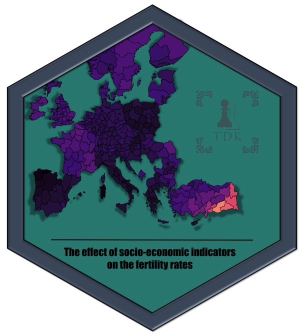


The effect of socio-economic indicators on the fertilty rates

An empirical analysis of fertility rates amoung the regions of Europe

Marcell Granát

February 18, 2021

Contents

Abstract

Here is the abstract.

Introduction

Ay alábbi rövid kézirat a brit **Family Expenditure Survey** adataiból kinyert fogyasztási jellemzőket tárgyalja. Az empirikus elemzés egyszerű lineáris regresszió alkalmazásával készül. Az adatok összesen 1519 család jövedelmét és kiadását tartalmazzák, továbbá 6 termékcsoport (alkohol, ruházkodás, nem alkoholtartalmú élelmiszer, fűtés, közlekedés, egyéb) fogyasztáson belüli részarányát. Dolgozatom során én kizárólag az egy gyermekes családokra szűkítem az elemzést[1].

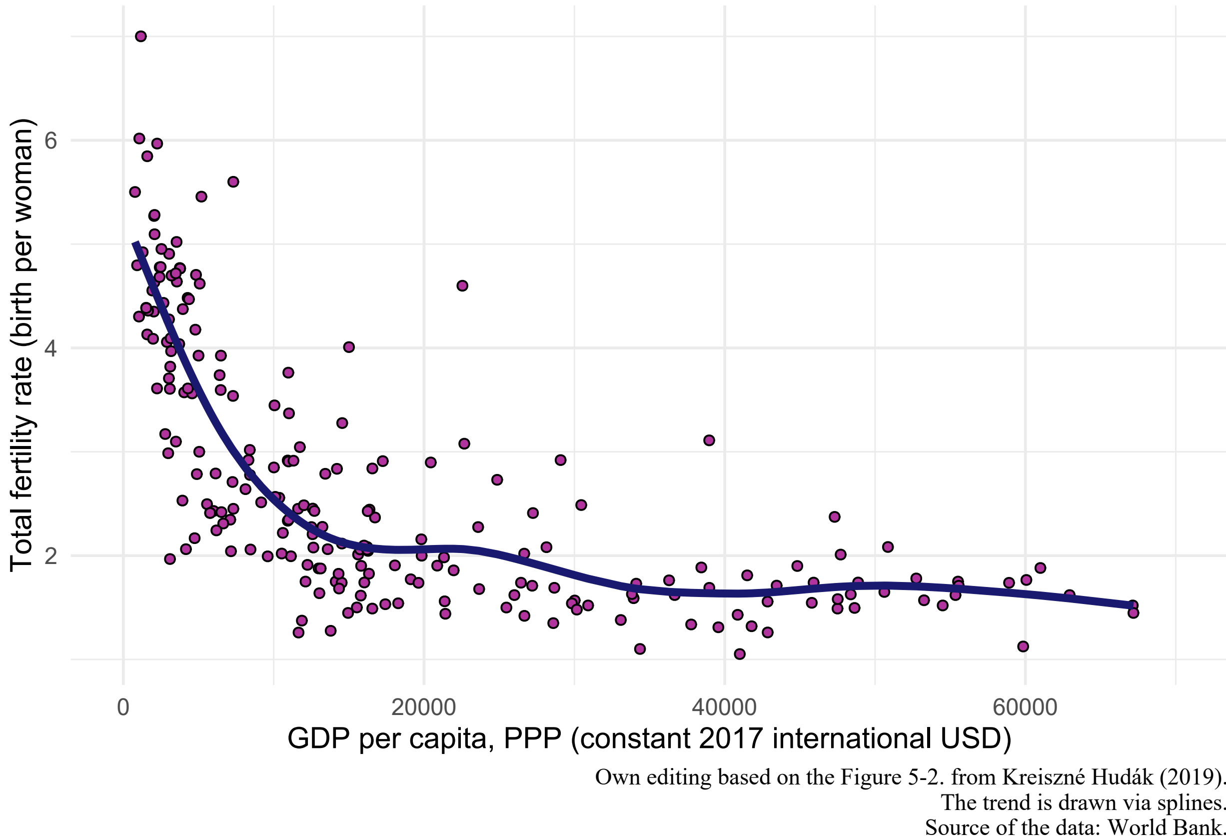


Figure 1: Seemingly negative effect of gross domestic product on fertility rates based on nation level observations (2017)

Data

Human development

Table 1: Indicators of similiarity between the Human Development Indices provided by UNDP and GDL

Indicator	Value
R^2	99.76%
Spearman R^2	99.71%
Mean absolute deviation	0.007
Mean absolute percentage deviation	1.20%

[1] Feladatkiírás által előírt megkötés.

A decent standard of living

Table 2: Indicators of similiarity between the income component of the Human Development Indices provided by GDL and the estimation based on regional GDP

Indicator	Value
R^2	92.43%
Spearman R^2	94.54%
Mean absolute deviation	0.0474
Mean absolute percentage deviation	6.00%

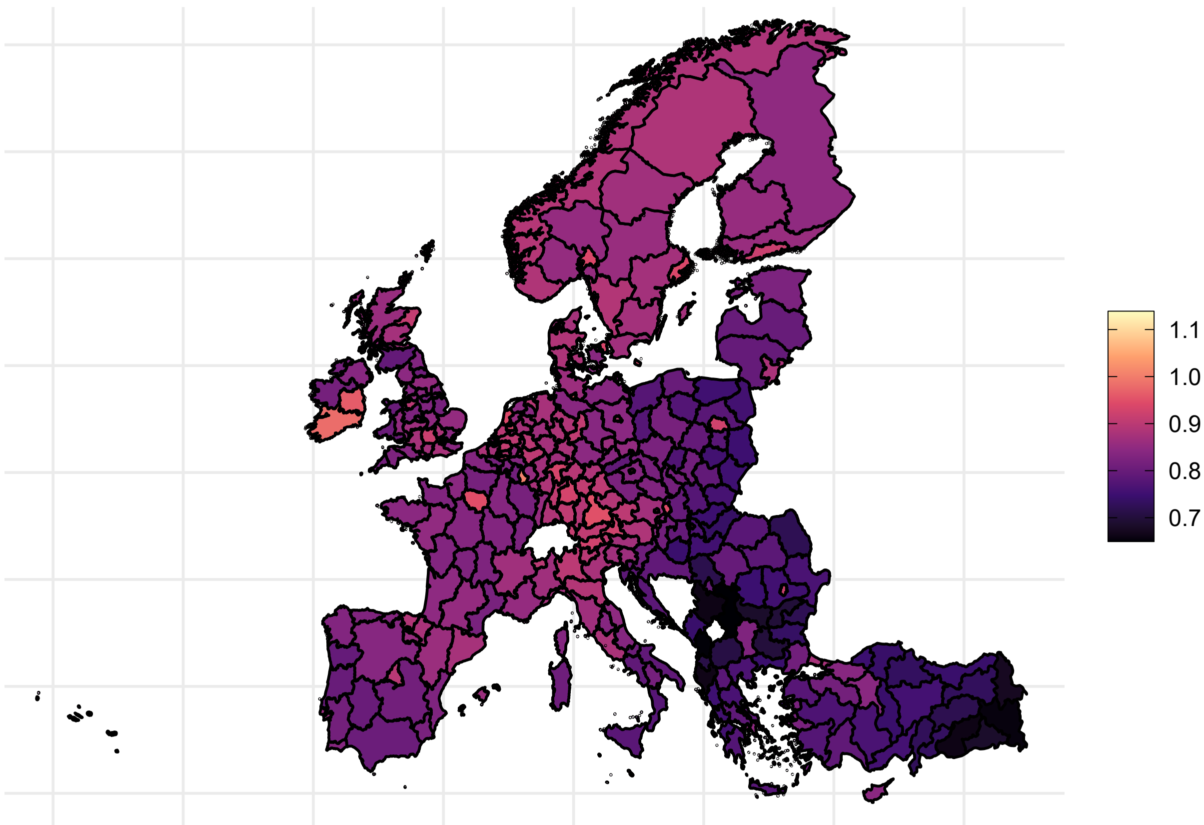


Figure 2: Calculated income index based on regional GDP data

Long and healthy life

Table 3: Indicators of similiarity between the health component of the Human Development Indices provided by GDL and the estimation based on regional life expectancy

Indicator	Value
R^2	98.24%

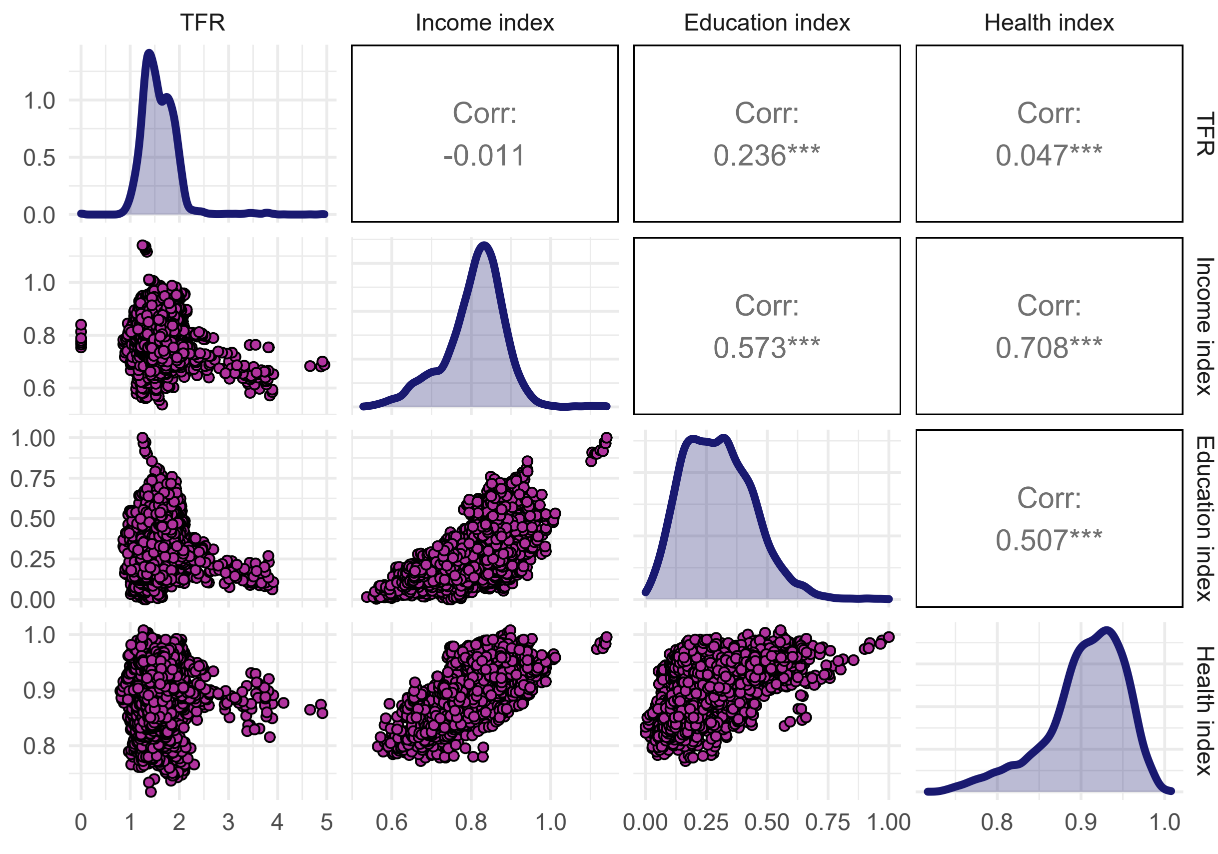
Indicator	Value
Spearman R^2	98.38%
Mean absolute deviation	0.0041
Mean absolute percentage deviation	0.45%

Knowledge

Table 4: Indicators of similiarity between the knowledge component of Human Development Indices provided by UNDP and the calculated principal components using educational attainment level

Indicator	Comp 1	Comp 2	Comp 3	Comp 4	Comp 5	Comp 6	Comp 7	Comp 8	Comp 9
R^2	33.41%	23.21%	10.74%	0.04%	0.58%	0.13%	0.00%	0.01%	0.01%
Spearman R^2	21.18%	23.65%	14.09%	0.05%	0.60%	0.46%	13.39%	1.79%	1.81%

Explore data



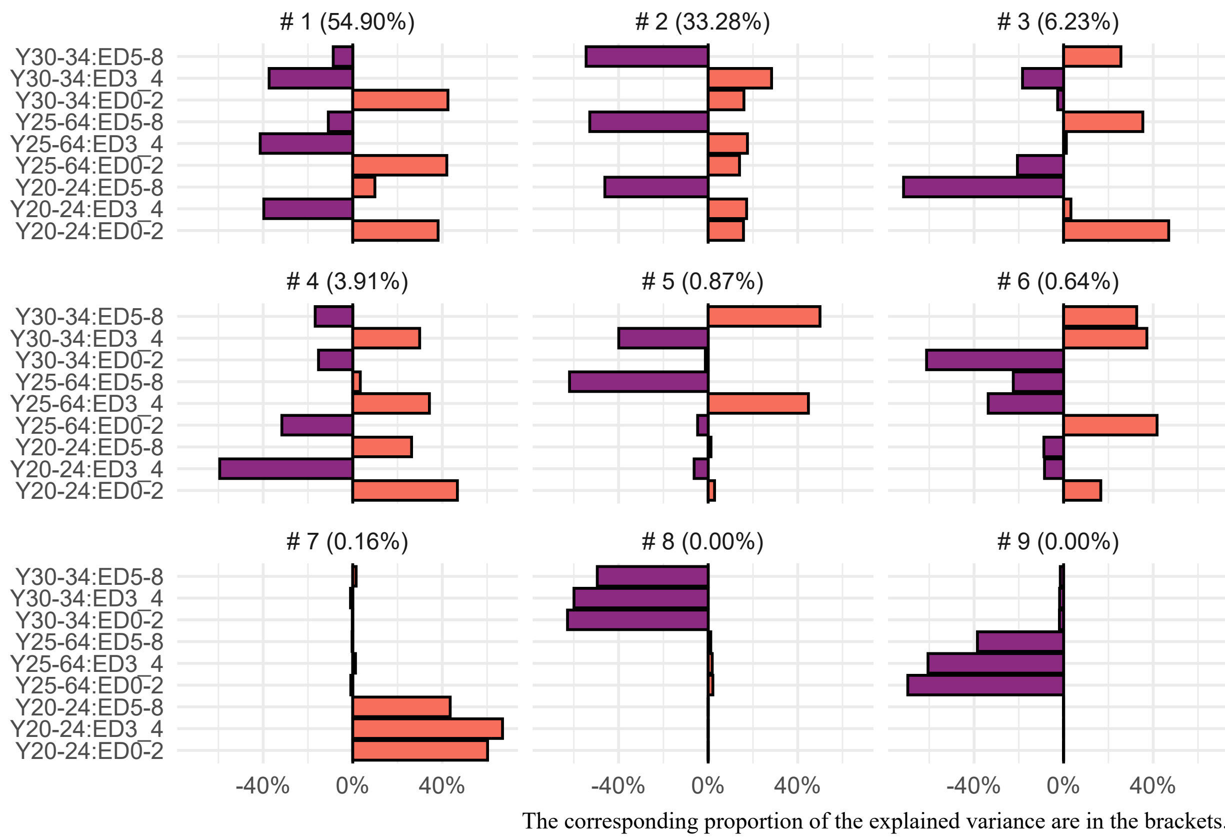
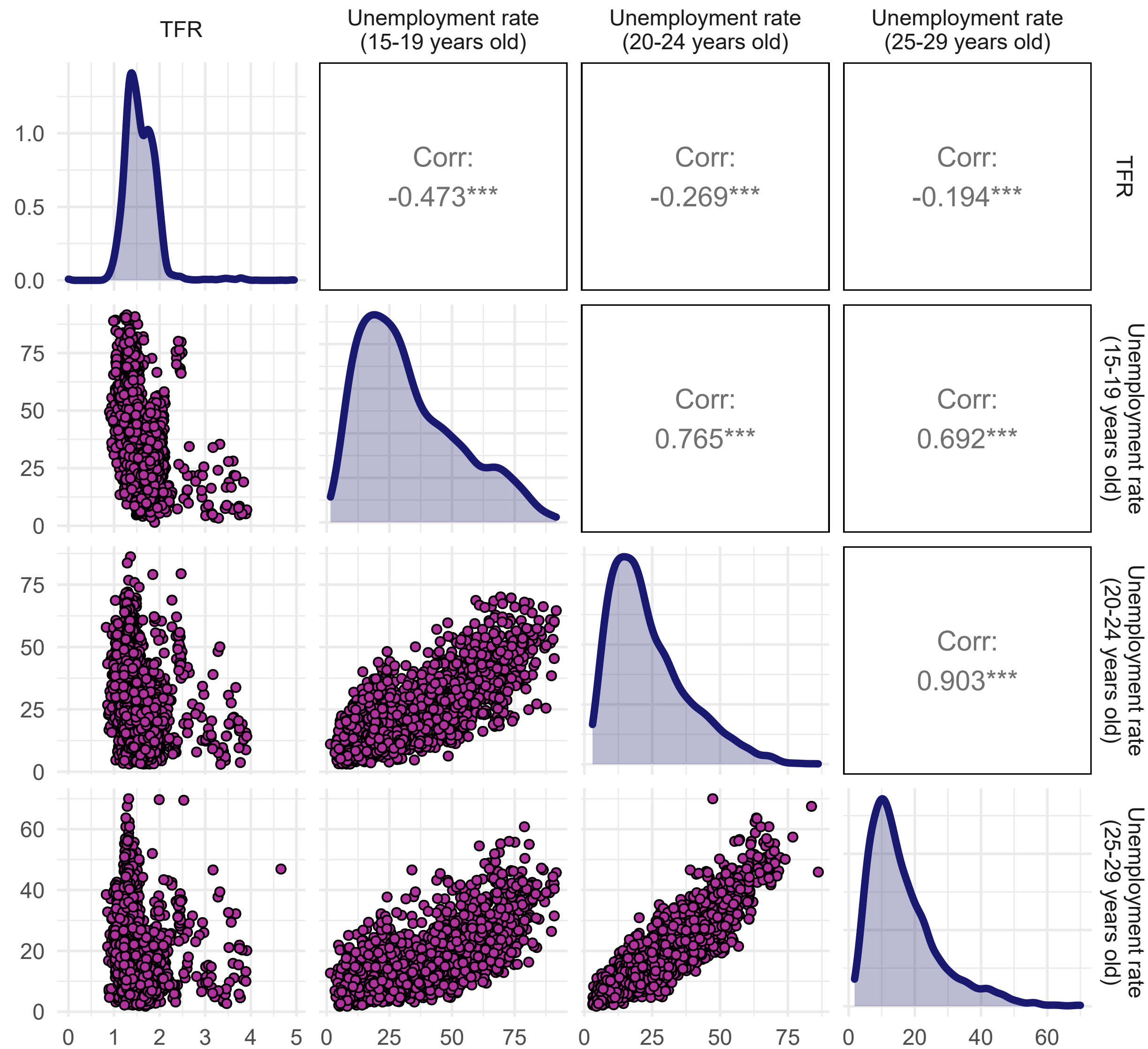
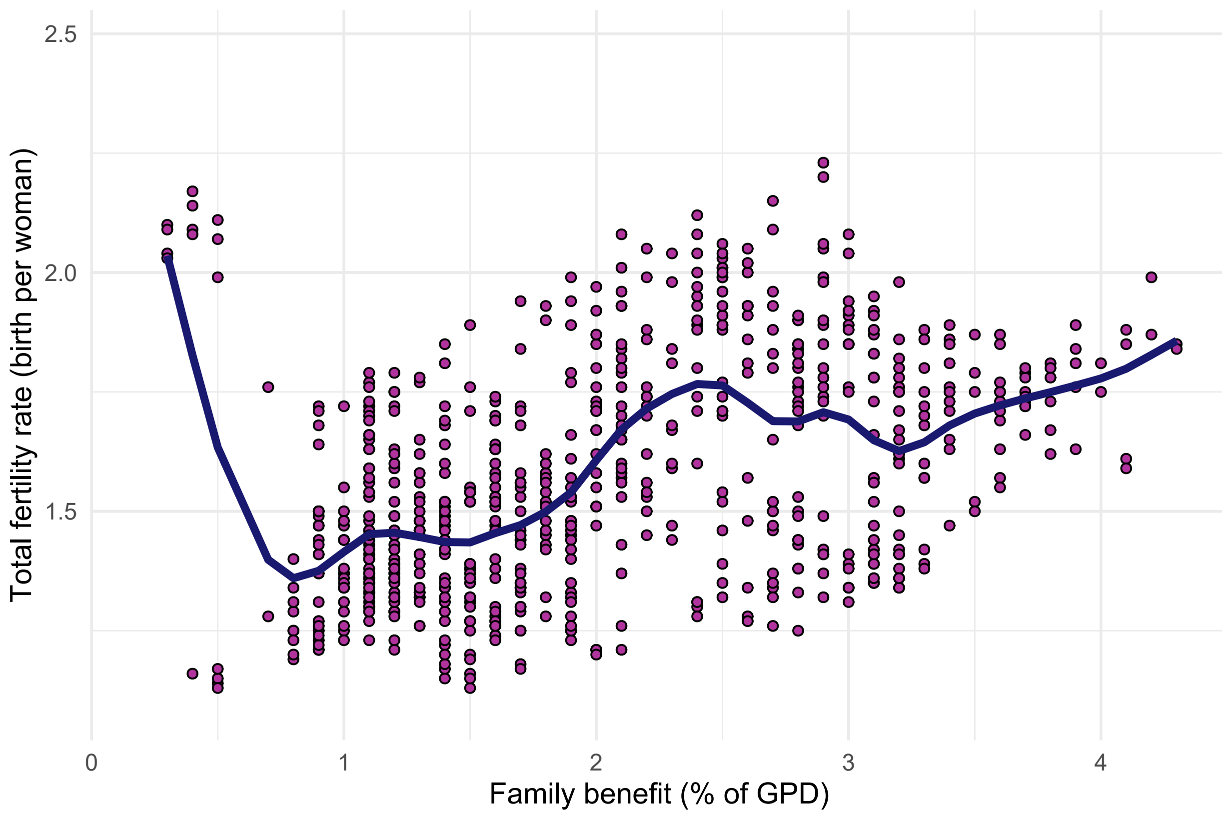


Figure 3: PCAs and the explained variance


TFR
Unemployment rate (15-19 years old)
Unemployment rate (20-24 years old)
Unemployment rate (25-29 years old)
Corr: -0.473***
Corr: -0.269***
Corr: -0.194***
Corr: 0.765***
Corr: 0.692***
Corr: 0.903***
TFR
Unemployment rate (15-19 years old)
Unemployment rate (20-24 years old)
Unemployment rate (25-29 years old)



The trend is drawn via splines.

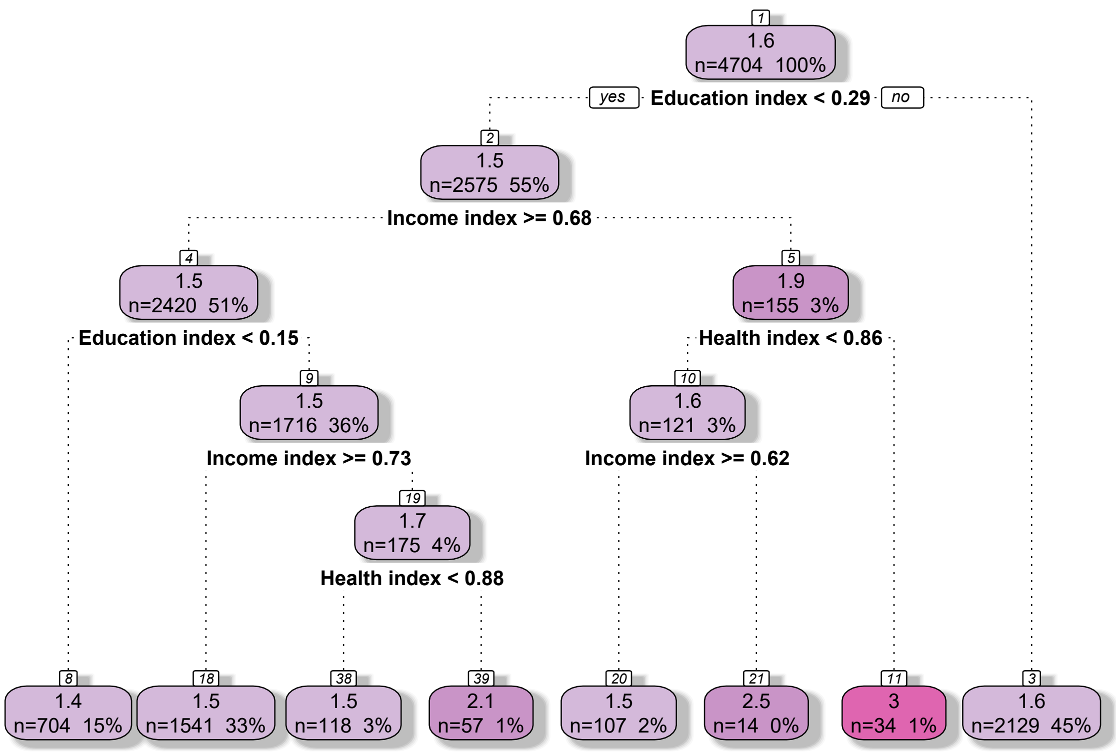


Figure 4: Regression tree explaining the TFR (cp = 0.02)

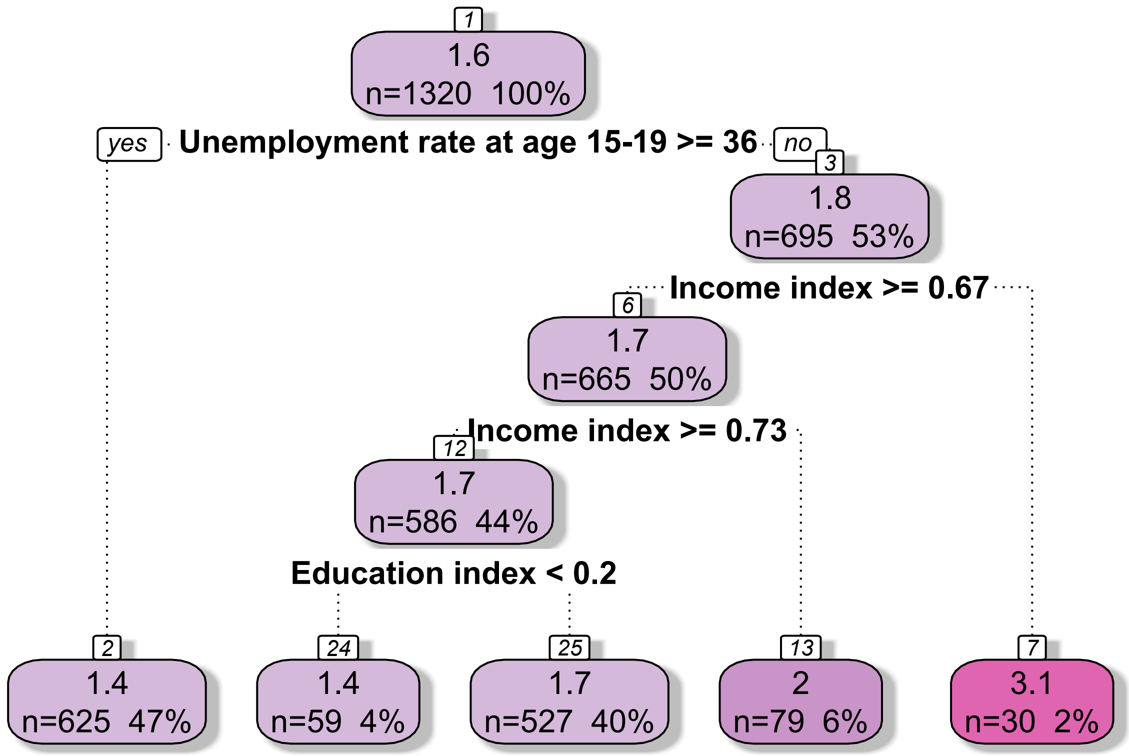

1
1.6
n=1320 100%
yes
Unemployment rate at age 15-19 >= 36
no
3
1.8
n=695 53%
Income index >= 0.67
6
1.7
n=665 50%
Income index >= 0.73
12
1.7
n=586 44%
Education index < 0.2
2
1.4
n=625 47%
24
1.4
n=59 4%
25
1.7
n=527 40%
13
2
n=79 6%
7
3.1
n=30 2%

Figure 5: HDI and its components based on the dataset from Global Data Lab (2017)

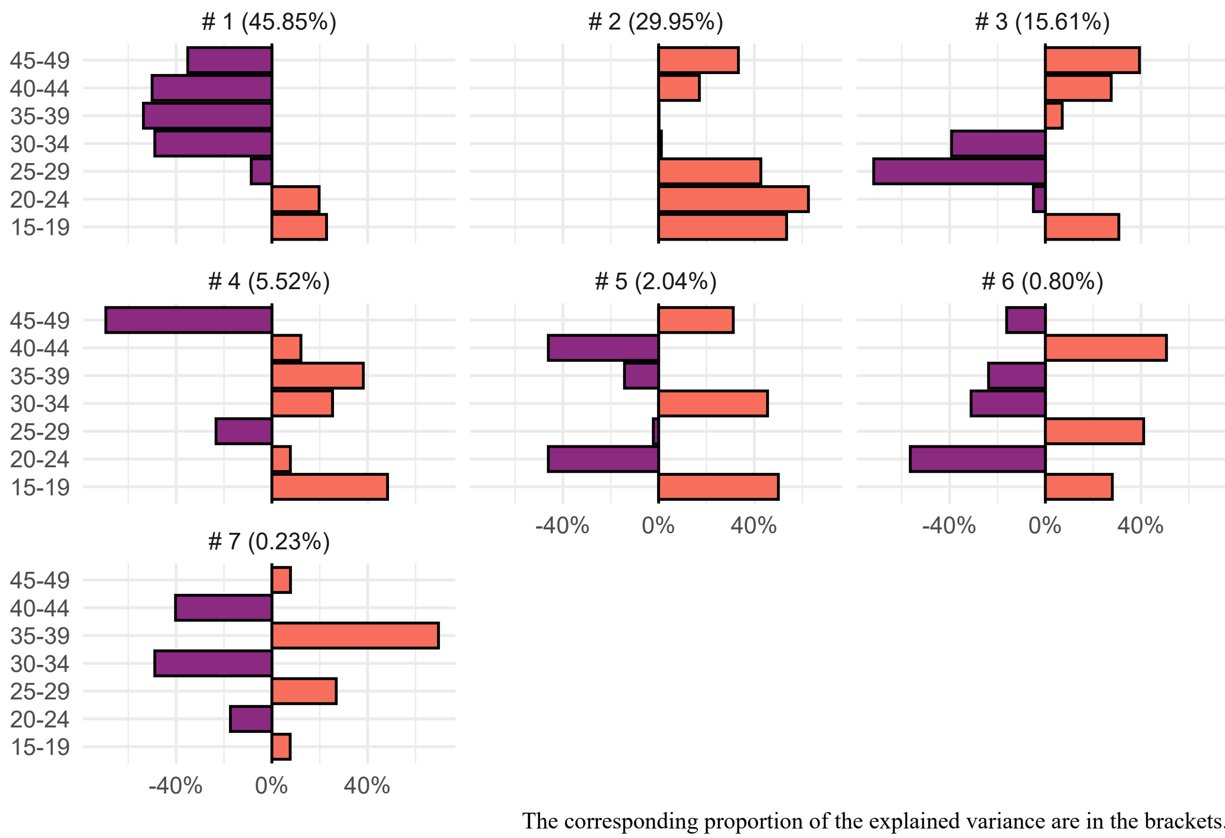


Figure 6: PCAs and the explained variance

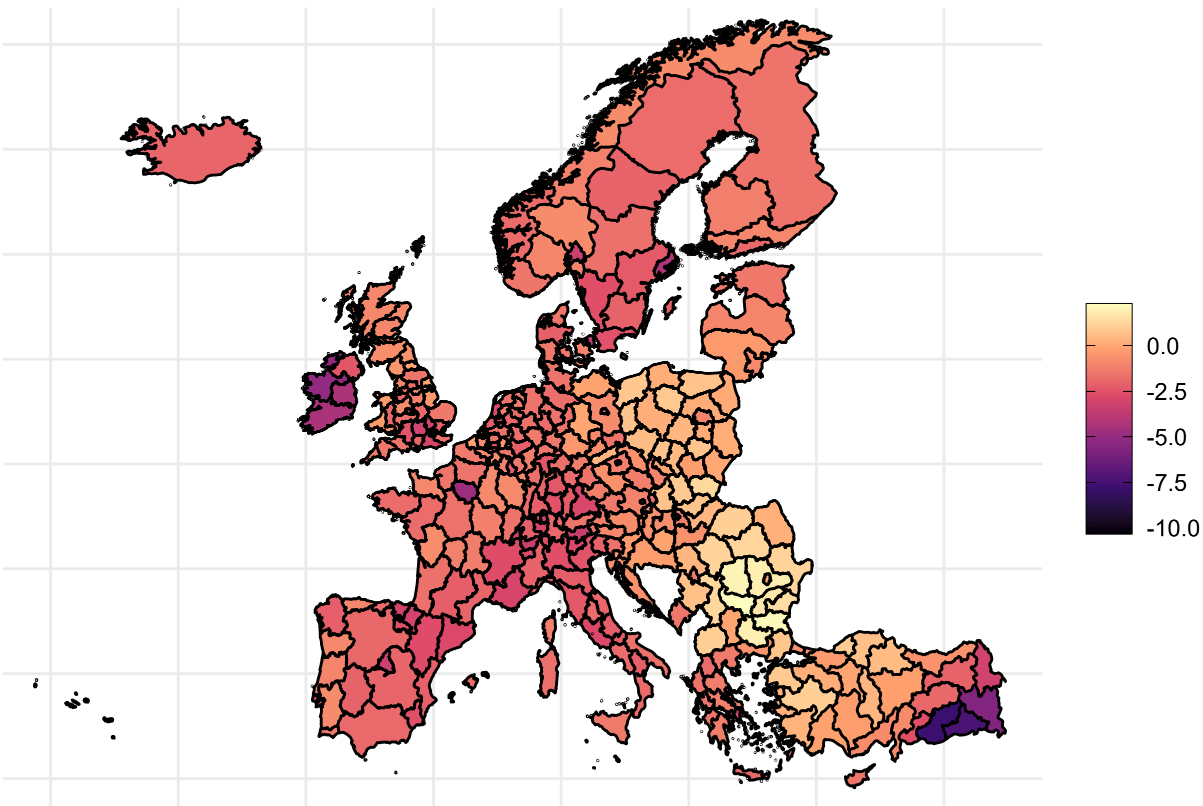


Figure 7: Scores of the 1st PCA component by regions (2017)

Model building

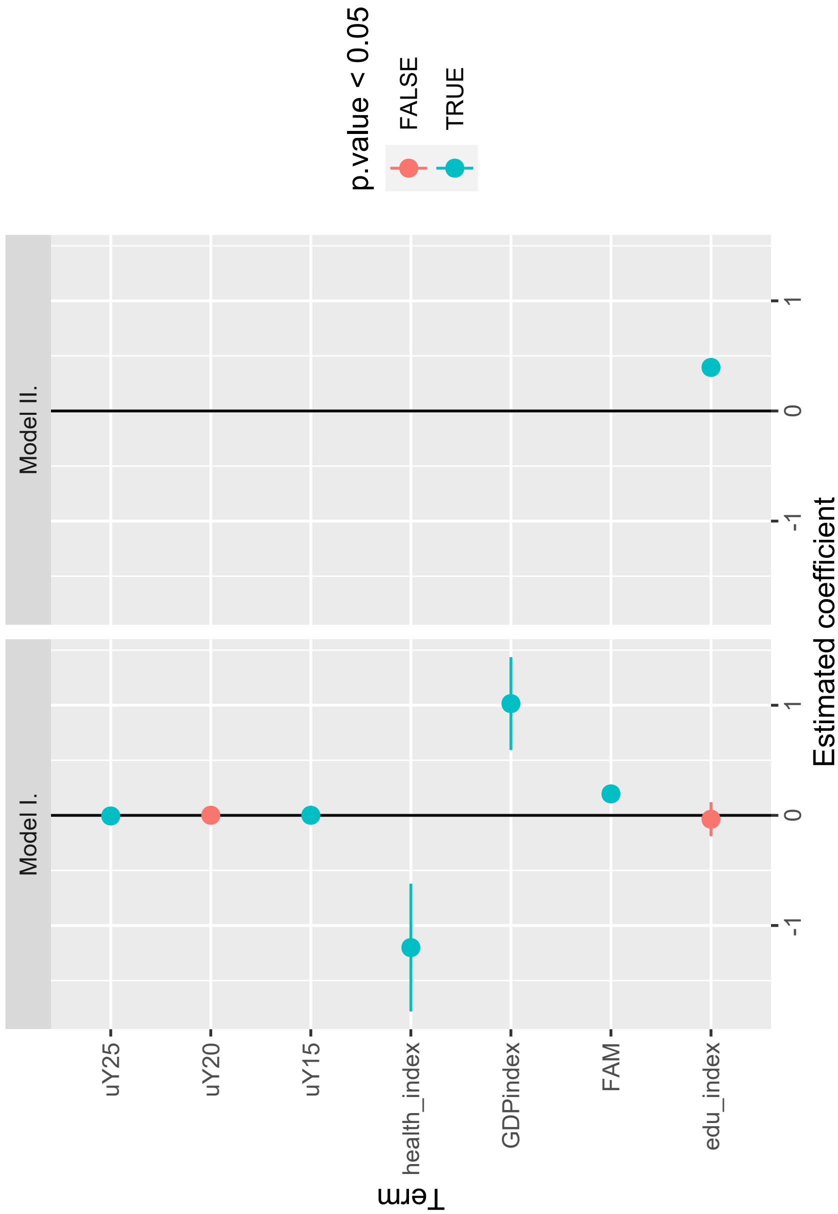


Table 5: Models

Indicator	Model I.	Model II.
pooltest	0.00%	0.00%
phtest	0.00%	7.24%
$Adjusted R^2$	6.49%	0.29%

References

UNITED NATIONS DEVELOPMENT PROGRAMME (2020), 'Technical notes: Calculating the human development indices'.
URL: *http://hdr.undp.org/en/content/calculating-indices*

Appendix: R codes

```
# Set up --------------------------------------------------------------------------------

## Packages =============================================================================

library(tidyverse)
library(patchwork)
library(knitr)
library(broom)
library(eurostat)

## Gg theme =============================================================================

update_geom_defaults("point", list(fill = "#B1339E",
                                   shape = 21,
                                   color = "black",
                                   size = 1.4))
update_geom_defaults("line",
                     list(color = "midnightblue", size = 1.4))

update_geom_defaults("smooth", list(color = "red4", size = 1.4))

update_geom_defaults("density",
                     list(color = "midnightblue", fill =  "midnightblue", alpha = .3, size = 1.4))

extrafont::loadfonts(device="win")

theme_set(theme_minimal() + theme(
  legend.direction = "vertical",
  # text = element_text(family = "Impact"),
  plot.caption = element_text(family = "serif")
))

# https://data.worldbank.org/indicator/SP.DYN.TFRT.IN

WB_fertility <- read_csv("WB_fertility.csv",
                         skip = 4)

# https://data.worldbank.org/indicator/NY.GDP.PCAP.PP.KD

WB_GDP <- read_csv("WB_GDP.csv",
                   skip = 4)

merge(WB_fertility %>%
        select('Country Name', '2017') %>%
        rename(tfr = '2017'),
      WB_GDP %>%
        select('Country Name', '2017') %>%
        rename(GDP = '2017')) %>%
  ggplot(aes(GDP, tfr)) + geom_point() +
  ggformula::geom_spline() +
  scale_x_continuous(limits = c(0, 7e+4)) +
  labs(y = "Total fertility rate (birth per woman)",
```

```r
      x = "GDP per capita, PPP (constant 2017 international USD)",
      caption = "Own editing based on the Figure 5-2. from Kreiszné Hudák (2019).
      The trend is drawn via splines.
      Source of the data: World Bank."
  )

plot_NUTS2 <- function(df, viridis_c = T, ..., all.x = F) {
  p <- df %>%
    {merge(eurostat::get_eurostat_geospatial(nuts_level = 2), ., all.x = all.x)} %>%
    ggplot(aes(fill = values)) +
    geom_sf(color = "black") +
    theme(
      axis.text = element_blank()
    ) +
    xlim(c(-30, 44)) +
    ylim(c(35, 70)) +
    labs(fill = NULL)

  if (viridis_c) {
    p <- p + scale_fill_viridis_c(option = "magma", ...,
                                  guide = guide_colorbar(frame.colour = "black",
                                                         ticks.colour = "black"),
                                  na.value = "white")
  }
  p
}

# Data import ---------------------------------------------------------------------------

# Eurostat database ======================================================================

f_data <- get_eurostat("demo_r_find2", time_format = "num") %>%
  select(geo, time, var = indic_de, values)


# Data from Global Data Labor ============================================================

### Sub-national data ####################################################################

# source of csv files: https://globaldatalab.org/

GDL_import <- function(x) {
  get_eurostat_geospatial(nuts_level = 2) %>%
    data.frame() %>%
    tibble %>%
    mutate(
      ISO_Code = countrycode::countrycode(CNTR_CODE, origin = "iso2c", "iso3c"),
      ISO_Code = ifelse(CNTR_CODE == "UK", "GBR", ISO_Code),
      ISO_Code = ifelse(CNTR_CODE == "EL", "GRC", ISO_Code),
    ) %>%
    select(ISO_Code, NUTS_NAME, geo) %>%
    merge(read_csv(x), by = "ISO_Code") %>%
    mutate(
```

```
      z = stringdist::stringsim(NUTS_NAME, Region)
    ) %>%
    arrange(desc(z)) %>%
    filter(!duplicated(Region)) %>%
    filter(!duplicated(NUTS_NAME)) %>%
    filter((z > .5 | Country %in% c("Greece", "Turkey", 'Romania',
                                    'Malta', 'Italy')) & NUTS_NAME != "Dresden") %>%
    select(geo, '1990':'2018') %>%
    pivot_longer(-1, names_to = "time", values_to = "values") %>%
    mutate(time = as.numeric(time))
}

GDL_subnat <- GDL_import("GDL-Sub-national-HDI-data.csv") %>% rename(HDI = values) %>%
  merge(
    GDL_import("GDL-Educational-index--data.csv") %>% rename(education = values)
  ) %>%
  merge(
    GDL_import("GDL-Health-index-data.csv") %>% rename(health = values)
  ) %>%
  merge(
    GDL_import("GDL-Income-index-data.csv") %>% rename(income = values)
  )

### National data ##########################################################################

GDL_nat <- read_csv("GDL-Sub-national-HDI-data.csv") %>%
  filter(Level == "National") %>%
  select(Country, 6:34) %>% pivot_longer(-1, names_to = "time", values_to = "values") %>%
  mutate(time = as.numeric(time)) %>%
  na.omit()

# Data from UNDP ==========================================================================

# source: http://hdr.undp.org/

HDI_UNDP <- read_csv("Human Development Index (HDI).csv",
                     skip = 5) %>%
  select(!starts_with("X"), - 'HDI Rank') %>%
  mutate_at(-1,
            function(x) {as.numeric(ifelse(x == "..", NA, x))}) %>%
  pivot_longer(-1, names_to = "time", values_to = "values") %>%
  mutate(time = as.numeric(time)) %>%
  na.omit()

merge(GDL_nat %>% rename(GDL = values),
      HDI_UNDP %>% rename(UNDP = values)) %>%
  {
    c(
      scales::percent(cor(x = .$GDL, y = .$UNDP)^2, accuracy = .01),
      scales::percent(cor(x = .$GDL, y = .$UNDP, method = "spearman")^2, accuracy = .01),
      as.character(format(mean(abs(.$GDL - .$UNDP)), digits = 1)),
      scales::percent(mean(abs(.$GDL - .$UNDP)/.$UNDP), accuracy = .01)
    )
```

```
  } %>%
  {tibble(
    Indicator = c("$R^2$", "Spearman $R^2$",
                  "Mean absolute deviation", "Mean absolute percentage deviation"),
    Value = .
  )} %>%
  kable(
    caption = "Indicators of similiarity between the Human Development Indices
    provided by UNDP and GDL"
  )

GDP_index <- get_eurostat("nama_10r_2gdp", time_format = "num") %>%
  filter(unit == "PPS_HAB") %>%  # Purchasing power standard (PPS) per inhabitant
  select(-unit) %>%
  rename(GDP = values) %>% merge(
    get_eurostat("ert_bil_eur_a", time_format = "num") %>% # EUR/USD annual avg exc r
      filter(currency == "USD" & statinfo == "AVG") %>%
      select(time, e = values)
  ) %>%
  {
    GDP <- .$GDP/.$e # mutate to USD
    mutate(.,
           GDPindex = (log(GDP) - log(100))/
             (log(75000) - log(100))
    )
  }
merge(GDL_subnat, GDP_index) %>%
  {
    c(
      scales::percent(cor(x = .$income, y = .$GDPindex)^2, accuracy = .01),
      scales::percent(cor(x = .$income, y = .$GDPindex, method = "spearman")^2, accuracy = .01),
      as.character(format(mean(abs(.$income - .$GDPindex)), digits = 1, nsmall = 4)),
      scales::percent(mean(abs(.$income - .$GDPindex)/.$GDPindex), accuracy = .01)
    )
  } %>%
  {tibble(
    Indicator = c("$R^2$", "Spearman $R^2$",
                  "Mean absolute deviation", "Mean absolute percentage deviation"),
    Value = .
  )} %>%
  kable(
    caption = "Indicators of similiarity between the income component of the
    Human Development Indices provided by GDL and the estimation based on regional GDP"
  )
GDP_index %>%
  filter(time == 2017) %>%
  select(geo, values = GDPindex) %>%
  plot_NUTS2
health_index <- get_eurostat("demo_r_mlifexp", time_format = "num") %>%
  filter(age == "Y_LT1" & sex == "T") %>%
  select(geo, time, le = values) %>%
  mutate(
    health_index = (le - 20) / (85 - 20)
```

```
  )
merge(GDL_subnat, health_index) %>%
  {
    c(
      scales::percent(cor(x = .$health, y = .$health_index)^2, accuracy = .01),
      scales::percent(cor(x = .$health, y = .$health_index, method = "spearman")^2, accuracy = .01),
      as.character(format(mean(abs(.$health - .$health_index)), digits = 1, nsmall = 4)),
      scales::percent(mean(abs(.$health - .$health_index)/.$health_index), accuracy = .01)
    )
  } %>%
  {tibble(
    Indicator = c("$R^2$", "Spearman $R^2$",
                  "Mean absolute deviation", "Mean absolute percentage deviation"),
    Value = .
  )} %>%
  kable(
    caption = "Indicators of similiarity between the health component of the
    Human Development Indices provided by GDL and the estimation based on regional life expectency"
  )
edu_wide <- get_eurostat("edat_lfse_04", time_format = "num") %>%
  filter(sex == "T" & !str_detect(isced11, "GEN") &
           !str_detect(isced11, "VOC") & isced11 != "ED3-8"
  ) %>%
  mutate(
    var = str_c(age, ":", isced11)
  ) %>%
  select(geo, time, var, values) %>%
  pivot_wider(names_from = var, values_from = values) %>%
  {
    x <- .
    names(x) <- letters[1:length(x)]
    x <- cbind(
      .[, 1:2],
      mice::complete(mice::mice(select(x, -a,-b), printFlag = F))
    )
    names(x) <- names(.)
    x
  }
edu_comps <- edu_wide%>%
  select(-time, -geo) %>%
  na.omit() %>%
  {princomp(scale(.))}

edu_comp_vars <- edu_comps %>%
  summary() %>%
  {.$sdev^2/sum(.$sdev^2)} %>%
  scales::percent(accuracy = .01) %>%
  {str_c("# ", 1:length(.), " (", ., ")")}

edu_comps %>%
  .$loadings %>%
  unclass() %>%
  data.frame() %>%
```

```
  rownames_to_column() %>%
  pivot_longer(-1) %>%
  mutate(
    name = as.numeric(str_remove(name, 'Comp.')),
  ) %>%
  arrange(name) %>%
  mutate(
    name = edu_comps %>%
      summary() %>%
      {.$sdev^2/sum(.$sdev^2)} %>%
      scales::percent(accuracy = .01) %>%
      {str_c("# ", 1:length(.), " (", ., ")")} %>%
      .[name]
  ) %>%
  ggplot +
  aes(rowname, value, fill = value < 0) +
  geom_hline(yintercept = 0) +
  geom_col(color = 'black') +
  coord_flip() +
  scale_fill_viridis_d(guide = F, option = "magma", begin = .4,
                       end= .7, direction = -1) +
  scale_y_continuous(labels = scales::percent) +
  facet_wrap(~name, ncol = 3) +
  labs(x = NULL, y = NULL, caption =
         "The corresponding proportion of the explained variance are in the brackets.")
edu_comps %>% .$scores %>%
  cbind(edu_wide) %>% merge(GDL_subnat) %>%
  select(3:11, education) %>%
  {
    x <- .$education
    apply(select(., -education), 2, function(y) {
      c(
        scales::percent(cor(x = x, y = y)^2, accuracy = .01),
        scales::percent(cor(x = x, y = y, method = "spearman")^2, accuracy = .01)
      )
    })
  } %>%
  data.frame() %>%
  mutate(Indicator = c("$R^2$", "Spearman $R^2$")) %>%
  rename_all(function(x) str_replace(x, "p.", "p ")) %>%
  select(Indicator, 1:9) %>%
  kable(
    caption = "Indicators of similiarity between the knowledge component of Human Development Indices
    provided by UNDP and the calculated principal components using educational attainment level"
  )
edu_index <- edu_comps %>%
  .$scores %>%
  data.frame() %>%
  select(2) %>%
  cbind(edu_wide) %>%
  select(geo, time, edu_index = Comp.2) %>%
  mutate(
    edu_index = -edu_index,
```

```
    edu_index = edu_index + abs(min(edu_index)),
    edu_index = edu_index/max(edu_index)
  )
dat <- f_data %>%
  pivot_wider(names_from = var, values_from = values) %>%
  merge(edu_index, all = T) %>%
  merge(health_index, all = T) %>%
  merge(GDP_index, all = T)
FAM_df <- get_eurostat("spr_exp_sum", time_format = "num") %>%
  filter(spdeps == "FAM" & unit == "PC_GDP") %>%
  rename(FAM = values, country = geo) %>%
  select(-(spdeps:unit))

yth_empl_byage <- get_eurostat("yth_empl_110", time_format = "num") %>%
  filter(unit == "PC" & sex == "F") %>%
  filter(age %in% c("Y15-19", "Y20-24", "Y25-29")) %>%
  select(-unit, -sex) %>%
  pivot_wider(names_from = age, values_from = values) %>%
  rename(
    "uY15"  = "Y15-19",
    "uY20"  = "Y20-24",
    "uY25"  = "Y25-29"
  )

dat <- dat %>%
  mutate(country = str_sub(geo, end = 2)) %>%
  merge(FAM_df, all.x = T, all.y = F) %>%
  merge(yth_empl_byage, all.x = T, all.y = F)

dat %>%
  filter(str_length(geo) == 4) %>%
  select(TOTFERRT, GDPindex, edu_index, health_index) %>%
  rename(
    'TFR'= 'TOTFERRT',
    'Income index' = 'GDPindex',
    'Health index' = 'health_index',
    'Education index' = 'edu_index'
  ) %>%
  GGally::ggpairs()

dat %>%
  filter(str_length(geo) == 4) %>%
  select(TOTFERRT, uY15, uY20, uY25) %>%
  set_names("TFR", "Unemployment rate\n(15-19 years old)",
            "Unemployment rate\n(20-24 years old)",
            "Unemployment rate\n(25-29 years old)") %>%
  GGally::ggpairs()
dat %>%
  filter(str_length(geo) == 2) %>%
  ggplot(aes(FAM, TOTFERRT)) + geom_point() +
  ggformula::geom_spline() +
  labs(y = "Total fertility rate (birth per woman)",
       x = "Family benefit (% of GPD)",
```

```
      caption = "The trend is drawn via splines."
  )

m_part <- dat %>%
  filter(str_length(geo) == 4) %>%
  select(TOTFERRT, GDPindex, edu_index, health_index) %>%
  rename(
    'Income index' = 'GDPindex',
    'Health index' = 'health_index',
    'Education index' = 'edu_index'
  ) %>%
  na.omit() %>%
  rpart::rpart(formula = TOTFERRT ~ ., cp = .02)

m_part %>% rattle::fancyRpartPlot(palettes = 'PuRd', sub = NULL)

m_part %>% summary()
m_part2 <- dat %>%
  filter(str_length(geo) == 4) %>%
  select(TOTFERRT, GDPindex, edu_index, health_index, uY15, uY20, uY25) %>%
  rename(
    'Income index' = 'GDPindex',
    'Health index' = 'health_index',
    'Education index' = 'edu_index',
    'Unemployment rate at age 15-19' = 'uY15'
  ) %>%
  na.omit() %>%
  rpart::rpart(formula = TOTFERRT ~ ., cp = .02)

m_part2 %>% rattle::fancyRpartPlot(palettes = 'PuRd', sub = NULL)

GDL_subnat %>%
  filter(time == 2017) %>%
  select(-time) %>%
  pivot_longer(-1, names_to = "var", values_to = "values") %>%
  filter(!is.na(var)) %>%
  mutate(
    var = str_to_title(var),
    var = str_replace(var, "Hdi", "HDI"),
    var = factor(var,
                 levels = c("HDI", "Income", "Education", "Health"),
                 ordered = T)
  ) %>%
  plot_NUTS2() + facet_wrap(~ var, ncol = 2) +
  labs(caption = "Source: https://globaldatalab.org")

fertility_byage <- get_eurostat("demo_r_frate2", time_format = "num") %>%
  filter(age != "TOTAL") %>%
  transmute(age = age, geo = geo, time, values)

fr_agegroups_wide <- fertility_byage %>%
  mutate(age = str_remove(age, "Y"), # sorting into categories by 5 years
         age = str_remove(age, "10-"),
```

```
        age = str_remove(age, "_GE"),
        age = as.numeric(age),
        age_group = paste0((age %/% 5)*5, "-", (age %/% 5 + 1)*5 - 1),
        age_group = ifelse(age_group == "50-54", "50-", age_group)
  ) %>%
  group_by(age_group, time, geo) %>%
  summarise(values = sum(values)) %>%
  ungroup() %>%
  pivot_wider(names_from = "age_group", values_from = "values") %>%
  select(-"10-14", -"50-") %>%
  na.omit() %>%
  arrange(time, geo)

fr_age_comps <- fr_agegroups_wide %>%
  select(-time, -geo) %>%
  na.omit() %>%
  {princomp(scale(.))}

fr_age_comp_vars <- fr_age_comps %>%
  summary() %>%
  {.$sdev^2/sum(.$sdev^2)} %>%
  scales::percent(accuracy = .01) %>%
  {str_c("# ", 1:length(.), " (", ., ")")}

fr_age_comps %>%
  .$loadings %>%
  unclass() %>%
  data.frame() %>%
  rownames_to_column() %>%
  pivot_longer(-1) %>%
  mutate(
    name = as.numeric(str_remove(name, 'Comp.')),
  ) %>%
  arrange(name) %>%
  mutate(
    name = fr_age_comps %>%
      summary() %>%
      {.$sdev^2/sum(.$sdev^2)} %>%
      scales::percent(accuracy = .01) %>%
      {str_c("# ", 1:length(.), " (", ., ")")} %>%
      .[name]
  ) %>%
  ggplot +
  aes(rowname, value, fill = value < 0) +
  geom_hline(yintercept = 0) +
  geom_col(color = 'black') +
  coord_flip() +
  scale_fill_viridis_d(guide = F, option = "magma", begin = .4,
                       end= .7, direction = -1) +
  scale_y_continuous(labels = scales::percent) +
  facet_wrap(~name, ncol = 3) +
  labs(x = NULL, y = NULL, caption =
        "The corresponding proportion of the explained variance are in the brackets.")
```

```r

fr_age_comps %>%
  .$score %>%
  .[,1] %>%
  {cbind(values =., na.omit(fr_agegroups_wide))} %>%
  select(1:3) %>%
  pivot_wider(names_from = geo, values_from = values) %>%
  arrange(time) %>%
  {apply(.[, -1], 2, FUN = function(x) {x <- na.omit(x)
  (tail(x, 1) - head(x, 1))/length(x)})} %>%
  {tibble(FID = names(.), values = .)} %>%
  plot_NUTS2()

fr_age_comps %>%
  .$score %>%
  .[,1] %>%
  {cbind(values =., na.omit(fr_agegroups_wide))} %>%
  select(1:3) %>%
  filter(time == 2017) %>%
  plot_NUTS2()

dat_plm <- dat %>%
  select(
    geo, time, TOTFERRT, edu_index, health_index, GDPindex, FAM, uY15, uY20, uY25
  ) %>%
  filter(str_length(geo) == 4 & !is.na(TOTFERRT))
library(plm)

m_panels <- c("TOTFERRT ~ edu_index + health_index + GDPindex + FAM + uY15 + uY20 + uY25", "TOTFERRT ~
  lapply(function(formula) {
    pooling <- plm(eval(formula), data = dat_plm, model = "pooling")
    within <- plm(eval(formula), data = dat_plm, model = "within")
    random <- plm(eval(formula), data = dat_plm, model = "random")

    # X <- fixef(within) %>%
    #   data.frame() %>%
    #   rownames_to_column() %>%
    #   set_names('geo', 'alpha')
    #
    # X <- merge(dat_plm, X) %>%
    #   mutate(TOTFERRT = TOTFERRT + alpha)
    #
    # X <- lm(data = dat_plm, formula = eval(paste(formula, "+ geo")))
    #
    # X <- lm(data = dat_plm, formula = eval(paste(formula, "+ geo"))) %>%
    #   coef() %>%
    #   data.frame() %>%
    #   rownames_to_column() %>%
    #   set_names('geo', 'alpha') %>%
    #   filter(geo == "(Intercept)" | str_detect(geo, "geo")) %>%
    #   mutate(geo = str_replace(geo, "geo_"))

    # merge(dat_plm, X)

```

```
    list(
      tests = c(
        pooltest(pooling, within)$p.value,
        phtest(within, random)$p.value,
        plm::r.squared(within, dfcor = T)),
      model = within,
      OLS = lm(data = dat_plm, formula = eval(paste(formula, "+ geo")))
    )
  })
m_panels %>%
  lapply(function(output) {
    output$model %>% broom::tidy(conf.int = T) %>%
      rownames_to_column()
  }) %>%
  reduce(rbind) %>%
  mutate(rowname = paste0("Model ", as.roman(cumsum(rowname == 1)), ".")) %>%
  ggplot() +
  aes(estimate, term, color = p.value < .05) +
  geom_vline(xintercept = 0, color = "gray4") +
  geom_point() +
  geom_pointrange(aes(xmin = conf.low, xmax = conf.high)) +
  facet_wrap(~rowname, nrow = 1) +
  theme_grey() +
  labs(x = "Estimated coefficient", y = "Term")

m_panels %>%
  lapply(function(output) {
    output$tests
  }) %>%
  reduce(rbind) %>%
  t() %>%
  data.frame() %>%
  mutate_all(function(x) scales::percent(x, accuracy = .01)) %>%
  {set_names(., paste0("Model ", as.roman(1:ncol(.)), ".")) } %>%
  mutate(
    Indicator = c("pooltest", "phtest", "$Adjusted R^2$")
  ) %>% # TODO ORDER
  select(Indicator, everything()) %>%
  knitr::kable(caption = "Models") # TODO NAME
```