

Tile map to show Forecasted Education Attainment for ages 15-39 in Belt and Road Countries (2015-2050) - SSP2 Scenario

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January 17, 2018

This is a reproducible example to produce a tile map that shows forecasted education attainment for ages 15 to 39 for belt and road countries based on the SSP2 scenario.

Libraries

```
library(tidyverse)
library(geofacet)
library(kani)

source("../grids.R")
options(scipen = 99)
```

Note: I have used a library called `kani` which has some theme aesthetics for plotting. It can be installed by using `devtools::install_github("kanishkamisra/kani")` in your R console.

Data import

We use data from Wittgenstein Center...

```
belt_road <- read_csv("belt_road_countries.csv")

belt_road <- belt_road %>%
  filter(Education != "Total" & Education != "Under 15" & Year <= 2050) %>%
  group_by(Area, Scenario, Year, Education) %>%
  summarise(Population = sum(Population))

edu_levels <- rev(c("No Education", "Incomplete Primary", "Primary", "Lower Secondary", "Upper Secondary"))

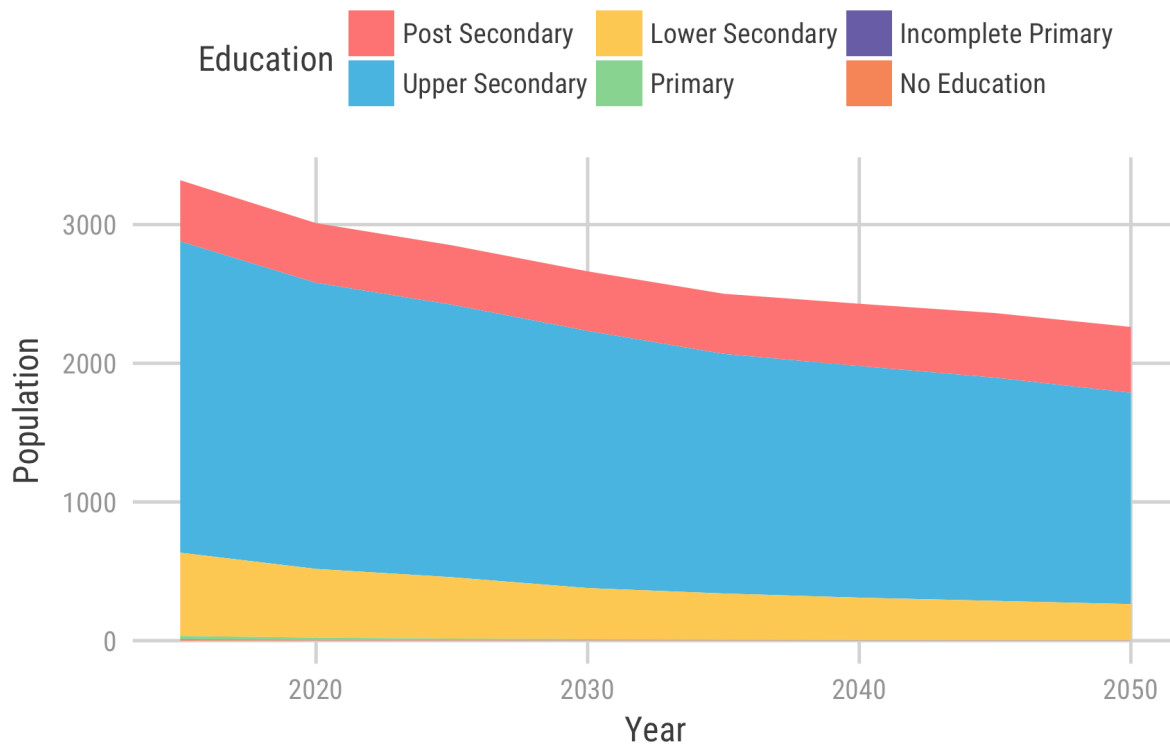
belt_road$Education <- factor(belt_road$Education, levels = edu_levels)

# Colors
red = "#ff7473"
blue = "#47b8e0"
yellow = "#ffc952"
green = "#8cd790"
purple = "#6a60a9"
orange = "#f68657"
```

Plot for one country (SSP2)

As an example, we can plot the forecasted education attainment for ages 15-39 for Hungary. The tile plot introduced in the next section would just be a series of such plots arranged in a specific manner (relative to geographic alignment).

```
hungary_education <- belt_road %>%  
  filter(Area == "Hungary" & Scenario == "SSP2") %>%  
  ggplot(aes(Year, Population, group = Education, fill = Education)) +  
  geom_area() +  
  scale_fill_manual(values = c(red, blue, yellow, green, purple, orange)) +  
  theme_kani() +  
  theme(  
    legend.position = "top",  
    plot.background = element_rect(fill = "white"),  
    panel.background = element_rect(fill = "white"),  
    legend.background = element_rect(fill = "white"),  
    legend.key = element_rect(fill = "white"),  
    strip.background = element_rect(fill = "white"),  
    strip.text.x = element_text(face = "bold")  
  ) +  
  labs(  
    y = "Population per 1000 people"  
  )  
  
ggsave("hungary_education.png", hungary_education, height = 4, width = 6)
```



Defining the Grid

In order to implement grids for the `geofacet` package to plot the area plots relative to the countries' position on a world map, we define a grid as per `geofacet`'s guidelines that takes the row and column values as well as identifiers for the countries and aligns the plots accordingly.

The grid for belt and road is shown as follows:

```
obor_grid <- data.frame(
  row = c(1, 1, 2, 2, 3, 3, 3, 3, 3, 4, 4, 4, 4, 4, 4, 4, 5, 5, 5, 5,
          6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 7, 7, 7, 7, 7, 7, 7, 8, 8, 8, 8,
          9, 9, 9, 9, 9, 10, 10, 10, 11),
  col = c(4, 5, 3, 4, 12, 3, 4, 8, 9, 12, 1, 3, 4, 5, 6, 7, 8, 7, 10, 13,
          14, 1, 2, 5, 6, 7, 8, 9, 10, 11, 12, 1, 2, 3, 9, 11, 12, 14, 3,
          5, 8, 12, 3, 4, 5, 11, 14, 4, 5, 11, 3),
  name = c("Poland", "Russia", "Germany", "Hungary", "Mongolia", "Austria", "Serbia",
            "Kazakhstan", "Kyrgyzstan", "China", "Spain", "Italy", "Greece", "Turkey",
            "Georgia", "Uzbekistan", "Tajikistan", "Turkmenistan", "Nepal", "Macao",
            "Hong Kong", "Senegal", "Mauritania", "Egypt", "Saudi Arabia", "Iran",
            "Pakistan", "India", "Bangladesh", "Myanmar", "Laos", "Cote d'Ivoire",
            "Ghana", "Nigeria", "Sri Lanka", "Thailand", "Viet Nam", "Philippines",
            "Cameroon", "Ethiopia", "Maldives", "Cambodia", "Gabon", "Uganda", "Kenya",
            "Malaysia", "Indonesia", "Rwanda", "Tanzania", "Singapore", "Angola"),
  code = c("POL", "RUS", "DEU", "HUN", "MNG", "AUT", "SRB", "KAZ", "KGZ", "CHN", "ESP",
            "ITA", "GRC", "TUR", "GEO", "UZB", "TJK", "TKM", "NPL", "MAC", "HKG", "SEN",
            "MRT", "EGY", "SAU", "IRN", "PAK", "IND", "BGD", "MMR", "LAO", "CIV", "GHA",
            "NGA", "LKA", "THA", "VNM", "PHL", "CMR", "ETH", "MDV", "KHM", "GAB", "UGA",
            "KEN", "MYS", "IDN", "RWA", "TZA", "SGP", "AGO"),
  stringsAsFactors = FALSE
)

knitr::kable(obor_grid)
```

row	col	name	code
1	4	Poland	POL
1	5	Russia	RUS
2	3	Germany	DEU
2	4	Hungary	HUN
3	12	Mongolia	MNG
3	3	Austria	AUT
3	4	Serbia	SRB
3	8	Kazakhstan	KAZ
3	9	Kyrgyzstan	KGZ
4	12	China	CHN
4	1	Spain	ESP
4	3	Italy	ITA
4	4	Greece	GRC
4	5	Turkey	TUR
4	6	Georgia	GEO
4	7	Uzbekistan	UZB
4	8	Tajikistan	TJK
5	7	Turkmenistan	TKM
5	10	Nepal	NPL
5	13	Macao	MAC

row	col	name	code
5	14	Hong Kong	HKG
6	1	Senegal	SEN
6	2	Mauritania	MRT
6	5	Egypt	EGY
6	6	Saudi Arabia	SAU
6	7	Iran	IRN
6	8	Pakistan	PAK
6	9	India	IND
6	10	Bangladesh	BGD
6	11	Myanmar	MMR
6	12	Laos	LAO
7	1	Cote d'Ivoire	CIV
7	2	Ghana	GHA
7	3	Nigeria	NGA
7	9	Sri Lanka	LKA
7	11	Thailand	THA
7	12	Viet Nam	VNM
7	14	Philippines	PHL
8	3	Cameroon	CMR
8	5	Ethiopia	ETH
8	8	Maldives	MDV
8	12	Cambodia	KHM
9	3	Gabon	GAB
9	4	Uganda	UGA
9	5	Kenya	KEN
9	11	Malaysia	MYS
9	14	Indonesia	IDN
10	4	Rwanda	RWA
10	5	Tanzania	TZA
10	11	Singapore	SGP
11	3	Angola	AGO

Grid Preview

```
grid_prev <- grid_preview(obor_grid) + theme_minimal()
ggsave("obor_grid.png", grid_prev)
```

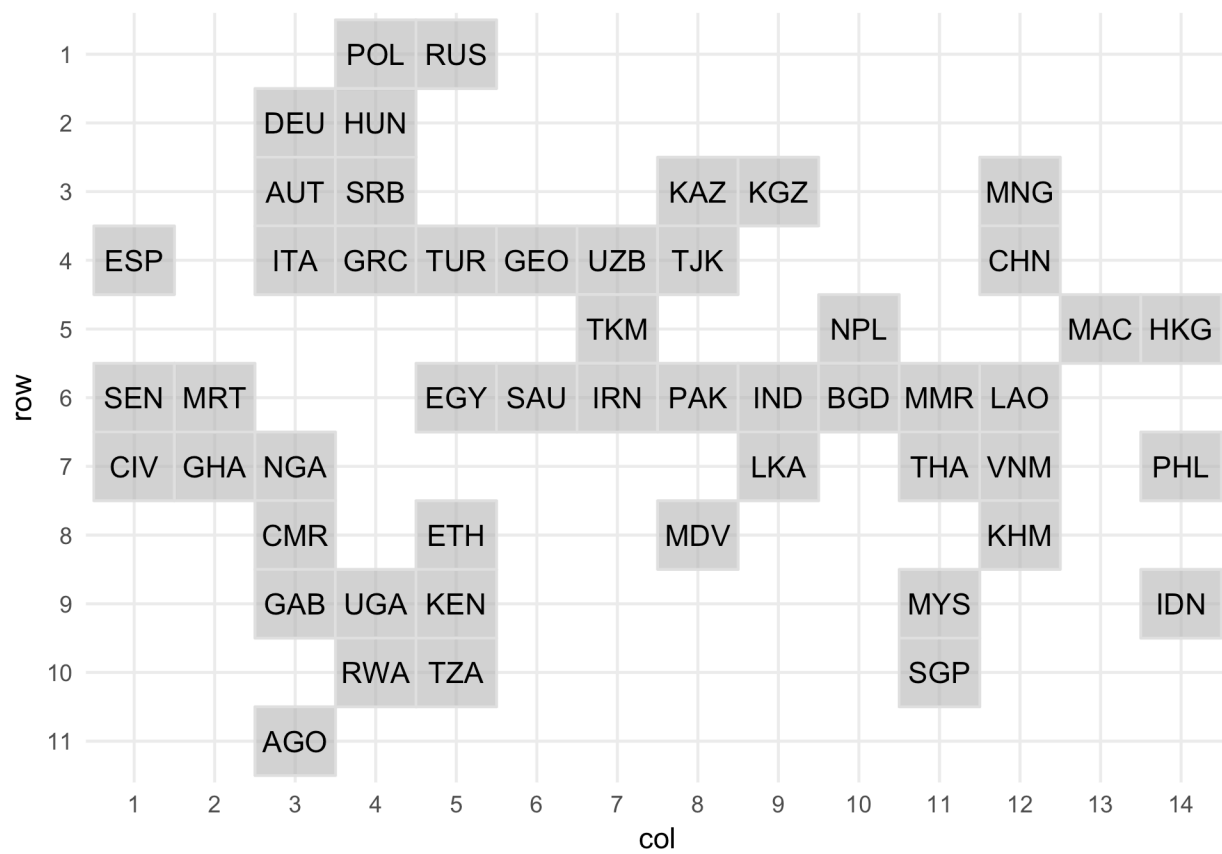


Figure 1: Belt and road countries shown as tiles

Plotting Belt and Road countries

```
belt_road_plot <- belt_road %>%
  filter(Scenario == "SSP2") %>%
  ggplot(aes(Year, Population, fill = Education, group = Education)) +
  geom_area() +
  facet_geo(~Area, grid = obor_grid, scales = "free_y", label = "code") +
  theme_kani() +
  scale_fill_manual(values = c(red, blue, yellow, green, purple, orange)) +
  scale_x_continuous(limits = c(2015, 2050)) +
  theme(
    legend.position = "top",
    legend.margin = margin(b = -1, unit = "cm"),
    plot.background = element_rect(fill = "white"),
    panel.background = element_rect(fill = "white"),
    legend.background = element_rect(fill = "white"),
    legend.key = element_rect(fill = "white"),
    strip.background = element_rect(fill = "white"),
    strip.text = element_text(face = "bold"),
    legend.text = element_text(size = rel(1.1)),
    legend.title = element_text(size = rel(1.1))
  ) +
  labs(
    y = "Total population by educational attainment, 000s",
    x = ""
  )

ggsave("belt_road_education.png", belt_road_plot, height = 15, width = 26)
```

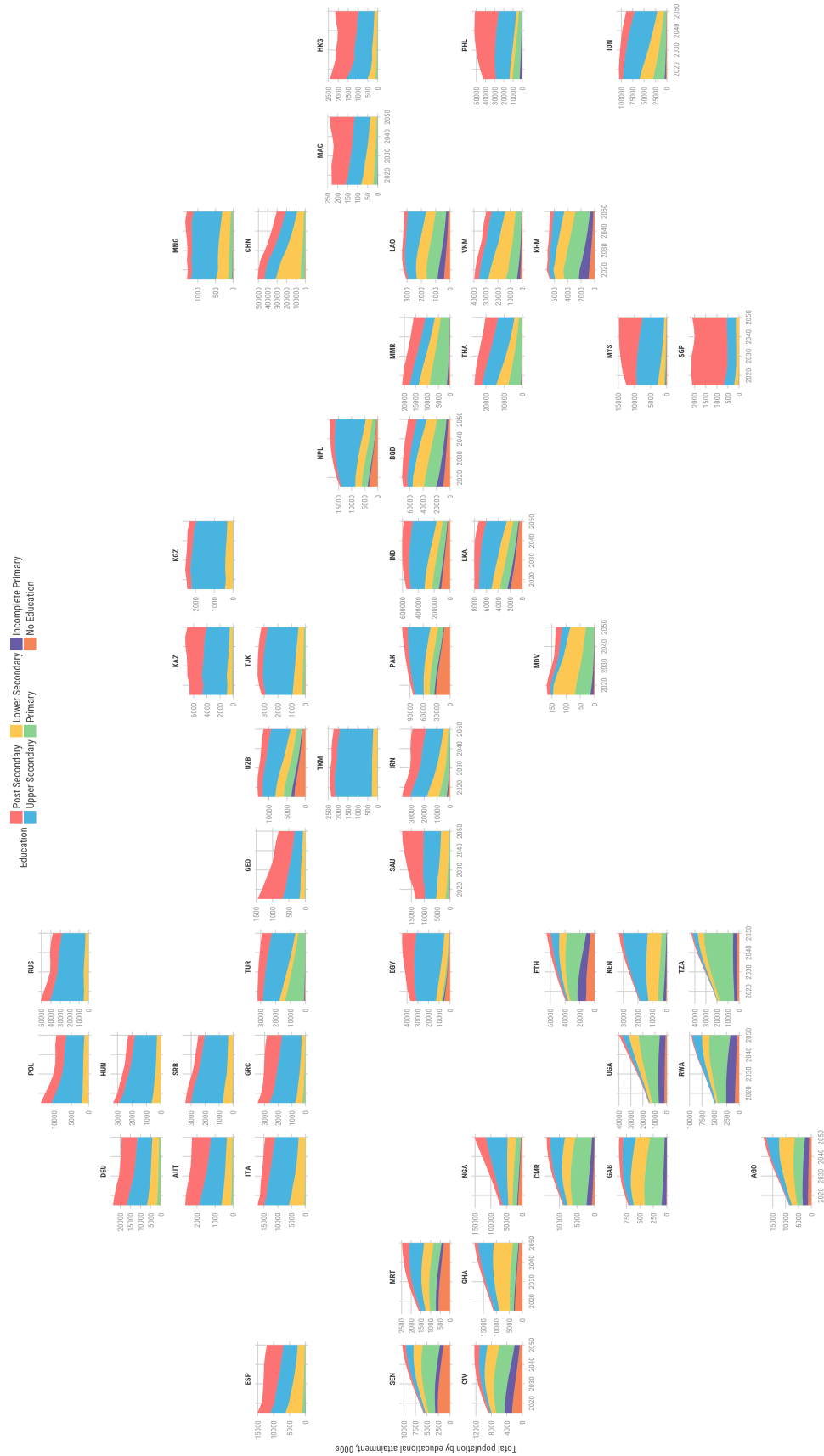


Figure 3: Education in the Belt and Road countries (2015 - 2050)