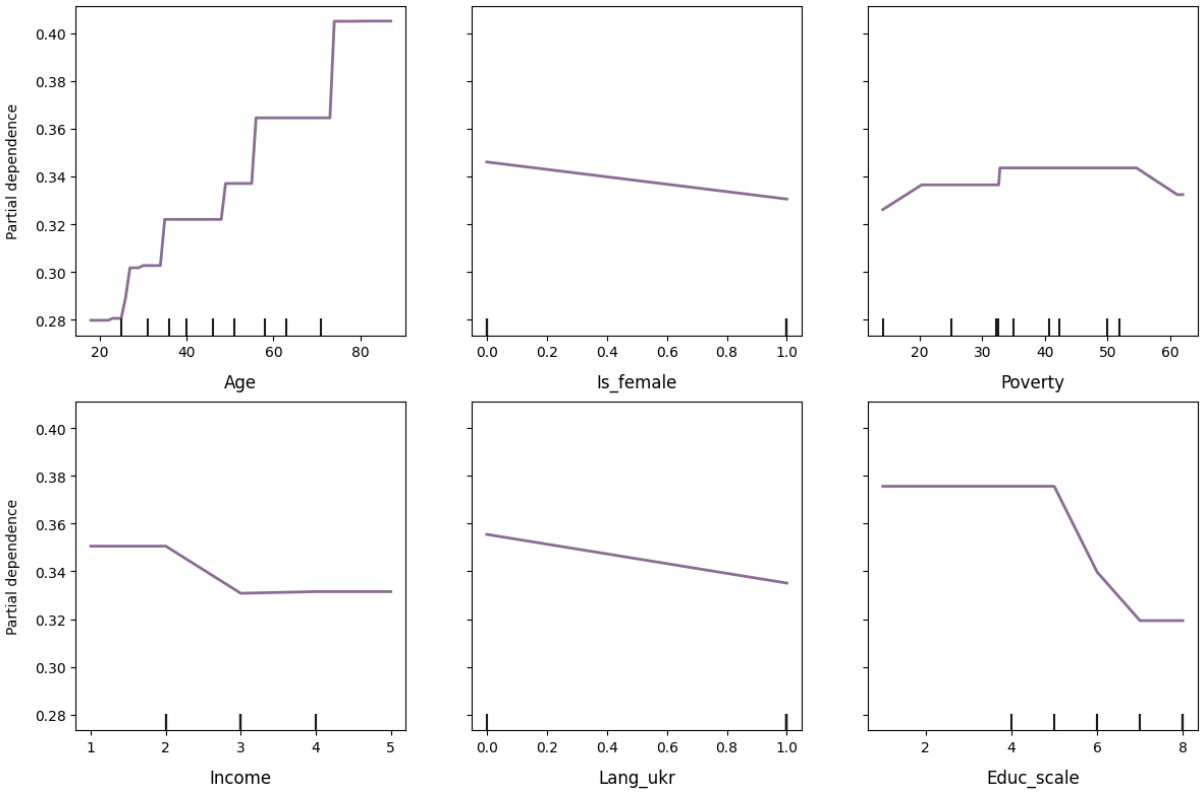

Figure A.1 PDP for the general attitude, class 0; KIIS survey data, 2022-2024.

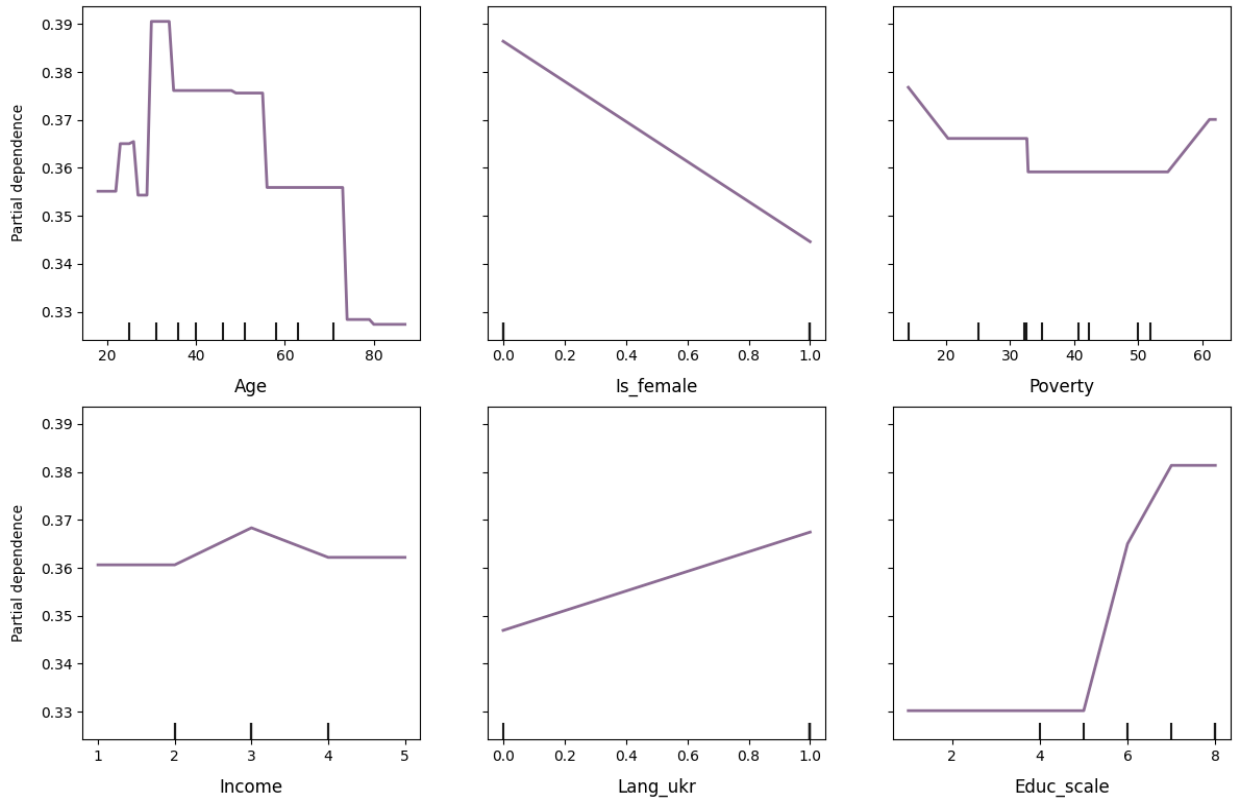

Figure A.2 PDP for the general attitude, class 1; KIIS survey data, 2022-2024.

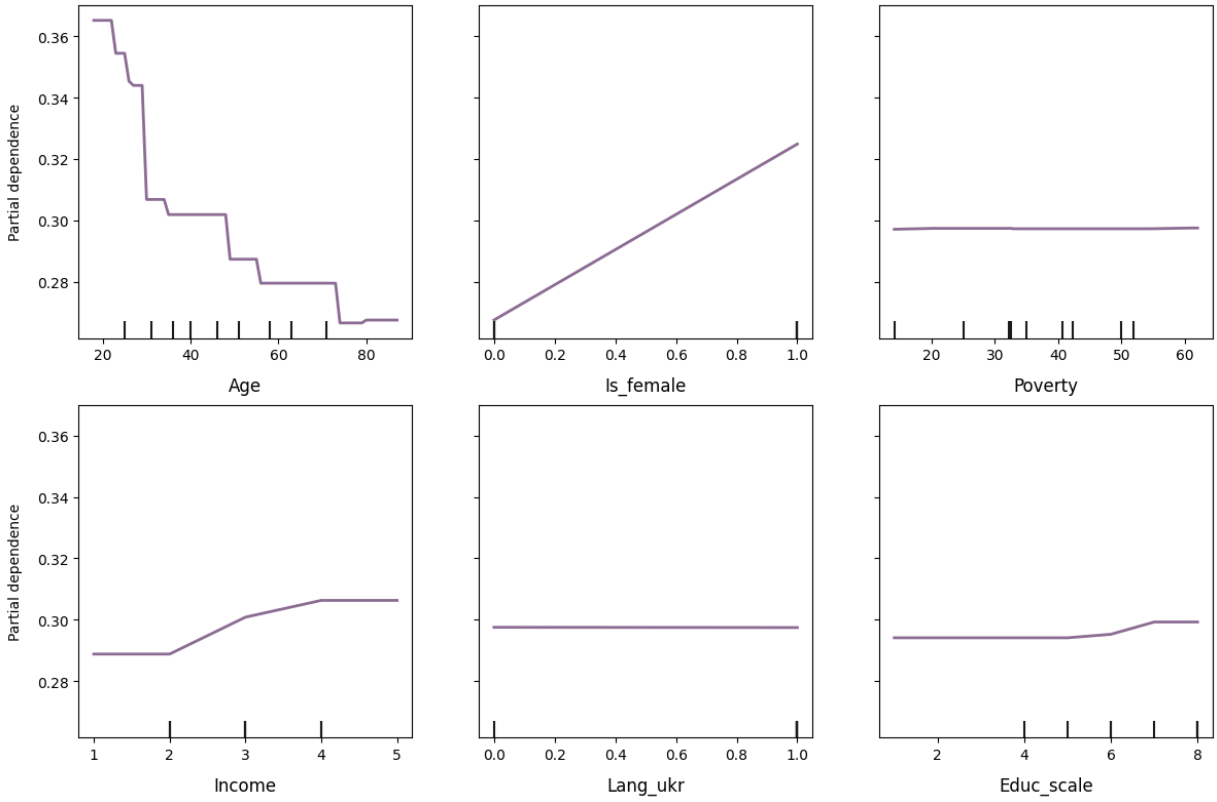

Figure A.3 PDP for the general attitude, class 2; KIIS survey data, 2022-2024.

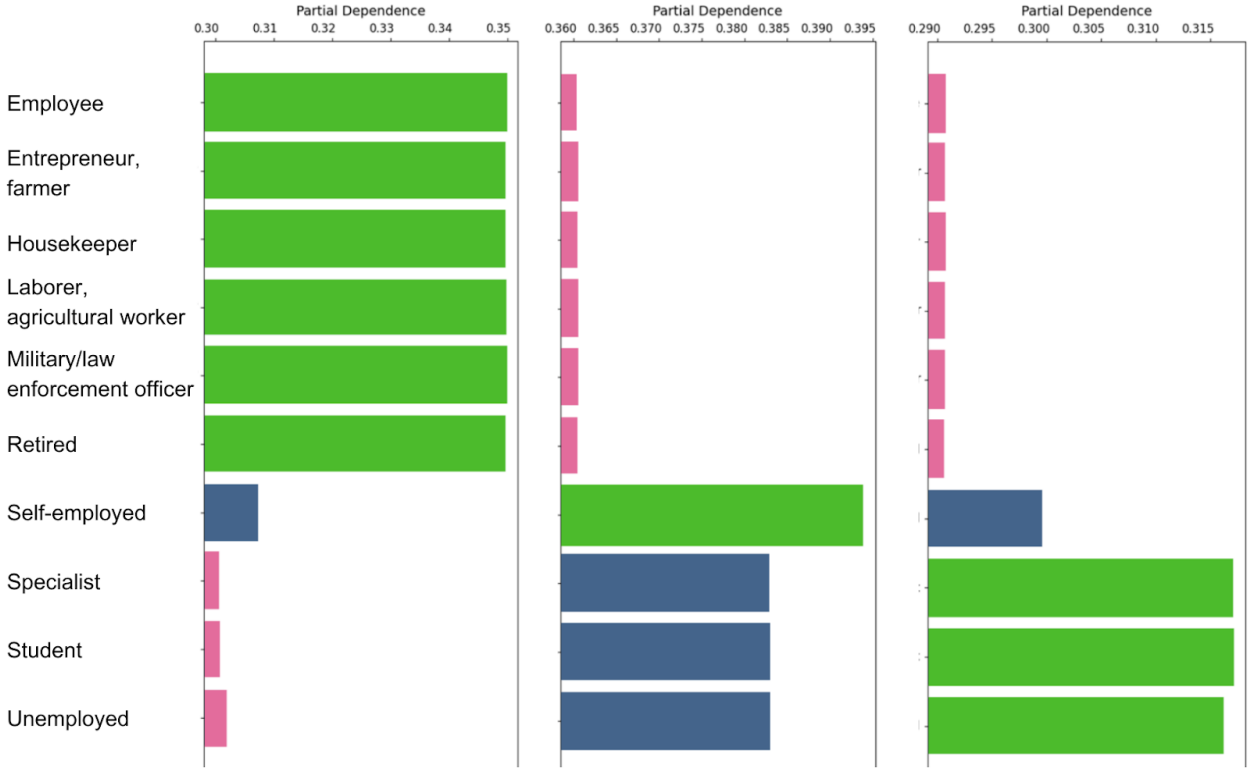

Figure A.4 PDP for the general attitude by occupation for class 0, class 1 and class 2; KIIS survey data, 2022-2024.

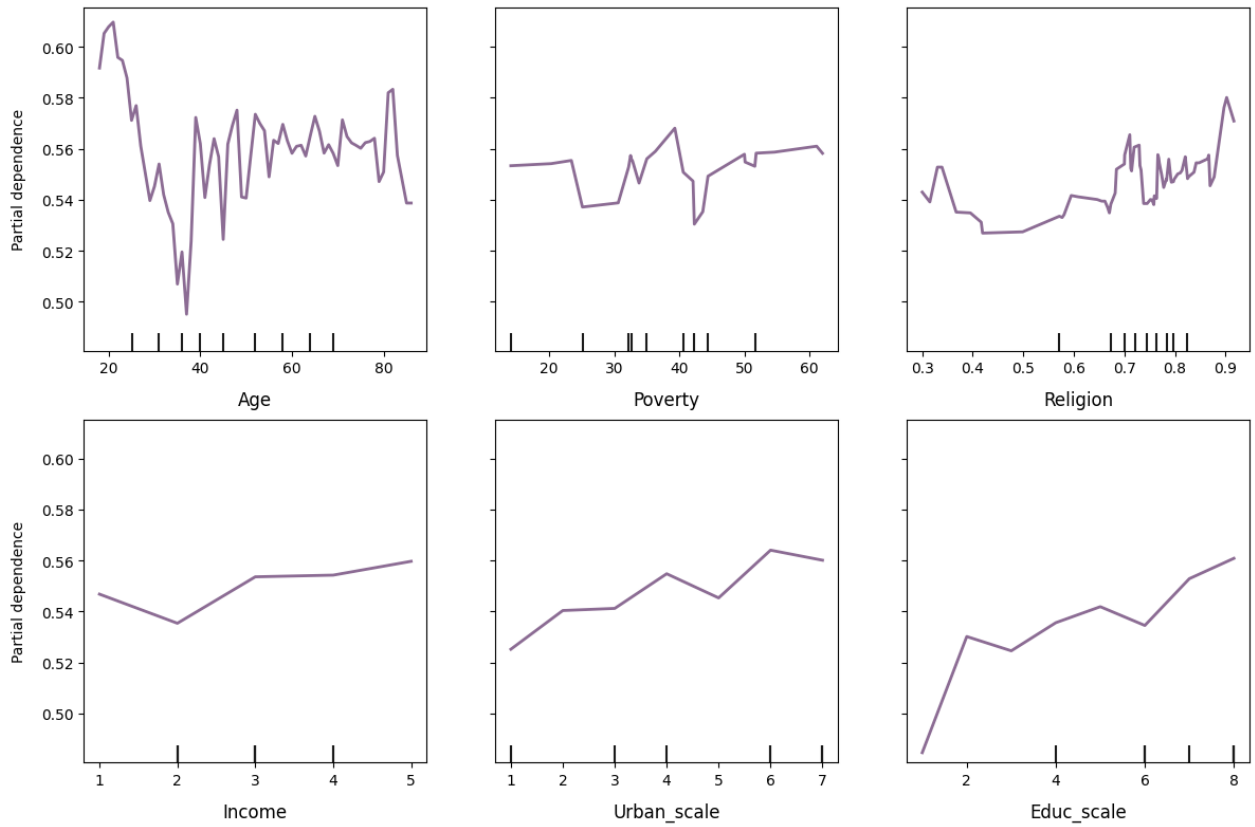

Figure A.5 PDP for the positive attitude towards equal rights for LGBT community; KIIS survey data, 2022-2024.

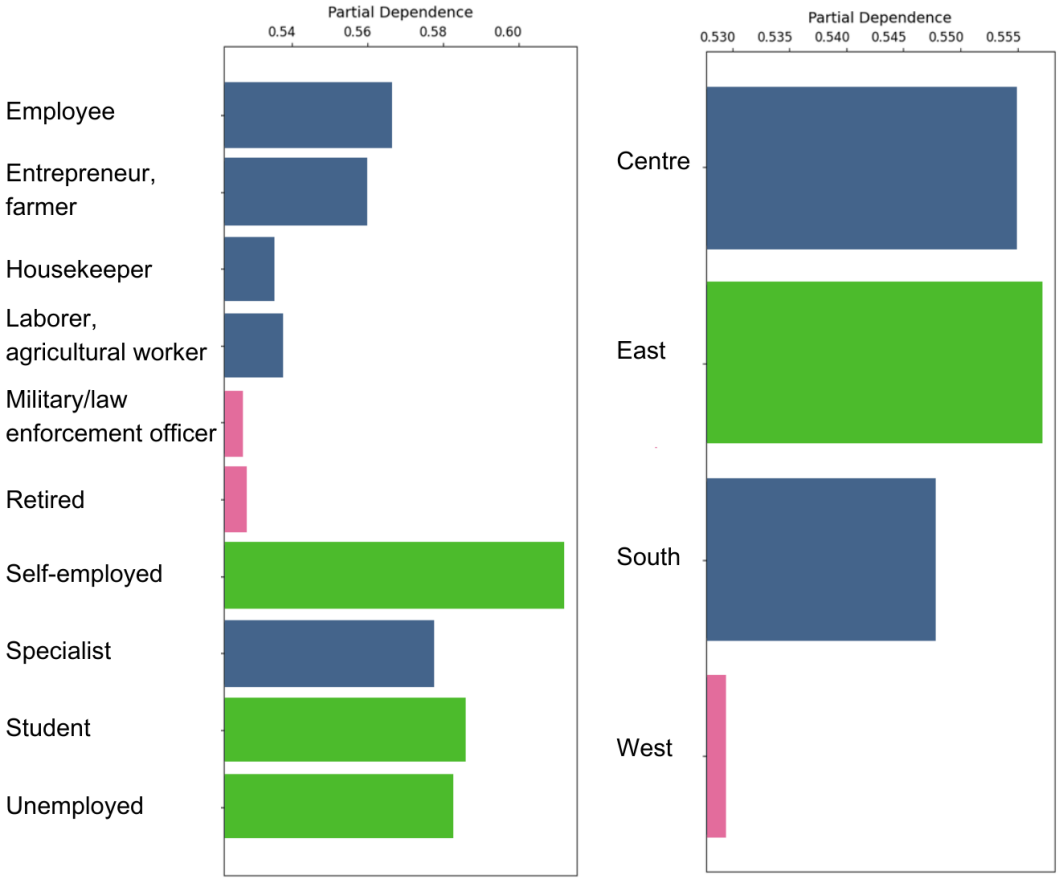

Figure A.6 PDP for the positive attitude towards equal rights for LGBT community by occupation and macro region; KIIS survey data, 2022-2024.

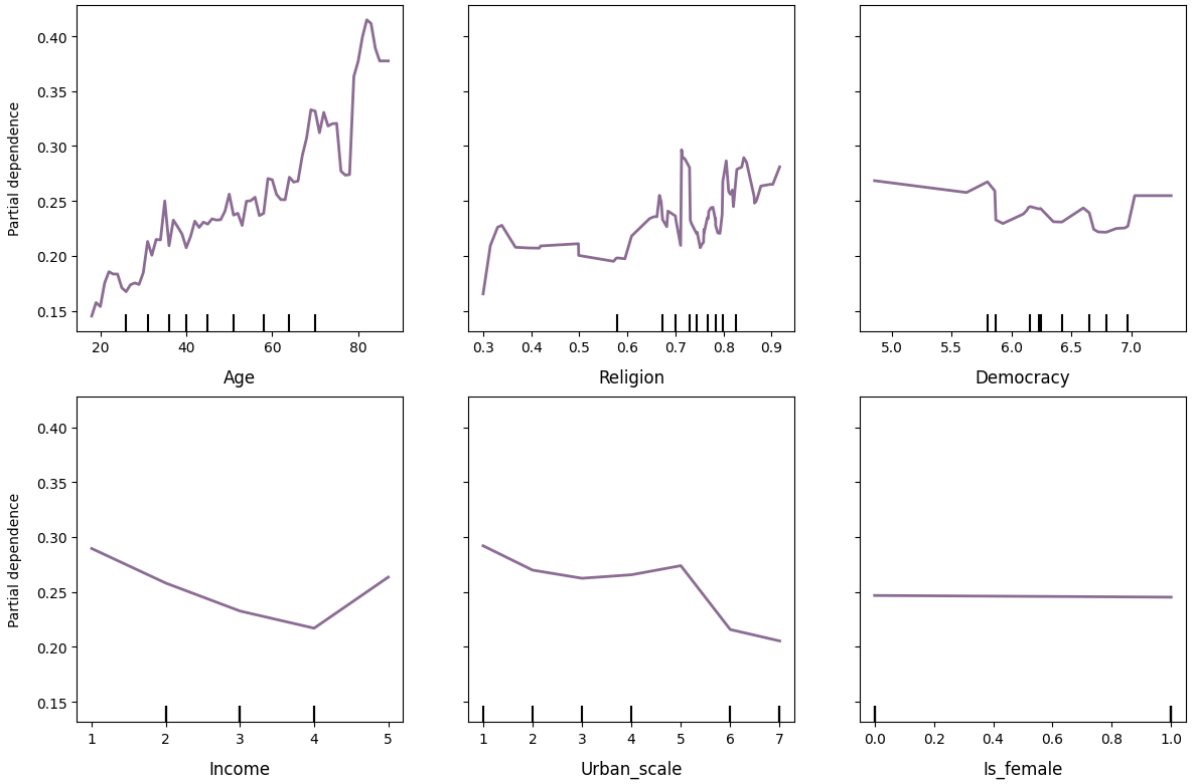

Figure A.7 PDP for the attitude towards LGBT military in Ukraine's Armed Forces, class 0; KIIS survey data, 2022-2024.

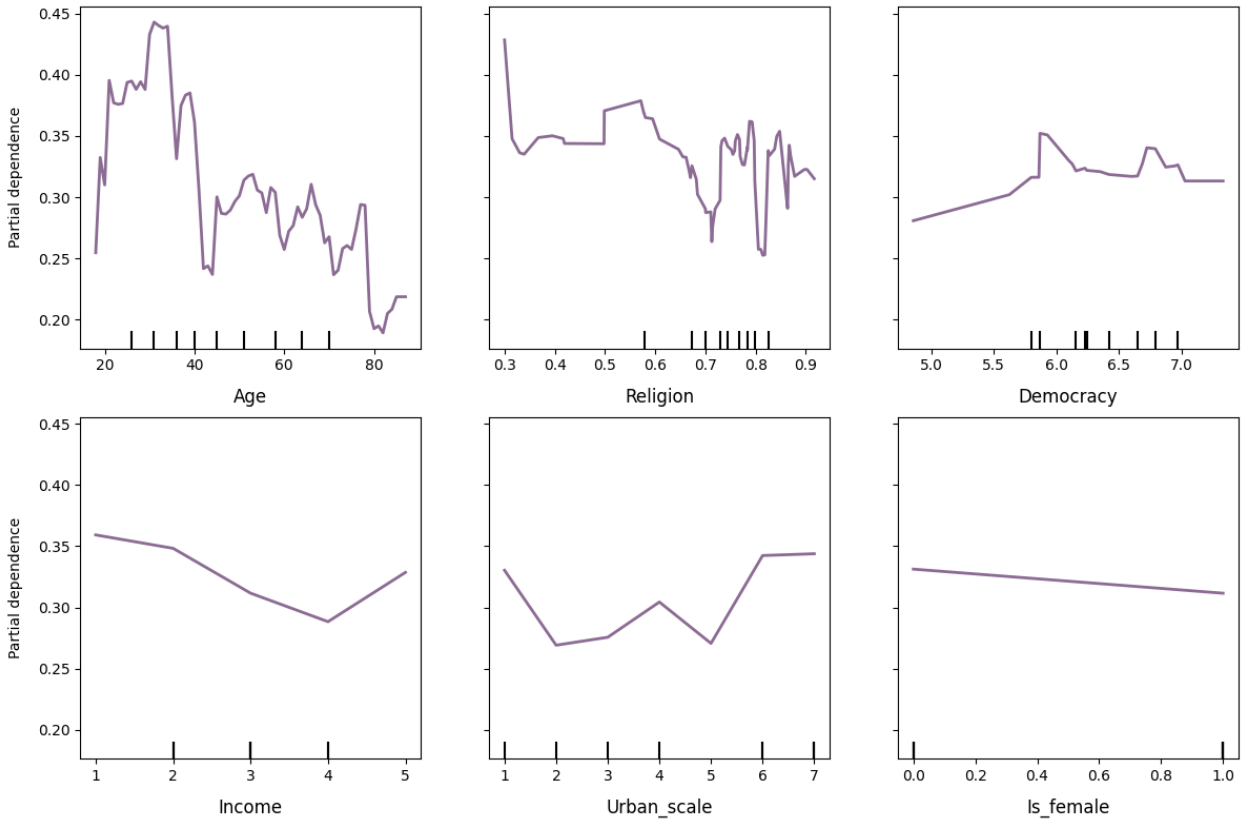

Figure A.8 PDP for the attitude towards LGBT military in Ukraine's Armed Forces, class 1; KIIS survey data, 2022-2024.

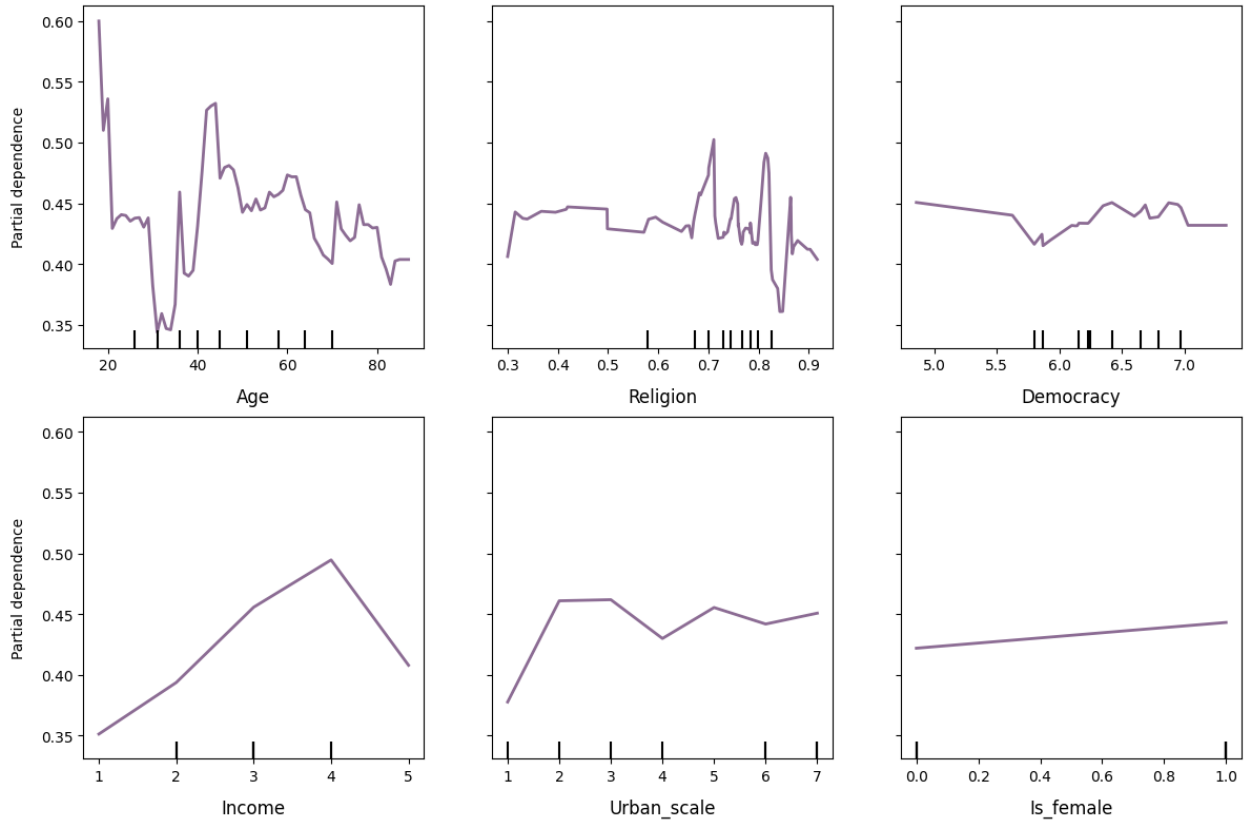

Figure A.9 PDP for the attitude towards LGBT military in Ukraine's Armed Forces, class 2; KIIS survey data, 2022-2024.

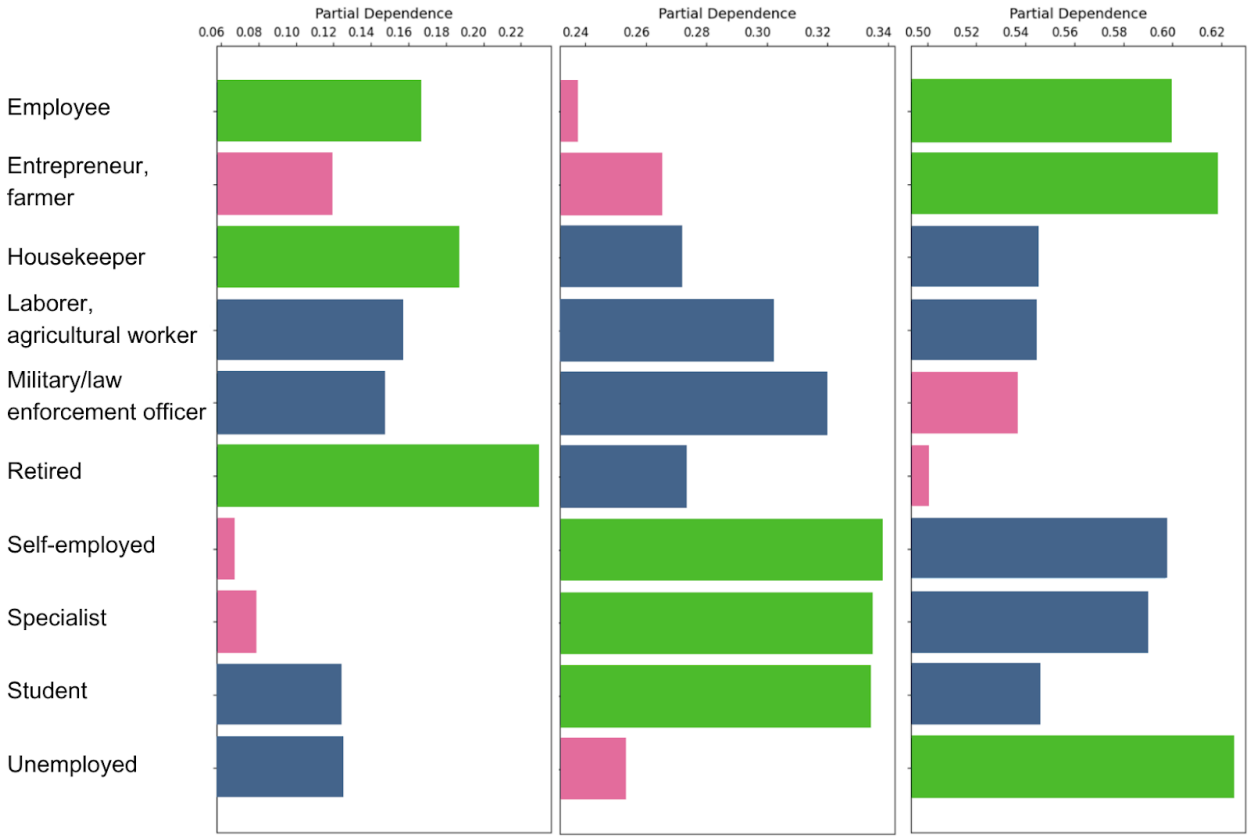

Figure A.10 PDP for the attitude towards LGBT military in Ukraine's Armed Forces by occupation; KIIS survey data, 2022-2024.

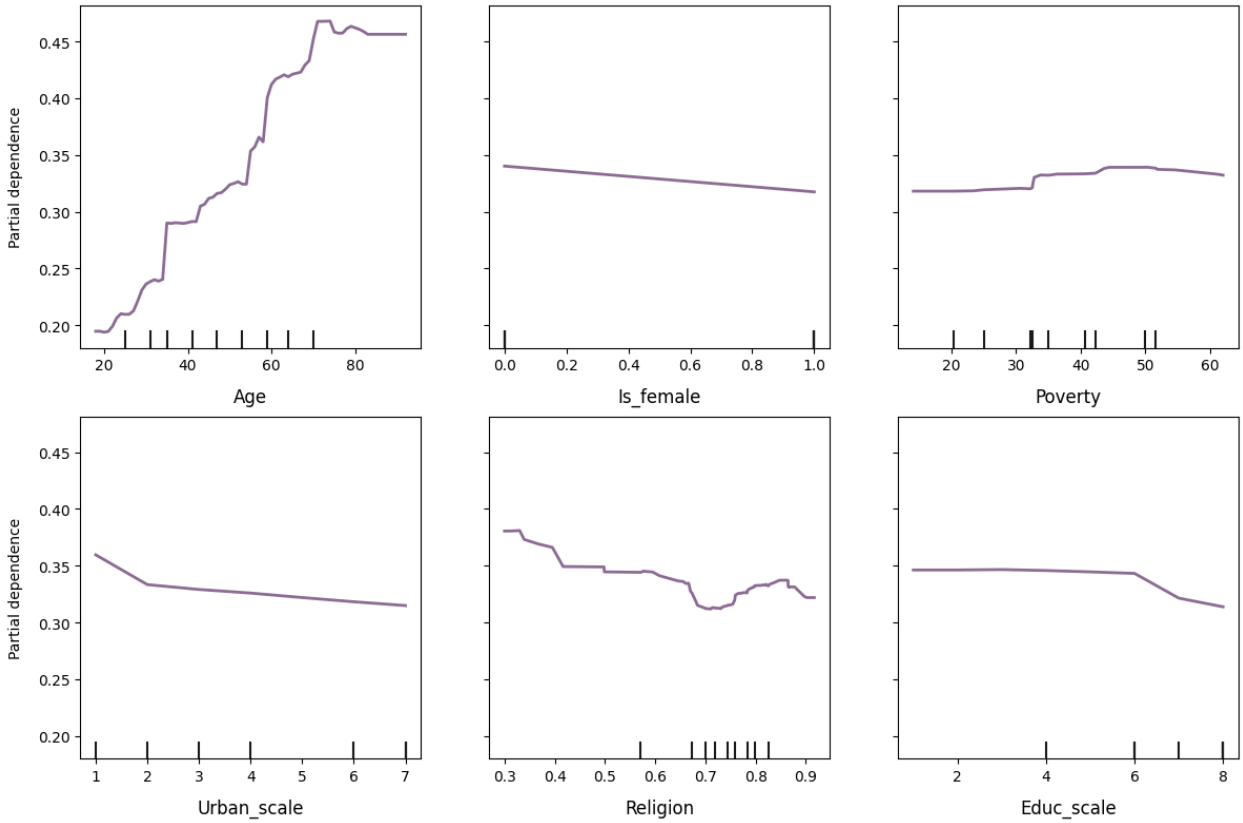

Figure A.11 PDP for the attitude towards the legalisation of the same-sex partnerships, class 0; KIIS survey data, 2022-2024.

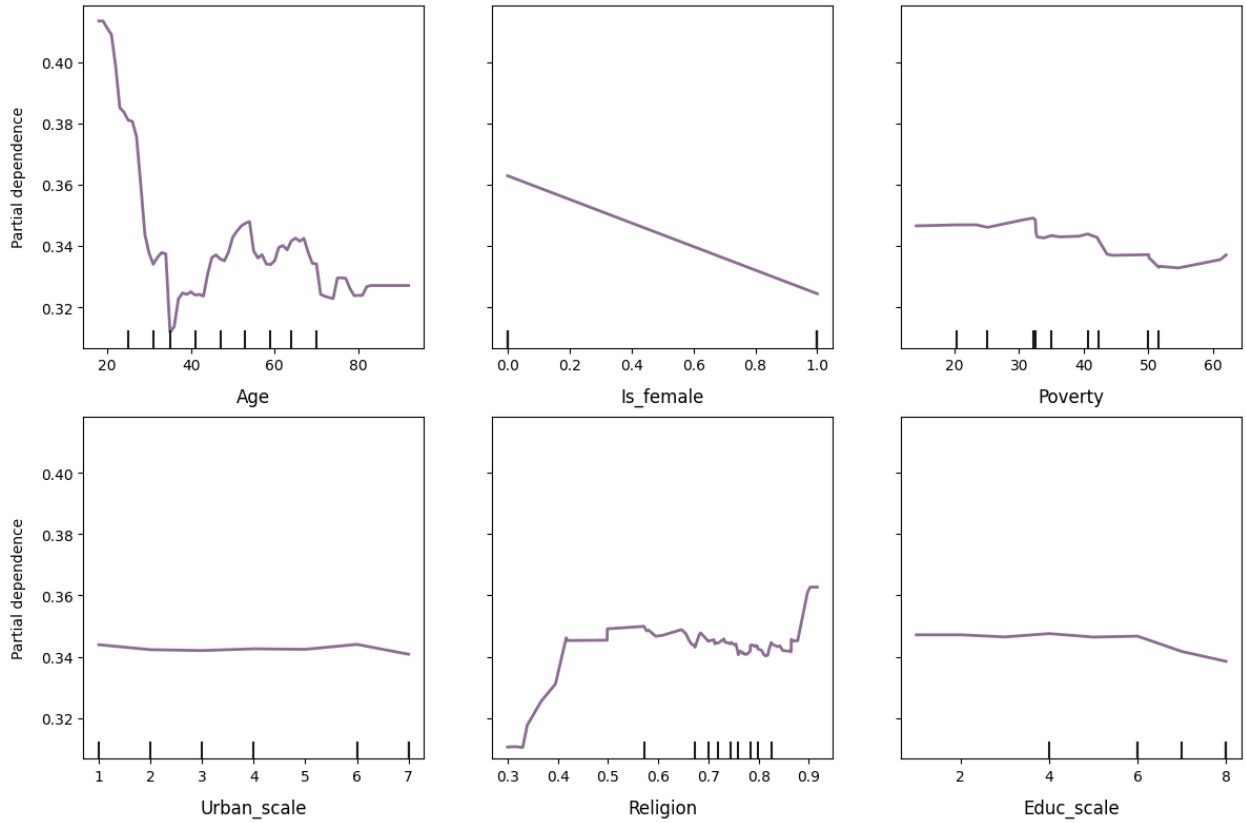

Figure A.12 PDP for the attitude towards the legalisation of the same-sex partnerships, class 1; KIIS survey data, 2022-2024.

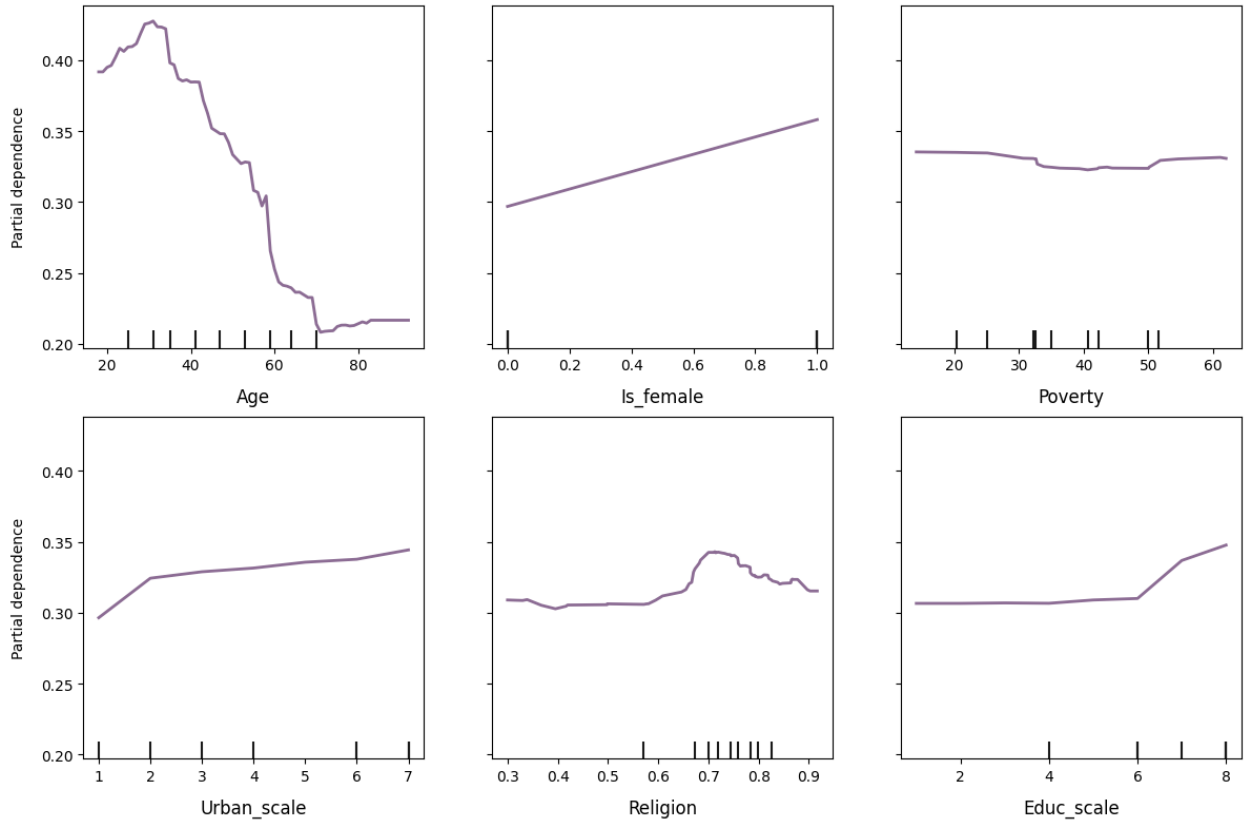

Figure A.13 PDP for the attitude towards the legalisation of the same-sex partnerships, class 2; KIIS survey data, 2022-2024.