project

Table of contents

```
library(tidyverse)
library(ggplot2)
library(reshape2)
library(dplyr)
library(tidyr)
library(MASS)  # For Box-Cox
library(moments)  # For skewness/kurtosis
library(ggfortify)
library(viridis)  # For a professional color palette
library(ggpubr)    # For boxplots    # For normality tests and transformations
library(ggthemes) # For better themes
library(kableExtra)
library(GGally)
```

1 Introduction

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2 Setting up our relevante Dataset:

```
data_loc = "mc.csv"
data <- read.csv(data_loc)
#-3 values represent null values so we assing NA
data[data == -3] <- NA
#subset = styria -> NUTS2 = AT22
data <- data |> filter(xnuts2 == 22)
#filtering only for the relevant Predictors
data <- data |>dplyr::select(werr, dseitz, dstd, kjahr, xanzkind, xminalt,
            balt5, bsex,bfst, xbstaat, xbgeblan, xhatlevel, xeinw, xlfi,xpatch)
head(data)
```

	werr	dseitz	dstd	kjahr	xanzkind	xminalt	balt5	bsex	bfst	xbstaat	xbgeblan
1	3	17	30	26	NA	NA	7	1	4	1	1
2	6	NA	NA	50	0	25	11	1	2	1	1
3	6	NA	NA	47	0	25	10	2	2	1	1
4	8	NA	NA	69	1	24	14	2	3	1	1
5	8	NA	NA	45	1	24	10	2	1	1	1
6	4	NA	NA	49	NA	NA	14	1	2	1	1

```
  xhatlevel xeinw xlfi xpatch
1        32     4    1      NA
2        32     1    3      NA
3        32     1    3      NA
4        21     2    3      NA
5        21     2    3      NA
6        51     4    3      NA
```

```r
data <- data %>%
    mutate(
    werr = factor(werr, levels = 1:8,
                  labels = c("before 1919", "1919-1944", "1945-1960",
                             "1961-1970", "1971-1980", "1981-1990",
                             "1991-2000", "after 2000")),

    balt5 = factor(balt5, levels = 0:15,
                   labels = c("0-14", "15-19", "20-24", "25-29", "30-34", "35-39",
                              "40-44", "45-49", "50-54", "55-59", "60-64", "65-69",
                              "70-74", "75-79", "80-84", "85+")),

    bsex = factor(bsex, levels = c(1, 2), labels = c("Male", "Female")),

    bfst = factor(bfst, levels = 1:4,
                  labels = c("Single", "Married", "Widowed", "Divorced")),

    xbstaat = factor(xbstaat, levels = 1:7,
                     labels = c("Austria", "EU15 without Austria", "EU15 10 new members",
                                "Former Yugoslavia", "Turkey", "Other countries", "Bulgaria/I

    xbgeblan = factor(xbgeblan, levels = 1:7,
                      labels = c("Austria", "EU15 without Austria", "EU15 10 new members",
                                 "Former Yugoslavia", "Turkey", "Other countries", "Bulgaria/

    xhatlevel = factor(xhatlevel, levels = c(0, 11, 21, 22, 30, 31, 32, 41, 42, 43, 51, 52, 6
                       labels = c("ISCED 0/1", "ISCED 1", "ISCED 2", "ISCED 3c <2 years",
                                  "ISCED 3", "ISCED 3c 2+ years", "ISCED 3a, b", "ISCED 4a, 
                                  "ISCED 4c", "ISCED 4", "ISCED 5b", "ISCED 5a", "ISCED 6", "

    xeinw = factor(xeinw, levels = 1:4,
                   labels = c("up to 2000", "2001-10000", "10001-100000", "100001+")),

    xlfi = factor(xlfi, levels = 1:3,
```

```r
                     labels = c("Employed", "Unemployed", "Not in labor force")),

    xpatch = factor(xpatch, levels = c(1, 2), labels = c("Yes", "No"))
  )
data <- na.omit(data)

head(data)
```

```
        werr dseitz dstd kjahr xanzkind xminalt balt5    bsex     bfst xbstaat
10 after 2000      4   30    30        2      13 50-54    Male Married Austria
11 after 2000    156   70    15        2      13 45-49 Female Married Austria
14  1991-2000     74   38    31        2      14 45-49    Male  Single Austria
15  1991-2000    216   34    24        2      14 40-44 Female  Single Austria
16  1991-2000     11   40     3        2      14 20-24 Female  Single Austria
21  1981-1990     12   39     3        1      20 20-24    Male  Single Austria
   xbgeblan    xhatlevel      xeinw    xlfi xpatch
10  Austria ISCED 3a, b    100001+ Employed     No
11  Austria    ISCED 5a    100001+ Employed     No
14  Austria ISCED 3a, b up to 2000 Employed     No
15  Austria ISCED 3a, b up to 2000 Employed     No
16  Austria ISCED 3a, b up to 2000 Employed     No
21  Austria ISCED 3a, b 2001-10000 Employed     No
```

```r
data.numeric <-c("dseitz","dstd","kjahr","xanzkind")
data.polytomous <- c("balt5","bfst","xbstaat","xbgeblan","xhatlevel","xeinw","xlfi")
data.categorical <- c("balt5","bsex","bfst","xbstaat","xbgeblan","xhatlevel","xeinw","xlfi",
```

3 Descriptice Analysis

3.1 Numeric Variables

```r
# Load required libraries
library(ggplot2)
library(ggpubr)

# Define the function
plot_numeric_variable <- function(data, column_name, target_variable,plot_title) {

  # Histogram with density line
  hist_plot <- ggplot(data, aes_string(x = column_name)) +
    geom_histogram(aes(y = ..density..), bins = 30) +
    geom_density() +
    labs(x = "Data", y = "Density") +
    ggtitle("Histogram") +
    theme_grey() +
    scale_colour_grey()

  # Boxplot
  boxplot <- ggplot(data, aes_string(y = column_name)) +
    geom_boxplot() +
    xlim(-1, 1) +
    labs(y = "Data") +
    ggtitle("Boxplot") +
    theme_grey() +
    scale_colour_grey() +
    scale_fill_grey()

  # Relationship between the numeric variable and the categorical target variable
  relationship_plot <- ggplot(data, aes_string(x = target_variable, y = column_name)) +
    geom_boxplot() +
    labs(x = target_variable, y = column_name) +
    ggtitle("relationship with target werr") +
    theme_grey() +
    scale_colour_grey() +
    scale_fill_grey()

  # Arrange all three plots in one row
  plot <- ggarrange(hist_plot, boxplot, relationship_plot, ncol = 3, nrow = 1, widths = c(0.5
```

```
  # Add title to the combined plot
  plot_with_title <- annotate_figure(plot,
                                      top = text_grob(paste(plot_title, target_variable),
                                                      face = "bold", size = 14))

  # Return the plot with title
  return(plot_with_title)
}
```

3.1.1 dseitz: working in the current job since. . . (in months)

```
summary(data$dseitz)
```

```
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
    0.0    29.5    95.5   127.6   187.5   469.0
```

```
sd(data$dseitz)
```

```
[1] 117.1715
```

```
#|warning: false
#|
plot_numeric_variable(data, "dseitz","werr","dseitz: working in the current job since. . . (
```


dseitz: working in the current job since. . . (in months) werr
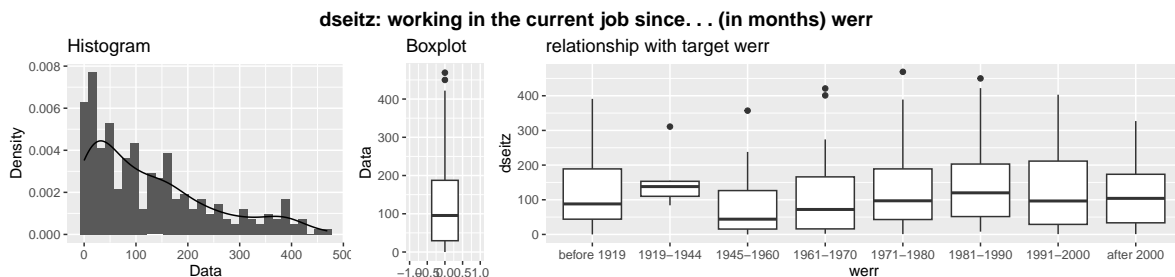
```
#plot_numeric_variable(data, "dstd","werr","dstd: normal weekly working hours")
#plot_numeric_variable(data, "kjahr","werr","kjahr: years since completing the highest level
#plot_numeric_variable(data, "xanzkind","werr","xanzkind: number of children under 18 in the
#plot_numeric_variable(data, "xminalt","werr","age of youngest child in the family (in years)
```

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The histogram shows that the variable follows a right-skewed distribution and has a high spread. Trough the boxplot we see that most values are between 0 and 200 with some outliers above 400. The box plot categorized by the buildings-Year shows that the distribution of dseitz differs across the categories. Additionally we see some outliers, but none of the seem to strongly influence the mean of the category, except 1919-1944 which shows a mean skewed towards the outlier.

The skeweness and the different distributions throughout the categories might indicate that a transformation would help to conform more to a normal-distribution.

```
plot_numeric_variable_with_transformation(data,"dseitz","werr")
```


Comparison of Original and Transformed (sqrt) Data dseitz
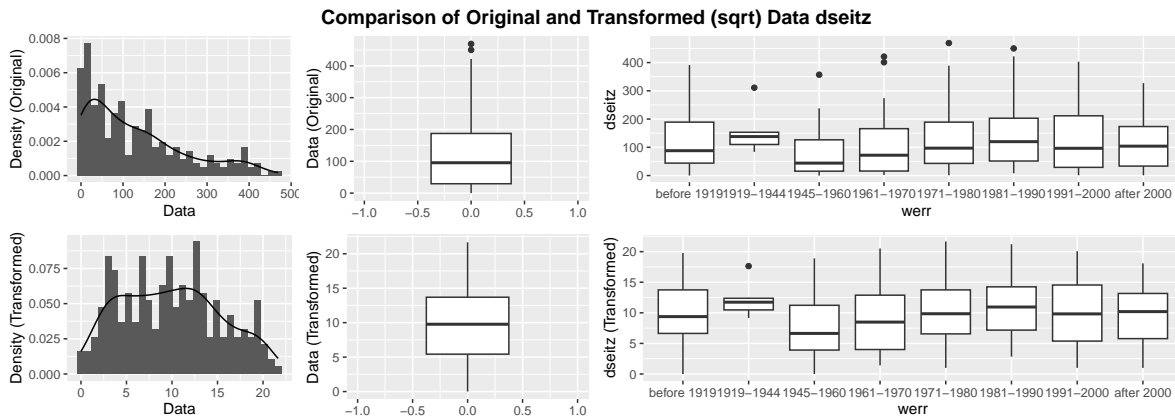
```
# Perform Shapiro-Wilk test before transformation
shapiro_before <- shapiro.test(data$dseitz)
data_sqrt <- sqrt(data$dseitz)
shapiro_after <- shapiro.test(data_sqrt)

# Create a formatted table of test results
shapiro_results <- data.frame(
  Test = c("Original Data", "Square Root Transformed"),
  W_Statistic = c(shapiro_before$statistic, shapiro_after$statistic),
  P_Value = c(shapiro_before$p.value, shapiro_after$p.value)
)
kable(shapiro_results, caption = "Shapiro-Wilk Normality Test Results", digits = 5)
```

Table 1: Shapiro-Wilk Normality Test Results

Test	W_Statistic	P_Value
Original Data	0.88551	0e+00
Square Root Transformed	0.97086	4e-05

After applying the

```
pair_data <- data[,data.numeric]
ggpairs(pair_data,
        lower = list(continuous = "smooth"), # Smoothed scatterplots on the lower panel
        diag = list(continuous = "densityDiag"), # Density plots on the diagonal
        upper = list(continuous = "cor")) # Add correlation coefficients on the upper panel
```
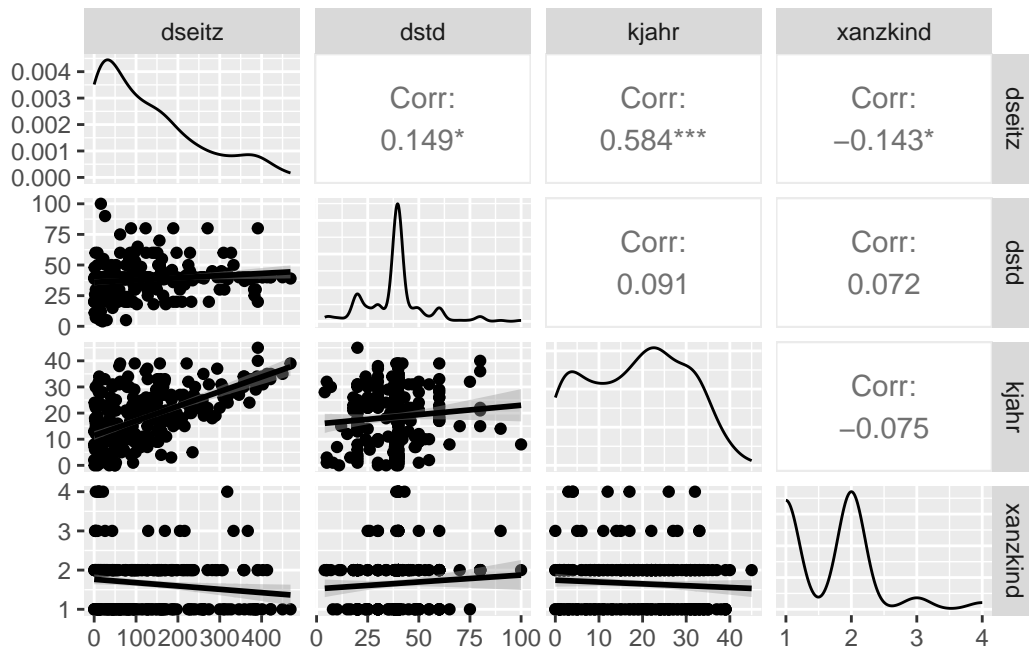

3.1.1.1 Examine Outliers

```
plot_numeric_variable_with_transformation(data,"dseitz","werr")
```

Comparison of Original and Transformed (sqrt) Data dseitz


```
plot_numeric_variable_with_transformation(data,"dstd","werr")
```
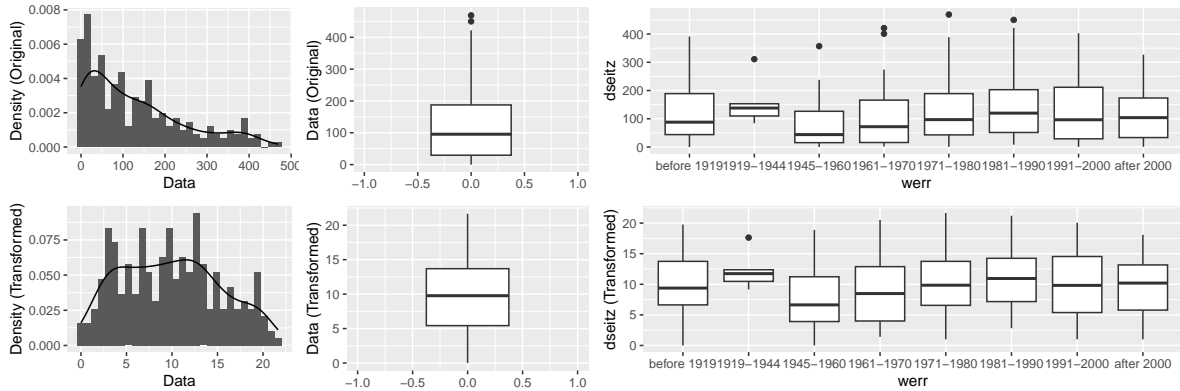
Comparison of Original and Transformed (sqrt) Data dstd
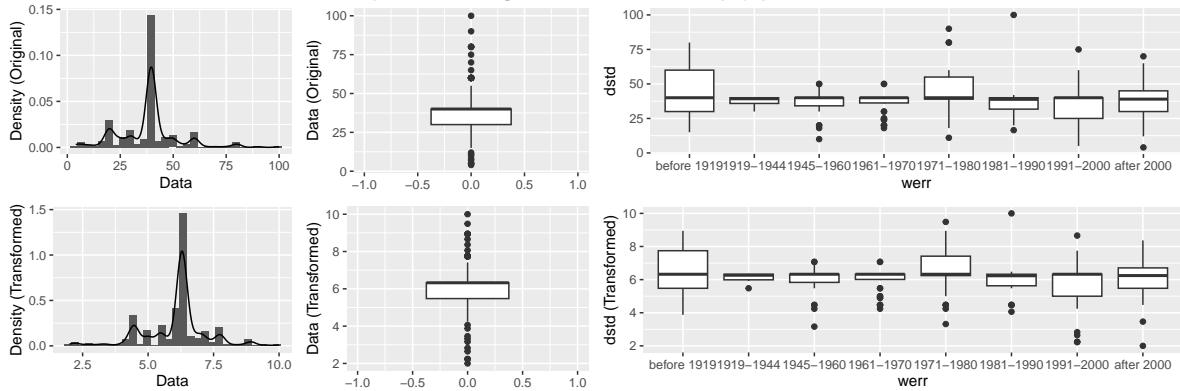

```
plot_numeric_variable_with_transformation(data,"kjahr","werr")
```

Comparison of Original and Transformed (sqrt) Data kjahr

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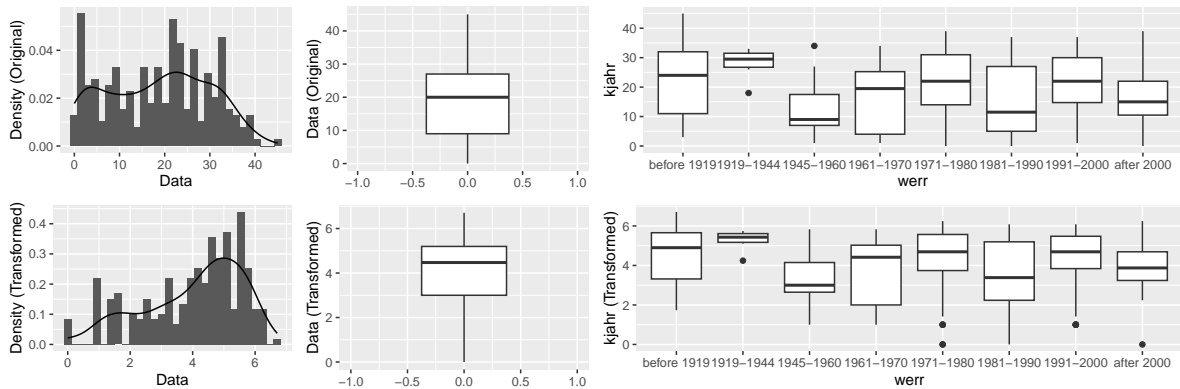
```
plot_numeric_variable_with_transformation(data,"xanzkind","werr")
```

Comparison of Original and Transformed (sqrt) Data xanzkind

3.1.1.2 Consider Transformations for Normality

```
# Function to remove outliers and compare distributions
remove_outliers_IQR <- function(data, column_name) {

  # Step 1: Identify Outliers using IQR
  Q1 <- quantile(data[[column_name]], 0.25)
  Q3 <- quantile(data[[column_name]], 0.75)
  IQR <- Q3 - Q1
  lower_bound <- Q1 - 1.5 * IQR
  upper_bound <- Q3 + 1.5 * IQR

  # Step 2: Create a new column 'is_outlier' to indicate outliers
  data$is_outlier <- ifelse(data[[column_name]] < lower_bound | data[[column_name]] > upper_l

  # Step 3: Remove the outliers by filtering the rows where 'is_outlier' is FALSE
  data_no_outliers <- data[data$is_outlier == FALSE, ]

  # Step 4: Return the dataset without outliers (with the 'is_outlier' column still present)
  return(data_no_outliers)
}

temp_data <- remove_outliers_IQR(data, "dstd")
temp_data
```

```
          werr dseitz dstd kjahr xanzkind xminalt balt5   bsex      bfst
```

10	after 2000	4 30.0	30	2	13 50-54	Male	Married
14	1991-2000	74 38.0	31	2	14 45-49	Male	Single
15	1991-2000	216 34.0	24	2	14 40-44	Female	Single
16	1991-2000	11 40.0	3	2	14 20-24	Female	Single
21	1981-1990	12 39.0	3	1	20 20-24	Male	Single
22	1961-1970	52 50.0	21	1	20 50-54	Male	Divorced
39	1981-1990	13 16.5	3	1	20 20-24	Female	Single
40	1981-1990	127 30.0	37	1	20 55-59	Female	Married
41	1981-1990	450 40.0	35	1	20 50-54	Male	Married
51	1945-1960	151 40.0	13	2	9 35-39	Male	Single
58	1961-1970	138 38.5	26	1	12 40-44	Male	Married
59	1961-1970	258 40.0	21	1	12 40-44	Female	Married
68	1991-2000	7 39.0	1	1	16 15-19	Male	Single
77	1945-1960	357 40.0	34	2	20 50-54	Male	Married
80	1945-1960	44 40.0	2	2	20 20-24	Male	Single
90	after 2000	23 25.0	14	2	9 35-39	Female	Married
94	1945-1960	41 50.0	9	2	0 25-29	Male	Married
99	after 2000	60 38.5	31	1	21 45-49	Female	Married
100	after 2000	319 38.5	24	1	21 40-44	Male	Married
101	after 2000	127 38.5	7	1	21 25-29	Male	Single
102	1981-1990	413 40.0	35	2	19 50-54	Female	Married
103	1981-1990	167 38.5	27	2	19 50-54	Male	Widowed
105	1981-1990	17 40.0	2	2	19 15-19	Female	Single
109	before 1919	161 38.5	27	1	11 45-49	Male	Single
110	before 1919	12 25.0	24	1	11 40-44	Female	Divorced
117	after 2000	127 40.0	15	1	0 30-34	Female	Single
118	after 2000	189 36.0	20	1	0 35-39	Male	Single
126	1991-2000	127 40.0	22	2	9 40-44	Male	Married
127	1991-2000	210 20.0	18	2	9 35-39	Female	Married
139	1961-1970	229 40.0	25	1	16 55-59	Male	Married
140	1961-1970	274 20.0	31	1	16 50-54	Female	Married
147	1971-1980	28 50.0	1	1	20 20-24	Male	Single
148	1971-1980	162 55.0	31	1	20 45-49	Male	Divorced
150	1991-2000	187 40.0	21	2	9 35-39	Male	Married
155	1961-1970	128 25.0	22	2	5 35-39	Female	Single
163	1961-1970	172 40.0	11	1	9 25-29	Male	Single
166	1961-1970	74 24.0	10	1	9 25-29	Female	Single
169	1945-1960	112 48.5	7	1	20 20-24	Male	Single
170	1961-1970	11 40.0	32	4	20 45-49	Female	Divorced
172	1961-1970	21 40.0	3	4	20 20-24	Female	Single
173	1961-1970	4 40.0	12	4	20 25-29	Male	Divorced
174	1961-1970	10 40.0	4	4	20 20-24	Male	Single
175	1961-1970	13 40.0	4	4	20 20-24	Male	Single

179	1991-2000	388	40.0	33	1	20	50-54	Male	Married
185	1971-1980	56	20.0	16	2	10	30-34	Female	Married
201	1971-1980	389	40.0	34	1	19	50-54	Male	Married
212	1961-1970	16	30.0	10	2	4	25-29	Female	Married
252	1945-1960	30	30.0	10	2	3	25-29	Female	Married
253	1945-1960	153	50.0	9	2	3	25-29	Male	Married
259	1991-2000	115	40.0	25	2	6	40-44	Male	Married
260	1991-2000	32	20.0	21	2	6	40-44	Female	Married
263	1991-2000	80	20.0	14	1	19	45-49	Female	Single
278	1971-1980	155	40.0	17	2	0	30-34	Male	Married
283	1991-2000	107	38.5	23	2	11	40-44	Female	Married
288	1991-2000	241	40.0	30	1	20	45-49	Female	Married
289	1991-2000	45	20.0	4	1	20	20-24	Male	Single
298	1981-1990	89	42.0	10	2	1	30-34	Male	Married
301	before 1919	333	50.0	28	3	13	50-54	Male	Married
302	before 1919	169	40.0	33	3	13	50-54	Female	Married
308	after 2000	235	37.5	5	1	21	45-49	Female	Married
309	after 2000	1	48.0	7	1	21	25-29	Female	Single
325	1991-2000	157	50.0	21	1	2	35-39	Male	Married
326	1991-2000	93	20.0	1	1	2	30-34	Female	Married
331	1991-2000	10	20.0	6	2	2	25-29	Female	Single
335	1961-1970	21	25.0	23	1	15	40-44	Female	Single
338	1961-1970	8	40.0	1	1	15	15-19	Male	Single
342	1991-2000	95	42.0	20	1	18	50-54	Male	Married
343	1991-2000	79	20.0	30	1	18	45-49	Female	Married
344	1991-2000	31	40.0	4	1	18	15-19	Female	Single
347	1991-2000	8	40.0	1	2	17	15-19	Female	Single
350	1991-2000	11	40.0	28	1	19	45-49	Female	Married
363	after 2000	96	30.0	9	1	12	40-44	Female	Single
368	1991-2000	8	50.0	24	1	15	35-39	Male	Married
369	1991-2000	262	40.0	22	1	15	35-39	Female	Married
383	1991-2000	1	40.0	24	2	6	40-44	Male	Single
390	after 2000	98	53.0	10	2	1	35-39	Male	Single
391	after 2000	45	21.0	15	2	1	35-39	Female	Single
401	1991-2000	168	38.5	32	1	20	50-54	Male	Married
403	1991-2000	14	38.5	5	1	20	20-24	Female	Single
404	1945-1960	52	20.0	25	2	18	35-39	Female	Married
405	1945-1960	238	40.0	27	2	18	40-44	Male	Married
406	1945-1960	9	40.0	1	2	18	20-24	Female	Single
407	1945-1960	34	40.0	3	2	18	15-19	Male	Single
415	1991-2000	307	40.0	30	2	19	50-54	Male	Married
429	after 2000	4	25.0	22	3	5	35-39	Female	Single
437	1991-2000	261	40.0	35	1	16	50-54	Male	Single

438	1991-2000	40	25.0	26	1	16	40-44	Female	Single
441	1991-2000	44	47.0	31	2	18	45-49	Female	Divorced
445	1991-2000	80	39.0	20	1	10	35-39	Male	Married
448	after 2000	157	40.0	39	1	18	55-59	Female	Married
450	1991-2000	403	40.0	31	2	13	45-49	Male	Married
459	1971-1980	253	40.0	25	1	11	40-44	Female	Married
480	1991-2000	5	20.0	2	2	16	20-24	Female	Single
481	1991-2000	25	40.0	33	2	16	50-54	Male	Single
482	1991-2000	357	40.0	30	2	16	45-49	Female	Single
486	1961-1970	4	40.0	16	2	0	30-34	Male	Married
487	1961-1970	71	40.0	6	2	0	25-29	Female	Married
490	1991-2000	24	40.0	11	2	6	40-44	Female	Married
495	before 1919	27	40.0	3	2	15	15-19	Male	Single
498	before 1919	382	30.0	32	1	21	55-59	Female	Widowed
499	before 1919	0	20.0	8	1	21	25-29	Female	Single
507	after 2000	216	40.0	15	3	1	30-34	Male	Single
539	1961-1970	142	18.0	26	2	16	40-44	Female	Married
540	1961-1970	224	38.5	24	2	16	50-54	Male	Married
541	1961-1970	46	38.3	1	2	16	15-19	Female	Single
542	1961-1970	10	38.3	1	2	16	15-19	Male	Single
557	1971-1980	189	20.0	16	1	6	30-34	Female	Single
561	1961-1970	73	20.0	31	1	15	45-49	Female	Married
562	1961-1970	93	40.0	26	1	15	40-44	Male	Married
568	1981-1990	113	38.0	22	2	9	40-44	Male	Single
569	1981-1990	197	20.0	20	2	9	35-39	Female	Divorced
577	1991-2000	359	40.0	32	2	20	50-54	Female	Married
588	1971-1980	383	25.0	32	1	13	50-54	Female	Married
589	1971-1980	377	39.0	33	1	13	50-54	Male	Married
595	1981-1990	160	40.0	4	2	0	35-39	Male	Married
596	1981-1990	170	20.0	17	2	0	35-39	Female	Married
599	after 2000	161	45.0	13	2	7	30-34	Male	Married
603	1961-1970	34	40.0	15	1	13	35-39	Female	Married
604	1961-1970	164	38.5	19	1	13	35-39	Male	Married
608	after 2000	31	38.0	10	2	0	25-29	Male	Divorced
609	after 2000	54	25.0	9	2	0	20-24	Female	Divorced
616	after 2000	94	34.0	18	2	3	35-39	Female	Single
625	after 2000	186	46.0	22	2	7	40-44	Female	Married
626	after 2000	160	46.0	17	2	7	40-44	Male	Married
633	1919-1944	104	40.0	18	2	3	30-34	Male	Single
639	after 2000	37	42.0	18	2	1	35-39	Male	Married
640	after 2000	92	20.0	15	2	1	30-34	Female	Married
643	1981-1990	371	38.5	24	1	14	45-49	Male	Married
656	1961-1970	46	40.0	24	1	15	40-44	Male	Married

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657	1961-1970	132	40.0	17	1	15	30-34	Female	Married
661	1971-1980	304	45.0	31	2	10	45-49	Male	Married
673	1991-2000	150	30.0	24	2	14	40-44	Female	Married
674	1991-2000	128	40.0	19	2	14	45-49	Male	Married
679	1981-1990	67	38.7	9	1	11	25-29	Female	Single
693	after 2000	117	35.0	11	1	6	30-34	Female	Divorced
694	after 2000	262	39.0	19	1	6	35-39	Male	Divorced
700	1971-1980	97	40.0	39	1	20	55-59	Male	Married
702	1971-1980	10	38.5	1	1	20	20-24	Female	Single
704	after 2000	229	45.0	22	1	3	45-49	Male	Single
705	after 2000	300	30.0	22	1	3	40-44	Female	Single
707	1971-1980	49	45.0	21	2	10	40-44	Male	Married
708	1971-1980	44	18.0	22	2	10	40-44	Female	Married
717	1945-1960	102	18.0	23	2	10	40-44	Female	Married
718	1945-1960	141	39.0	22	2	10	40-44	Male	Married
719	1945-1960	0	39.0	2	2	10	15-19	Female	Single
723	1981-1990	359	37.0	34	1	21	50-54	Female	Single
724	1981-1990	65	40.0	5	1	21	25-29	Female	Single
725	1971-1980	184	40.0	27	2	13	45-49	Male	Married
726	1971-1980	185	40.0	25	2	13	40-44	Female	Married
731	after 2000	36	40.0	0	1	20	20-24	Female	Single
742	1991-2000	346	40.0	27	1	20	50-54	Male	Married
743	1991-2000	165	25.0	30	1	20	45-49	Female	Married
744	1991-2000	99	38.5	5	1	20	20-24	Male	Single
747	after 2000	282	45.0	18	2	9	50-54	Male	Married
748	after 2000	13	40.0	12	2	9	35-39	Female	Married
752	1991-2000	171	18.0	21	2	8	35-39	Female	Divorced
761	after 2000	2	40.0	18	2	6	30-34	Female	Single
764	1991-2000	11	39.0	17	4	3	40-44	Female	Married
765	1991-2000	318	43.0	26	4	3	50-54	Male	Married
778	1981-1990	422	40.0	35	1	20	55-59	Male	Single
779	1981-1990	50	39.0	0	1	20	20-24	Male	Single
781	1991-2000	294	40.0	37	2	3	55-59	Male	Married
802	1961-1970	225	50.0	32	1	20	50-54	Male	Married
803	1961-1970	81	24.0	34	1	20	50-54	Female	Married
804	1961-1970	16	30.0	1	1	20	20-24	Female	Single
805	1971-1980	76	50.0	21	2	20	45-49	Male	Married
806	1971-1980	182	41.0	26	2	20	45-49	Female	Married
812	1961-1970	421	40.0	33	1	20	50-54	Male	Married
813	1961-1970	33	40.0	3	1	20	20-24	Male	Single
823	1971-1980	22	55.0	2	2	17	25-29	Male	Single
826	before 1919	44	15.0	12	1	5	40-44	Male	Divorced
827	before 1919	44	48.0	11	1	5	25-29	Female	Divorced

831	1981-1990	56	20.0	13	1	7	25-29	Female	Single
833	after 2000	129	40.0	11	3	4	40-44	Male	Married
834	after 2000	2	26.0	6	3	4	35-39	Female	Married
852	1919-1944	84	38.5	30	1	18	45-49	Male	Married
853	1919-1944	311	30.0	26	1	18	45-49	Female	Married
861	1945-1960	103	40.0	8	2	1	25-29	Female	Single
862	1945-1960	19	38.3	7	2	1	25-29	Male	Single
865	1971-1980	469	39.0	39	1	18	55-59	Male	Married
866	1971-1980	60	30.0	38	1	18	55-59	Female	Married
869	1991-2000	59	38.5	8	2	9	40-44	Male	Married
876	1945-1960	6	40.0	13	1	7	30-34	Male	Single
877	1945-1960	0	20.0	13	1	7	30-34	Female	Single
880	1971-1980	221	42.0	39	2	19	55-59	Male	Married
881	1971-1980	12	30.0	34	2	19	50-54	Female	Married
882	1971-1980	98	50.0	12	2	19	30-34	Male	Single
883	1971-1980	49	34.0	0	2	19	15-19	Female	Single
885	1971-1980	213	40.0	27	2	20	45-49	Male	Married
888	1971-1980	4	39.0	2	2	20	20-24	Male	Single
898	1991-2000	235	40.0	23	2	13	40-44	Male	Married
899	1991-2000	98	30.0	23	2	13	40-44	Female	Married
900	1991-2000	26	39.0	2	2	13	15-19	Male	Single
902	1961-1970	11	20.0	24	1	20	40-44	Female	Married
903	1961-1970	184	38.5	3	1	20	40-44	Male	Married
904	1961-1970	2	38.5	2	1	20	20-24	Male	Single
907	1991-2000	290	42.5	19	2	3	35-39	Male	Married
912	1971-1980	2	40.0	23	2	14	40-44	Female	Married
923	1991-2000	44	38.5	30	1	20	45-49	Male	Married
924	1991-2000	386	30.0	29	1	20	45-49	Female	Married
929	1961-1970	126	40.0	20	1	17	35-39	Female	Married
930	1961-1970	25	40.0	2	1	17	15-19	Female	Single
938	1961-1970	259	40.0	25	1	18	45-49	Male	Single
939	1961-1970	401	40.0	34	1	18	50-54	Female	Single
946	1919-1944	148	35.0	29	1	10	45-49	Female	Divorced
950	1919-1944	128	40.0	33	2	17	50-54	Male	Married
951	1919-1944	155	40.0	32	2	17	45-49	Female	Married
958	1981-1990	367	40.0	33	3	20	50-54	Male	Married
959	1981-1990	205	30.0	27	3	20	50-54	Female	Married
960	1981-1990	8	30.0	0	3	20	25-29	Male	Single
961	1981-1990	43	39.0	5	3	20	20-24	Male	Single
974	1991-2000	198	40.0	16	2	13	40-44	Male	Married
975	1991-2000	232	20.0	20	2	13	35-39	Female	Married
978	before 1919	391	20.0	45	2	20	60-64	Male	Married
981	before 1919	88	40.0	4	2	20	20-24	Female	Single

993	before 1919	75	40.0	11	2	20	25-29	Male	Single
998	1981-1990	149	38.5	9	1	1	25-29	Male	Married
999	1981-1990	61	40.0	6	1	1	25-29	Female	Married
1001	1991-2000	4	20.0	15	2	10	40-44	Female	Divorced
1004	1971-1980	84	55.0	10	1	21	50-54	Male	Married
1005	1971-1980	43	20.0	3	1	21	45-49	Female	Married
1009	1971-1980	52	39.0	1	1	20	20-24	Male	Married
1010	1971-1980	159	40.0	33	1	20	50-54	Male	Married

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14	Austria	Austria	ISCED 3a, b	up to 2000
15	Austria	Austria	ISCED 3a, b	up to 2000
16	Austria	Austria	ISCED 3a, b	up to 2000
21	Austria	Austria	ISCED 3a, b	2001-10000
22	Austria	Austria	ISCED 6	10001-100000
39	Austria	Austria	ISCED 4a, b	2001-10000
40	Austria	Austria	ISCED 3a, b	2001-10000
41	Austria	Austria	ISCED 3a, b	2001-10000
51	Austria	Austria	ISCED 5a	100001+
58	Austria	Austria	ISCED 3a, b	up to 2000
59	Austria	Austria	ISCED 3a, b	up to 2000
68	Austria	Austria	ISCED 2	up to 2000
77	Austria	Austria	ISCED 3a, b	up to 2000
80	Austria	Austria	ISCED 3a, b	up to 2000
90	Austria	Other countries	ISCED 5a	100001+
94	Austria	Austria	ISCED 3a, b	2001-10000
99	Austria	Austria	ISCED 3a, b	2001-10000
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109	Austria	Austria	ISCED 3a, b	2001-10000
110	Austria	Austria	ISCED 4a, b	2001-10000
117	Austria	Austria	ISCED 3a, b	up to 2000
118	Austria	Austria	ISCED 3a, b	up to 2000
126	Austria	Austria	ISCED 3a, b	up to 2000
127	Austria	Austria	ISCED 3a, b	up to 2000
139	Austria	Austria	ISCED 6	2001-10000
140	Austria	Austria	ISCED 5b	2001-10000
147	Austria	Austria	ISCED 3a, b	up to 2000
148	Austria	Austria	ISCED 3a, b	up to 2000
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155	Austria	Austria	ISCED 4a, b	up to 2000
163	Austria	Austria	ISCED 3a, b	up to 2000
166	Austria	Austria	ISCED 3a, b	up to 2000
169	Austria	Austria	ISCED 3a, b	2001–10000
170	Austria	Austria	ISCED 2	up to 2000
172	Austria	Austria	ISCED 3a, b	up to 2000
173	Austria	Austria	ISCED 2	up to 2000
174	Austria	Austria	ISCED 3a, b	up to 2000
175	Austria	Austria	ISCED 3a, b	up to 2000
179	Austria	Austria	ISCED 5b	up to 2000
185	Austria	Austria	ISCED 3a, b	up to 2000
201	Austria	Austria	ISCED 3a, b	up to 2000
212	Austria	Former Yugoslavia	ISCED 3a, b	100001+
252	Austria	Austria	ISCED 3a, b	2001–10000
253	Austria	Austria	ISCED 3a, b	2001–10000
259	Austria	Austria	ISCED 3a, b	up to 2000
260	Austria	Austria	ISCED 3a, b	up to 2000
263	Austria	Austria	ISCED 3a, b	2001–10000
278	Austria	Austria	ISCED 3a, b	2001–10000
283	Austria	Austria	ISCED 3a, b	up to 2000
288	Austria	Austria	ISCED 3a, b	2001–10000
289	Austria	Austria	ISCED 3a, b	2001–10000
298	Austria	Austria	ISCED 3a, b	2001–10000
301	Other countries	Other countries	ISCED 5b	100001+
302	Austria	Austria	ISCED 3a, b	100001+
308	Austria	Austria	ISCED 3a, b	up to 2000
309	Austria	Austria	ISCED 3a, b	up to 2000
325	EU15 without Austria	EU15 without Austria	ISCED 3a, b	2001–10000
326	Austria	Austria	ISCED 4a, b	2001–10000
331	Austria	Austria	ISCED 3a, b	up to 2000
335	Austria	Austria	ISCED 3a, b	2001–10000
338	Austria	Austria	ISCED 2	2001–10000
342	Austria	Austria	ISCED 4a, b	up to 2000
343	Austria	Austria	ISCED 3a, b	up to 2000
344	Austria	Austria	ISCED 2	up to 2000
347	Austria	Austria	ISCED 4a, b	up to 2000
350	Austria	Austria	ISCED 3a, b	2001–10000
363	Austria	Austria	ISCED 3a, b	2001–10000
368	Austria	Austria	ISCED 2	2001–10000
369	Austria	Austria	ISCED 3a, b	2001–10000
383	Austria	Austria	ISCED 3a, b	up to 2000
390	Austria	Austria	ISCED 3c <2 years	2001–10000
391	Austria	Austria	ISCED 5b	2001–10000

401	Austria	Austria ISCED 3c <2 years		up to 2000
403	Austria	Austria	ISCED 3a, b	up to 2000
404	Austria	Austria	ISCED 2	up to 2000
405	Austria	Austria	ISCED 3a, b	up to 2000
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407	Austria	Austria	ISCED 2	up to 2000
415	Austria	Austria	ISCED 3a, b	up to 2000
429	Austria	Austria	ISCED 2	up to 2000
437	Austria	Austria	ISCED 3a, b	2001-10000
438	Austria	Austria	ISCED 2	2001-10000
441	Austria	Austria	ISCED 4a, b	2001-10000
445	Austria	Austria	ISCED 3a, b	2001-10000
448	Austria	Austria	ISCED 3a, b	up to 2000
450	Austria	Austria	ISCED 3a, b	2001-10000
459	Austria	Austria	ISCED 2	2001-10000
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481	Austria	Austria	ISCED 3a, b	2001-10000
482	Austria	Austria	ISCED 3a, b	2001-10000
486	Former Yugoslavia	Former Yugoslavia	ISCED 3a, b	10001-100000
487	Austria	Former Yugoslavia	ISCED 3a, b	10001-100000
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495	Austria	Austria	ISCED 2	2001-10000
498	Austria	Austria	ISCED 5b	100001+
499	Austria	Austria	ISCED 3a, b	100001+
507	Austria	Austria	ISCED 3a, b	up to 2000
539	Austria	Austria	ISCED 3a, b	2001-10000
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557	Austria	Austria	ISCED 2	2001-10000
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562	Austria	Austria	ISCED 3a, b	2001-10000
568	Austria	Austria	ISCED 3a, b	2001-10000
569	Austria	Austria	ISCED 3a, b	2001-10000
577	Austria	Austria	ISCED 5b	up to 2000
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589	Austria	Austria	ISCED 3a, b	up to 2000
595	Austria	Austria	ISCED 5a	2001-10000
596	Austria	Austria	ISCED 3a, b	2001-10000
599	Austria	Austria	ISCED 3a, b	up to 2000
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604	Austria	Former Yugoslavia	ISCED 5b	2001-10000
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609	Austria	Austria	ISCED 2	up to 2000
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626	Austria	Austria	ISCED 5a	2001-10000
633	Austria	Austria	ISCED 2	100001+
639	Austria	Austria	ISCED 3a, b	up to 2000
640	Austria	Austria	ISCED 3a, b	up to 2000
643	Austria	Austria	ISCED 4a, b	2001-10000
656	Austria	Austria	ISCED 3a, b	up to 2000
657	Austria	Austria	ISCED 3a, b	up to 2000
661	Austria	Austria	ISCED 2	up to 2000
673	Austria	Austria	ISCED 4a, b	2001-10000
674	Austria	Austria	ISCED 5a	2001-10000
679	Austria	Austria	ISCED 3a, b	2001-10000
693	Austria	Austria	ISCED 5a	2001-10000
694	Austria	Austria	ISCED 3a, b	2001-10000
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702	Austria	Austria	ISCED 4a, b	2001-10000
704	Austria	Austria	ISCED 5a	2001-10000
705	Austria	Austria	ISCED 3a, b	2001-10000
707	Austria	Austria	ISCED 5b	up to 2000
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717	Austria	Austria	ISCED 3a, b	up to 2000
718	Austria	Austria	ISCED 3a, b	up to 2000
719	Austria	Austria	ISCED 2	up to 2000
723	Austria	Austria	ISCED 3a, b	2001-10000
724	Austria	Austria	ISCED 5b	2001-10000
725	Austria	Other countries	ISCED 4a, b	100001+
726	Austria	Other countries	ISCED 4a, b	100001+
731	Austria	Austria	ISCED 4a, b	2001-10000
742	Austria	Austria	ISCED 5b	up to 2000
743	Austria	Austria	ISCED 3a, b	up to 2000
744	Austria	Austria	ISCED 3a, b	up to 2000
747	Austria	Austria	ISCED 6	2001-10000
748	Austria	Austria	ISCED 5a	2001-10000
752	Austria	Austria	ISCED 3a, b	2001-10000
761	Austria	Austria	ISCED 2	2001-10000
764	Austria	Austria	ISCED 5a	2001-10000
765	Austria	Austria	ISCED 5b	2001-10000
778	Austria	Austria	ISCED 5b	up to 2000
779	Austria	Austria	ISCED 3a, b	up to 2000
781	Austria	Austria	ISCED 4a, b	2001-10000
802	Austria	Austria	ISCED 3a, b	2001-10000

803	Austria	Austria	ISCED 4a, b	2001-10000
804	Austria	Austria	ISCED 3a, b	2001-10000
805	Austria	Austria	ISCED 5a	100001+
806	Austria	Austria	ISCED 5b	100001+
812	Austria	Austria	ISCED 3a, b	up to 2000
813	Austria	Austria	ISCED 3a, b	up to 2000
823	Austria	Austria	ISCED 5a	up to 2000
826	Austria	Other countries	ISCED 5a	100001+
827	Bulgaria/Romania	Bulgaria/Romania	ISCED 3a, b	100001+
831	Austria	Austria	ISCED 2	2001-10000
833	Austria	Austria	ISCED 5a	up to 2000
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852	Austria	Austria	ISCED 3a, b	10001-100000
853	Austria	Austria	ISCED 3a, b	10001-100000
861	Austria	Austria	ISCED 3a, b	up to 2000
862	Austria	Austria	ISCED 3a, b	up to 2000
865	Austria	Austria	ISCED 3a, b	up to 2000
866	Austria	Austria	ISCED 3a, b	up to 2000
869	Austria	Austria	ISCED 3c <2 years	up to 2000
876	EU15 without Austria	EU15 without Austria	ISCED 3a, b	2001-10000
877	EU15 10 new members	EU15 10 new members	ISCED 3a, b	2001-10000
880	Austria	Austria	ISCED 3c <2 years	up to 2000
881	Austria	Austria	ISCED 3a, b	up to 2000
882	Austria	Austria	ISCED 3a, b	up to 2000
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902	Austria	Austria	ISCED 3a, b	2001-10000
903	Austria	Austria	ISCED 5b	2001-10000
904	Austria	Austria	ISCED 3a, b	2001-10000
907	Austria	Austria	ISCED 3a, b	2001-10000
912	Austria	Bulgaria/Romania	ISCED 2	2001-10000
923	Austria	Austria	ISCED 3a, b	2001-10000
924	Austria	Austria	ISCED 3a, b	2001-10000
929	Austria	Austria	ISCED 3a, b	up to 2000
930	Austria	Austria	ISCED 2	up to 2000
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939	Austria	Austria	ISCED 3a, b	up to 2000
946	Austria	Austria	ISCED 3a, b	100001+
950	Austria	Austria	ISCED 3a, b	2001-10000

951	Austria	Former Yugoslavia	ISCED 3a, b	2001-10000
958	Austria	Austria	ISCED 3a, b	2001-10000
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974	Austria	Austria	ISCED 4a, b	2001-10000
975	Austria	Austria	ISCED 4a, b	2001-10000
978	Austria	Austria	ISCED 2	up to 2000
981	Austria	Austria	ISCED 3a, b	up to 2000
993	Austria	Austria	ISCED 3a, b	2001-10000
998	Austria	Austria	ISCED 3a, b	up to 2000
999	Austria	Austria	ISCED 4a, b	up to 2000
1001	EU15 10 new members	EU15 10 new members	ISCED 6	2001-10000
1004	Austria	Austria	ISCED 5a	up to 2000
1005	Austria	Other countries	ISCED 5a	up to 2000
1009	Former Yugoslavia	Former Yugoslavia	ISCED 3a, b	up to 2000
1010	Former Yugoslavia	Former Yugoslavia	ISCED 3a, b	up to 2000

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779   Employed    No    FALSE
781   Employed    No    FALSE
802   Employed    No    FALSE
803   Employed    No    FALSE
804   Employed    No    FALSE
805   Employed    No    FALSE
806   Employed    No    FALSE
812   Employed    No    FALSE
813   Employed    No    FALSE
823   Employed    No    FALSE
826   Employed    No    FALSE
827   Employed    No    FALSE
831   Employed    No    FALSE
833   Employed    No    FALSE
834   Employed    No    FALSE
852   Employed    No    FALSE
853   Employed    No    FALSE
861   Employed    No    FALSE
862   Employed    No    FALSE
865   Employed    No    FALSE
866   Employed    No    FALSE
869   Employed    No    FALSE
876   Employed    Yes   FALSE
877   Employed    Yes   FALSE
880   Employed    No    FALSE
881   Employed    No    FALSE
882   Employed    No    FALSE
883   Employed    No    FALSE
885   Employed    No    FALSE
888   Employed    No    FALSE
898   Employed    No    FALSE
899   Employed    No    FALSE
900   Employed    No    FALSE
902   Employed    No    FALSE
903   Employed    No    FALSE
904   Employed    No    FALSE
907   Employed    No    FALSE
```
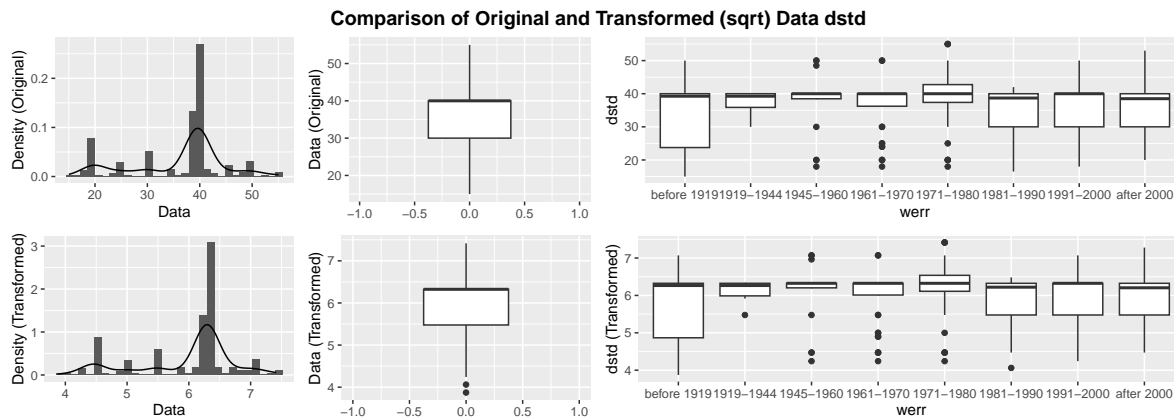
```
912  Employed    No      FALSE
923  Employed    No      FALSE
924  Employed    No      FALSE
929  Employed    No      FALSE
930  Employed    No      FALSE
938  Employed    No      FALSE
939  Employed    No      FALSE
946  Employed    No      FALSE
950  Employed    No      FALSE
951  Employed    No      FALSE
958  Employed    No      FALSE
959  Employed    No      FALSE
960  Employed    No      FALSE
961  Employed    No      FALSE
974  Employed    No      FALSE
975  Employed    No      FALSE
978  Employed    No      FALSE
981  Employed    No      FALSE
993  Employed    No      FALSE
998  Employed    No      FALSE
999  Employed    No      FALSE
1001 Employed    No      FALSE
1004 Employed    Yes     FALSE
1005 Employed    Yes     FALSE
1009 Employed    No      FALSE
1010 Employed    No      FALSE
```

```
plot_numeric_variable_with_transformation(data,"dstd","werr")
```


Comparison of Original and Transformed (sqrt) Data dstd
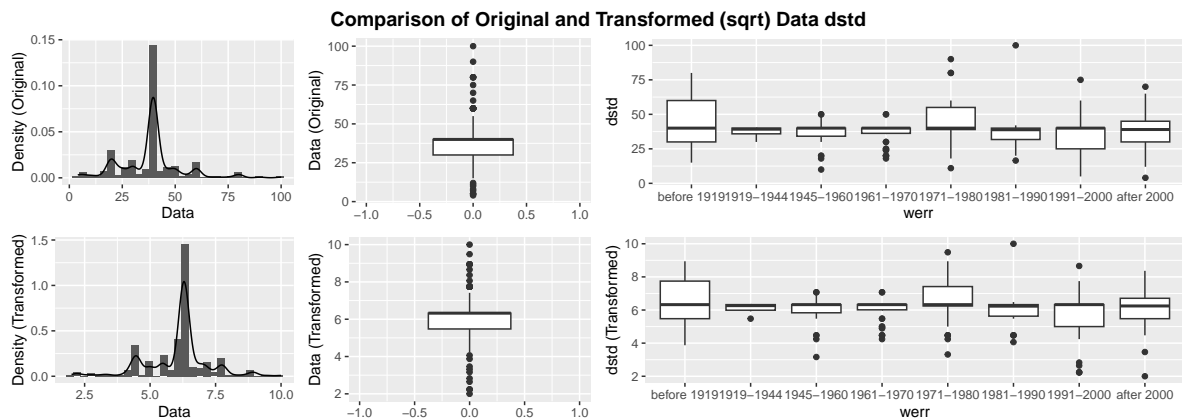
```
plot_numeric_variable_with_transformation(temp_data,"dstd","werr")
```

Comparison of Original and Transformed (sqrt) Data dstd

2.1.1 Introduction [20]

• Formulate research questions (see chapter 2.4.1 of the Meyer/Wurzer script) and research hypotheses, based on the predictors you selected

• Motivate the selection of the predictors - what was the reason for choosing them? • Describe starting point and objectives of your analysis • State the regression method you will use for your analysis (binary logistic, ordinal logistic, Poisson, . . .) and justify your decision

2.1.2 Data collection [10]
• Type of survey; facts concerning the execution of the survey (period etc.) ????? • Description of the data set/operationalization (type of sample, sample size, variables, scale levels, missing values etc.) • Data preparation (missing value treatment, transformations, . . .)

2.1.3 Descriptive analysis of the sample [70]
• Descriptive analysis of the analyzed variable(s) – Diagrams, numerical measures, tables, . . . – All statistics have to be commented, in particular diagrams! – Are there any distinctive features? (e.g., group differences, trends, outliers, . . .) • In detail, the following plots have to be produced: – Univariate visualizations of all variables – Bivariate relationships between predictors and response to show the influence of the former on the latter – Joint influences of all possible pairs of predictors on the response to show potential interactions (exception: the interaction between the two metric variables doesn't have to be visualized) • Summary of the descriptive analysis. Based on these descriptive findings, segue to the analysis of the questions about the population