

***LOGISTIC Regression With Sas***

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1. INTRODUCTION

In this research paper, our focus is on examining the relationship between satisfaction in democracy and overall life satisfaction in the context of Switzerland. Using an ordinal logistic regression model, we aim to investigate how satisfaction in democracy influences individuals' assessment of their overall life satisfaction in the Swiss context.The relationship between satisfaction in democracy and overall life satisfaction has been a topic of interest in social and political sciences.

Democracy, as a governing system that emphasizes citizen participation, freedom of expression, and decision-making processes, holds the promise of providing individuals with a sense of agency and the ability to shape their own destinies. The satisfaction in democracy can be viewed as an individual's subjective assessment of their level of contentment with the functioning and outcomes of the democratic system. It encompasses aspects such as perceived fairness, effectiveness, transparency, and responsiveness of democratic institutions and processes. Through the utilization of an ordinal logistic regression model, we aim to explore the hypothesis that the satisfaction in democracy positively influences the satisfaction of life as a whole.. The data was taken from European Social Survey.

Variables:  
stflife - How satisfied with life as a whole

stfdem - How satisfied with the way democracy works in country

polintr - How interested in politics

trstplt - Trust in politicians

hinctnta - Household's total net income, all sources

agea - Age of respondent, calculated

gndr – Gender

eduyrs - Years of full-time education completed

sclact - Take part in social activities compared to others of same age

2.Distrubition and grouping of variables:  
  
In this part, we will examine the frequency table and the distribution and group the variables accordingly. If we have small group category, we will include that category to another. We will also check if there is any inbalance in the data.  
  
2.1. stflife - How satisfied with life as a whole

Our frequency table and distribution of the variable can we seen below:

metin, sayı, numara, yazı tipi, ekran görüntüsü içeren bir resim

Açıklama otomatik olarak oluşturuldu

metin, ekran görüntüsü, diyagram, öykü gelişim çizgisi; kumpas; grafiğini çıkarma içeren bir resim

Açıklama otomatik olarak oluşturuldu

According to this chart and the table most people in Switzerland is satisfied with life and therefore we decided to take higher scale to group the life satisfaction. According to the data above and our interpretation, we decided to group life satistaction as:

The category which is between 0 and 6 (Including 0 and 6) is group 1 = not satisfied.  
The 7th and 8th category is group 2 = Satisfied.  
The 9th and 10th category is group 3 = Very satisfied.

2.2 stfdem - How satisfied with the way democracy works in country

Our frequency table and distribution of the variable can we seen below:

metin, sayı, numara, ekran görüntüsü, yazı tipi içeren bir resim

Açıklama otomatik olarak oluşturuldu

diyagram, metin, ekran görüntüsü, öykü gelişim çizgisi; kumpas; grafiğini çıkarma içeren bir resim

Açıklama otomatik olarak oluşturuldu

According to the data above and our interpretation, we decided to group democracy satisfaction as:

The category which is between 0 and 5 (Including 0 and 5) is group 1 = Not satisfied.  
7th and 8th category is group 2 = Satisfied.  
The category which is between 8 and 10 (Including 8 and 10) is group 3 = Very Satisfied.

2.3 polintr - How interested in politics

Our frequency table and distribution of the variable can we seen below:

metin, ekran görüntüsü, yazı tipi, sayı, numara içeren bir resim

Açıklama otomatik olarak oluşturuldu

dikdörtgen, ekran görüntüsü, metin, diyagram içeren bir resim

Açıklama otomatik olarak oluşturuldu

According to the data above and our interpretation, we decided to group this variable as:

1st category is group 1 = Not interested

2nd and 3rd category is group 2 = Interested  
4th category is group 4 = Highly interested

2.4 trstplt - Trust in politicians

Our frequency table and distribution of the variable can we seen below:

metin, sayı, numara, ekran görüntüsü, yazı tipi içeren bir resim

Açıklama otomatik olarak oluşturuldu

metin, diyagram, ekran görüntüsü, dikdörtgen içeren bir resim

Açıklama otomatik olarak oluşturuldu

According to the data above and our interpretation, we decided to group trust in politicians as:

The category which is between 0 and 4 (Including 0 and 4) is group 1 = Doesn’t trust politicians  
The category which is between 5 and 7 (Including 5 and 7) is group 2 = Trust politicians  
The category which is between 8 and 10 (Including 8 and 10) is group 3 = Highly trust politicians.

2.5 hinctnta - Household's total net income, all sources

Our frequency table and distribution of the variable can we seen below:

metin, sayı, numara, ekran görüntüsü, yazı tipi içeren bir resim

Açıklama otomatik olarak oluşturuldu

metin, ekran görüntüsü, öykü gelişim çizgisi; kumpas; grafiğini çıkarma, diyagram içeren bir resim

Açıklama otomatik olarak oluşturuldu

According to the data above and our interpretation, we decided to group total income as:

The category which is between 0 and 4 (Including 0 and 4) is group 1 = Low income  
The category which is between 5 and 8 (Including 5 and 8) is group 2 = average income  
The category which is between 9 and 10 (Including 9 and 10) is group 3 = High income

2.6 agea - Age of respondent, calculated

The age distribution can be seen below:  
ekran görüntüsü, diyagram, dikdörtgen, öykü gelişim çizgisi; kumpas; grafiğini çıkarma içeren bir resim

Açıklama otomatik olarak oluşturuldu

2.7 gndr – Gender

The gender distribution can be seen below:

metin, yazı tipi, ekran görüntüsü, çizgi içeren bir resim

Açıklama otomatik olarak oluşturuldu

ekran görüntüsü, dikdörtgen, ekran, görüntüleme, kare içeren bir resim

Açıklama otomatik olarak oluşturuldu

2.8 eduyrs - Years of full-time education completed

The distribution of education years can be seen below:

diyagram, dikdörtgen, öykü gelişim çizgisi; kumpas; grafiğini çıkarma, çizgi içeren bir resim

Açıklama otomatik olarak oluşturuldu

2.9 sclact - Take part in social activities compared to others of same age

Our frequency table and distribution of the variable can we seen below:

metin, ekran görüntüsü, yazı tipi, sayı, numara içeren bir resim

Açıklama otomatik olarak oluşturuldu

metin, ekran görüntüsü, diyagram, dikdörtgen içeren bir resim

Açıklama otomatik olarak oluşturuldu

3.Missing Values

Our Missing Data Pattern can be seen below:

metin, doküman, belge, sayı, numara, ekran görüntüsü içeren bir resim

Açıklama otomatik olarak oluşturuldu

From this table we can see that %77,94 of the people who attended survey answered all the questions. There is a big missing in income variable, with the number of %14,25 and can be handled technically for a better model.

4. Discriminatory performance of the variables:

4.1 For stfdem - How satisfied with the way democracy works in country:  
metin, ekran görüntüsü, diyagram, dikdörtgen içeren bir resim

Açıklama otomatik olarak oluşturuldu

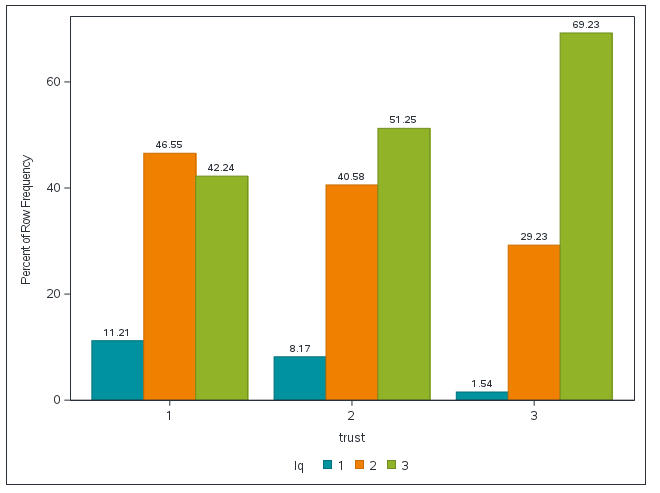
From this chart, we can see the “stairs effect” and say that the life satisfaction increases in Switzerland once democracy satisfaction increases.

4.2 polintr - How interested in politics:

metin, ekran görüntüsü, diyagram, dikdörtgen içeren bir resim

Açıklama otomatik olarak oluşturuldu  
From this chart, we can say that in this variable there is almost no discriminatory performance. Since we do not do predictive modelling we do not drop this variable in this stage.

4.3 For trstplt - Trust in politicians:



In this variable, we can see that life satisfaction increases once trust in politicians increases. It also decreases once trust in politicians decrease.

4.4 For hinctnta - Household's total net income, all sources

metin, ekran görüntüsü, diyagram, dikdörtgen içeren bir resim

Açıklama otomatik olarak oluşturuldu  
Here again, we can say that income positively effects life satisfaction.

4.5 For gndr – Gender:  
metin, ekran görüntüsü, diyagram, dikdörtgen içeren bir resim

Açıklama otomatik olarak oluşturuldu

From this chart, we can say that in this variable there is almost no discriminatory performance.

4.6 For sclact - Take part in social activities compared to others of same age :

metin, ekran görüntüsü, diyagram, dikdörtgen içeren bir resim

Açıklama otomatik olarak oluşturuldu  
In this graph, we can say that life satisfaction slighty increases once sclact variable increases. It also visible that, there is not much of a different between category 2 and 3 of this variable.

4.7 For age and education years variables:  
metin, ekran görüntüsü, yazı tipi, sayı, numara içeren bir resim

Açıklama otomatik olarak oluşturuldu  
It is very hard to interpret age variable in this stage without grouping it.   
It is also hard to interpret the education year values looking at the discriminatory performance.

5. Exploring the individual effectiveness of variables:

5.1 For stfdem - How satisfied with the way democracy works in country:

metin, yazı tipi, ekran görüntüsü, sayı, numara içeren bir resim

Açıklama otomatik olarak oluşturuldu

In the null hypothesis above, all three tests indicate that there is evidence to reject the global null hypothesis, suggesting that the democracy satisfaction variable have a significant impact on the life satisfaction.

metin, ekran görüntüsü, yazı tipi, sayı, numara içeren bir resim

Açıklama otomatik olarak oluşturuldu

The area under the roc curve value for this variable is 0.584

5.2 For polintr - How interested in politics:

metin, yazı tipi, ekran görüntüsü, sayı, numara içeren bir resim

Açıklama otomatik olarak oluşturuldu

metin, ekran görüntüsü, yazı tipi, sayı, numara içeren bir resim

Açıklama otomatik olarak oluşturuldu

The results from all three tests in the null hypothesis, suggest that there is insufficient evidence to reject the global null hypothesis. This means that the predictors included in the model do not have a significant effect on the life satisfaction. We will exclude this variable from our model at this point.

5.3 For trstplt - Trust in politicians:

metin, yazı tipi, ekran görüntüsü, sayı, numara içeren bir resim

Açıklama otomatik olarak oluşturuldu

In the null hypothesis above, all three tests indicate that there is evidence to reject the global null hypothesis, suggesting that the trust in politicians variable have a significant impact on the life satisfaction.

metin, ekran görüntüsü, yazı tipi, sayı, numara içeren bir resim

Açıklama otomatik olarak oluşturuldu  
The area under the roc curve value for this variable is 0.546

5.4 For hinctnta - Household's total net income, all sources

metin, yazı tipi, ekran görüntüsü, sayı, numara içeren bir resim

Açıklama otomatik olarak oluşturuldu

In the null hypothesis above, all three tests indicate that there is evidence to reject the global null hypothesis, suggesting that the income variable have a significant impact on the life satisfaction.

metin, ekran görüntüsü, yazı tipi, çizgi içeren bir resim

Açıklama otomatik olarak oluşturuldu

The area under to roc curve value is 0.547.

5.5 For gndr – Gender:

metin, yazı tipi, ekran görüntüsü, sayı, numara içeren bir resim

Açıklama otomatik olarak oluşturuldu

The results from all three tests in the null hypothesis, suggest that there is insufficient evidence to reject the global null hypothesis. This means that the predictors included in the model do not have a significant effect on the life satisfaction. We will exclude this variable from our model at this point.

metin, ekran görüntüsü, yazı tipi, sayı, numara içeren bir resim

Açıklama otomatik olarak oluşturuldu  
The area under the ROC curve value is 0,512 , almost null.

5.6 For sclact - Take part in social activities compared to others of same age :

metin, yazı tipi, ekran görüntüsü, sayı, numara içeren bir resim

Açıklama otomatik olarak oluşturuldu

The null hypothesis rejected again, which means that this variable effects life satisfaction.

metin, ekran görüntüsü, yazı tipi, çizgi içeren bir resim

Açıklama otomatik olarak oluşturuldu  
The area under the ROC curve value is 0.563

5.7 agea - Age of respondent, calculated

metin, yazı tipi, ekran görüntüsü, sayı, numara içeren bir resim

Açıklama otomatik olarak oluşturuldu

The null hypothesis rejected again, which means that this variable effects life satisfaction.

metin, ekran görüntüsü, yazı tipi, sayı, numara içeren bir resim

Açıklama otomatik olarak oluşturuldu

The area under the ROC curve value is 0.585.  
  
5.8 eduyrs - Years of full-time education completed

metin, yazı tipi, ekran görüntüsü, sayı, numara içeren bir resim

Açıklama otomatik olarak oluşturuldu

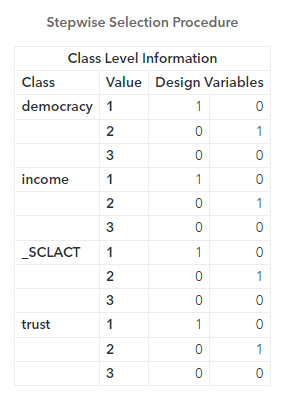
The results from all three tests in the null hypothesis, suggest that there is insufficient evidence to reject the global null hypothesis. This means that the predictors included in the model do not have a significant effect on the life satisfaction. We will exclude this variable from our model at this point.

metin, ekran görüntüsü, yazı tipi, çizgi içeren bir resim

Açıklama otomatik olarak oluşturuldu

The area under the ROC curve value is 0.531.  
  
In this stage, looking at the area under the ROC curve value, we can say that age and democratic satisfaction is main 2 variables that effects the life satisfaction most (from the chosen variables).

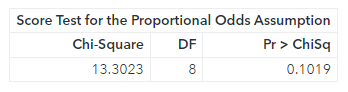
6. Exploratory analysis

According to the explaratory analysis using stepwise selection, those variables below was selected:  


7. Final Ordinal Logistic Regression Model

In the final result of the model, we found following results:

7.1 Score Test for the Proportional Odds Assumption



The proportional odds assumption is an important assumption in ordinal logistic regression, stating that the relationship between the predictors and the outcome variable remains consistent across all levels of the response variable.

In our model, the score test statistic is 13.3023, with 8 degrees of freedom. The p-value, which is 0.1019, represents the probability of observing a test statistic as extreme as the calculated value under the assumption that the proportional odds assumption holds. This assumption implies that the relationship between the predictor variable(s) and the outcome variable is consistent across all levels or categories of the outcome.

* 1. Type 3 Analysis of Effects

metin, ekran görüntüsü, yazı tipi, sayı, numara içeren bir resim

Açıklama otomatik olarak oluşturuldu

1-"democracy": The Wald Chi-Square test for democracy has a value of 20.7572, and the p-value is less than 0.0001. This indicates that democracy is significantly associated with the life satisfaction variable. The exact nature and direction of this association cannot be determined from the provided information.

2- "income": The Wald Chi-Square test for income has a value of 7.6028, and the p-value is 0.0223. This suggests that income is also significantly associated with the life satisfaction variable, although the association may be weaker compared to democracy.

3- "\_SCLACT": The Wald Chi-Square test for \_SCLACT has a value of 18.9955, and the p-value is less than 0.0001. This indicates a significant association between \_SCLACT and the life satisfaction variable.

4- "trust": The Wald Chi-Square test for trust has a value of 6.4245, and the p-value is 0.0403. This suggests that trust is significantly associated with the life satisfaction variable, although again, the association may be weaker compared to the other predictors.

* 1. Analysis of Maximum Likelihood Estimates

metin, ekran görüntüsü, yazı tipi, sayı, numara içeren bir resim

Açıklama otomatik olarak oluşturuldu

1)"Intercept" (Category 1): The intercept for Category 1 has an estimated coefficient of -3.6411, a standard error of 0.3594, and a highly significant Wald Chi-Square test (102.6518, p < 0.0001). The exponentiated estimate (Exp(Est)) of 0.026 indicates that the odds of being in a higher category decrease significantly for Category 1 compared to the reference category.

2)"Intercept" (Category 2): The intercept for Category 2 has an estimated coefficient of -1.1997, a standard error of 0.3428, and a significant Wald Chi-Square test (12.2473, p = 0.0005). The exponentiated estimate (Exp(Est)) of 0.301 suggests that the odds of being in a higher category decrease significantly for Category 2 compared to the reference category.

3)"democracy" (Category 1): The democracy variable for Category 1 has an estimated coefficient of 0.7226, a standard error of 0.2120, and a significant Wald Chi-Square test (11.6165, p = 0.0007). The exponentiated estimate (Exp(Est)) of 2.060 indicates that, holding other variables constant, a one-unit increase in democracy is associated with a more than two-fold increase in the odds of being in a higher category.

4)"democracy" (Category 2): The democracy variable for Category 2 has an estimated coefficient of 0.5060, a standard error of 0.1311, and a highly significant Wald Chi-Square test (14.9043, p < 0.0001). The exponentiated estimate (Exp(Est)) of 1.659 suggests that, holding other variables constant, a one-unit increase in democracy is associated with a 1.659-fold increase in the odds of being in a higher category.

5)"income" (Category 1): The income variable for Category 1 has an estimated coefficient of 0.3763, a standard error of 0.1631, and a marginally significant Wald Chi-Square test (5.3208, p = 0.0211). The exponentiated estimate (Exp(Est)) of 1.457 suggests that, holding other variables constant, a one-unit increase in income is associated with a 1.457-fold increase in the odds of being in a higher category.

6)"income" (Category 2): The income variable for Category 2 has an estimated coefficient of 0.0738, a standard error of 0.1574, and a non-significant Wald Chi-Square test (0.2201, p = 0.6390). The exponentiated estimate (Exp(Est)) of 1.077 suggests that, holding other variables constant, a one-unit increase in income is associated with a slight increase (1.077-fold) in the odds of being in a higher category, although this effect is not statistically significant.

7)"\_SCLACT" (Category 1): The \_SCLACT variable for Category 1 has an estimated coefficient of 0.4549, a standard error of 0.1662, and a significant Wald Chi-Square test (7.4888, p = 0.0062). The exponentiated estimate (Exp(Est)) of 1.576 indicates that, holding other variables constant, a one-unit increase in \_SCLACT is associated with a 1.576-fold increase in the odds of being in a higher category.

8)"\_SCLACT" (Category 2): The \_SCLACT variable for Category 2 has an estimated coefficient of -0.0796, a standard error of 0.1623, and a non-significant Wald Chi-Square test (0.2405, p = 0.6239). The exponentiated estimate (Exp(Est)) of 0.923 suggests that \_SCLACT does not have a significant effect on the odds of being in a higher category for Category 2.

9)"trust" (Category 1): The trust variable for Category 1 has an estimated coefficient of 0.8300, a standard error of 0.3292, and a significant Wald Chi-Square test (6.3554, p = 0.0117). The exponentiated estimate (Exp(Est)) of 2.293 indicates that, holding other variables constant, a one-unit increase in trust is associated with a more than two-fold increase in the odds of being in a higher category.

10)"trust" (Category 2): The trust variable for Category 2 has an estimated coefficient of 0.6624, a standard error of 0.3072, and a marginally significant Wald Chi-Square test (4.6484, p = 0.0311). The exponentiated estimate (Exp(Est)) of 1.939 suggests that, holding other variables constant, a one-unit increase in trust is associated with a 1.939-fold increase in the odds of being in a higher category.

Overall, the results indicate that the predictor variables (democracy, income, \_SCLACT, and trust) are significantly associated with the outcome variable in the ordinal logistic regression model. The exponentiated estimates (Exp(Est)) provide insights into the direction and magnitude of the effects of these variables on the odds of being in a higher category.

* 1. Odds Ratio Estimates

metin, ekran görüntüsü, sayı, numara, yazı tipi içeren bir resim

Açıklama otomatik olarak oluşturuldu

metin, sayı, numara, ekran görüntüsü, paralel içeren bir resim

Açıklama otomatik olarak oluşturuldu

1)"democracy 1 vs 3": The odds ratio estimate for comparing Category 1 of the "democracy" variable to Category 3 is 2.060. This indicates that, holding other variables constant, the odds of being in a higher category (Category 1 vs. Category 3) increase by a factor of 2.060. The 95% Wald Confidence Limits suggest that the true odds ratio lies between 1.359 and 3.121 with 95% confidence.

2)"democracy 2 vs 3": The odds ratio estimate for comparing Category 2 of the "democracy" variable to Category 3 is 1.659. This suggests that, holding other variables constant, the odds of being in a higher category (Category 2 vs. Category 3) increase by a factor of 1.659. The 95% Wald Confidence Limits indicate that the true odds ratio lies between 1.283 and 2.144 with 95% confidence.

3)"income 1 vs 3": The odds ratio estimate for comparing Category 1 of the "income" variable to Category 3 is 1.457. This suggests that, holding other variables constant, the odds of being in a higher category (Category 1 vs. Category 3) increase by a factor of 1.457. The 95% Wald Confidence Limits indicate that the true odds ratio lies between 1.058 and 2.006 with 95% confidence.

4)"income 2 vs 3": The odds ratio estimate for comparing Category 2 of the "income" variable to Category 3 is 1.077. This indicates that, holding other variables constant, the odds of being in a higher category (Category 2 vs. Category 3) increase by a factor of 1.077. The 95% Wald Confidence Limits suggest that the true odds ratio lies between 0.791 and 1.466 with 95% confidence.

5)"\_SCLACT 1 vs 3": The odds ratio estimate for comparing Category 1 of the "\_SCLACT" variable to Category 3 is 1.576. This suggests that, holding other variables constant, the odds of being in a higher category (Category 1 vs. Category 3) increase by a factor of 1.576. The 95% Wald Confidence Limits indicate that the true odds ratio lies between 1.138 and 2.183 with 95% confidence.

6)"\_SCLACT 2 vs 3": The odds ratio estimate for comparing Category 2 of the "\_SCLACT" variable to Category 3 is 0.923. This indicates that, holding other variables constant, the odds of being in a higher category (Category 2 vs. Category 3) decrease by a factor of 0.923. The 95% Wald Confidence Limits suggest that the true odds ratio lies between 0.672 and 1.269 with 95% confidence.

7)"trust 1 vs 3": The odds ratio estimate for comparing Category 1 of the "trust" variable to Category 3 is 2.293. This suggests that, holding other variables constant, the odds of being in a higher category (Category 1 vs. Category 3) increase by a factor of 2.293. The 95% Wald Confidence Limits indicate that the true odds ratio lies between 1.203 and 4.372 with 95% confidence.

8)"trust 2 vs 3": The odds ratio estimate for comparing Category 2 of the "trust" variable to Category 3 is 1.939. This suggests that, holding other variables constant, the odds of being in a higher category (Category 2 vs. Category 3) increase by a factor of 1.939. The 95% Wald Confidence Limits indicate that the true odds ratio lies between 1.062 and 3.541 with 95% confidence.

These odds ratio estimates provide insights into the strength and direction of the relationships between each predictor variable and the odds of being in a higher category compared to the reference category.

8. Conclusion  
The research paper focuses on examining the relationship between satisfaction in democracy and overall life satisfaction in Switzerland using logistic regression analysis. The study aims to explore how satisfaction in democracy influences individuals' assessment of their overall life satisfaction. The data used for the analysis is obtained from the European Social Survey.

The paper begins with an introduction that highlights the significance of studying the relationship between satisfaction in democracy and life satisfaction. Democracy, as a governing system emphasizing citizen participation and decision-making processes, is expected to provide individuals with a sense of agency and the ability to shape their own destinies. The satisfaction in democracy is considered as an individual's subjective assessment of their level of contentment with the functioning and outcomes of the democratic system.

The authors then proceed to discuss the distribution and grouping of variables. They examine various variables such as life satisfaction, satisfaction with democracy, interest in politics, trust in politicians, household income, age, gender, education years, and social activities. They present frequency tables and distributions for each variable and group them accordingly based on their interpretations.

The paper also addresses missing values in the data, noting that a significant portion of respondents answered all the questions, but there is a considerable amount of missing data in the income variable. The authors mention that this can be handled technically for a better model.

Next, the discriminatory performance of the variables is analyzed. The authors assess the relationship between each variable and life satisfaction, using graphs and statistical tests. They identify variables such as satisfaction with democracy, trust in politicians, household income, participation in social activities, age, and gender that have discriminatory performance and significantly affect life satisfaction.

The individual effectiveness of these variables is further explored through statistical tests. The authors conduct tests to determine the significance of each variable's impact on life satisfaction. Variables such as satisfaction with democracy, trust in politicians, household income, participation in social activities, and age are found to have a significant effect on life satisfaction based on the results of the tests.

The paper then presents the final ordinal logistic regression model, including the score test for the proportional odds assumption. The authors analyze the effects of each variable on life satisfaction, highlighting the significant associations between democracy, income, participation in social activities, and trust in politicians with life satisfaction. They provide the estimated coefficients and associated statistical tests for each variable in the model.

In conclusion, the study explores the relationship between satisfaction in democracy and overall life satisfaction in Switzerland. The findings suggest that satisfaction with democracy, household income, participation in social activities, and trust in politicians significantly influence individuals' life satisfaction. These results contribute to our understanding of the factors that affect individuals' subjective assessment of their overall well-being in a democratic context.

9. References:

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