

Week 8 Methods: Aging
ECON 125: The Science of Population

Setup

Today, we analyze age and sex structure by country and year:

- ▶ Population counts (in 1000s) for every country-year-age-sex combination
- ▶ Every tenth year since 1950
- ▶ From United Nations World Population Prospects

Start by setting up R and loading the data

```
# Load tidyverse and clear the R environment
```

```
library(tidyverse)
```

```
rm(list=ls())
```

```
# Load dataset
```

```
country_year_age_sex <- read_csv(url("https://github.com/tomvogl/econ12"))
```

```
# Ask R to not use scientific notation
```

```
options(scipen = 999)
```

Glimpse

```
glimpse(country_year_age_sex)
```

```
## Rows: 382,992
```

```
## Columns: 5
```

```
## $ Country <chr> "Burundi", "Burundi", "Burundi", "Burundi", "Burundi"
```

```
## $ Year      <dbl> 1950, 1950, 1950, 1950, 1950, 1950, 1950, 1950, 1950
```

```
## $ Age       <dbl> 0, 0, 1, 1, 2, 2, 3, 3, 4, 4, 5, 5, 6, 6, 7, 7, 8, 8
```

```
## $ Sex       <chr> "Males", "Females", "Males", "Females", "Males", "Fe
```

```
## $ Count     <dbl> 41.036, 41.926, 38.596, 39.626, 35.381, 36.604, 33.5
```

Setup

Set up data for plotting

Female counts to the left, male counts to the right

Simply code male counts as negative

For interpretability, convert 1000s to 100,000s

```
country_year_age_sex <-  
  country_year_age_sex |>  
  mutate(Population = if_else(Sex=="Males", -Count/100, Count/100))
```

Population Pyramid for the US in 2020

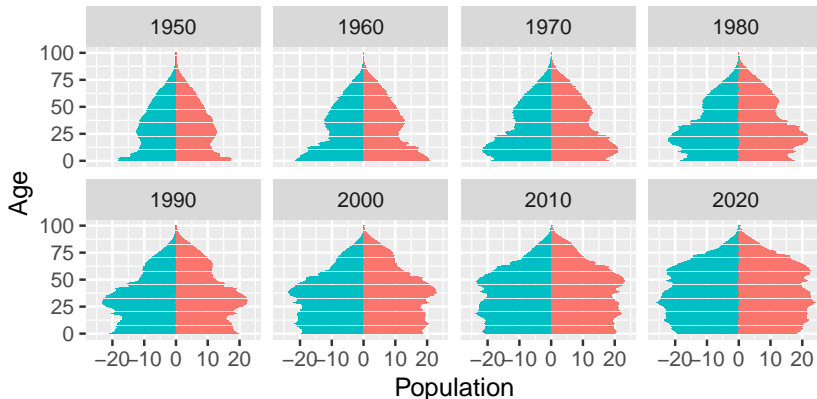
For flexibility, combine the pipe `|>` with `ggplot()`

```
country_year_age_sex |>  
  filter(Country=="United States of America" & Year==2020) |>  
  ggplot(aes(x = Age, y = Population, fill = Sex)) +  
  geom_col() + # bar plot  
  coord_flip() # horizontal bars
```



Population Pyramid for the US over Time

```
country_year_age_sex |>  
  filter(Country=="United States of America") |>  
  ggplot(aes(x = Age, y = Population, fill = Sex)) +  
  geom_col() +  
  coord_flip() +  
  facet_wrap(~Year, ncol = 4, nrow = 2) + # 8 panels  
  theme(legend.position = "none") # no legend
```



Population Pyramid for the US over Time

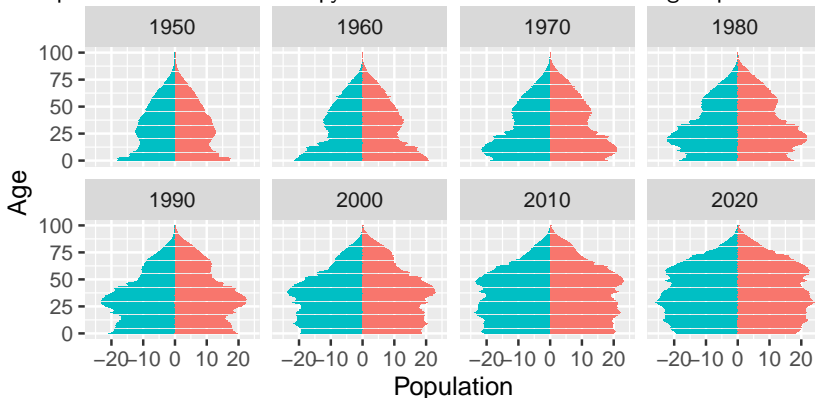
Interesting generational dynamics

Baby boom c. 1950 → many young adults c. 1980 → many children 1990

Known as **population momentum**: ↑ births because ↑ fertile women

Can also see **aging**: from rough pyramid (1950) to emerging beehive (2020)

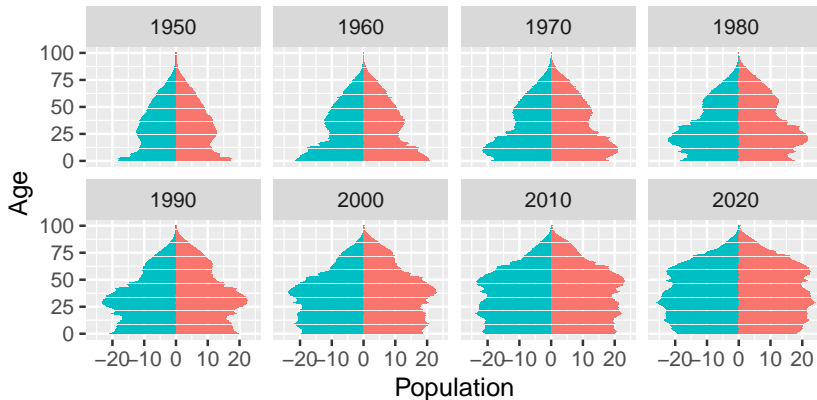
Scoops taken out of the 1950 pyramid: small cohorts born during Depression



Population Pyramid for the US over Time

If you were a marketing exec, what sorts of products would you prioritize in...

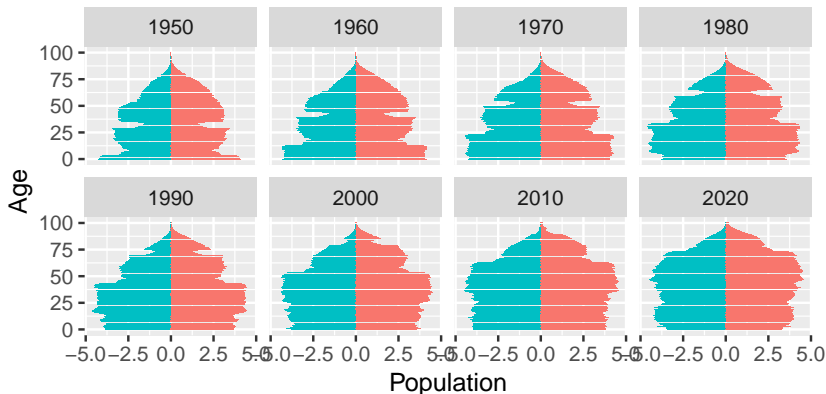
- ▶ 1950?
- ▶ 1980?
- ▶ 2010?



France

In some ways, similar to the US, but clearer effects of World Wars

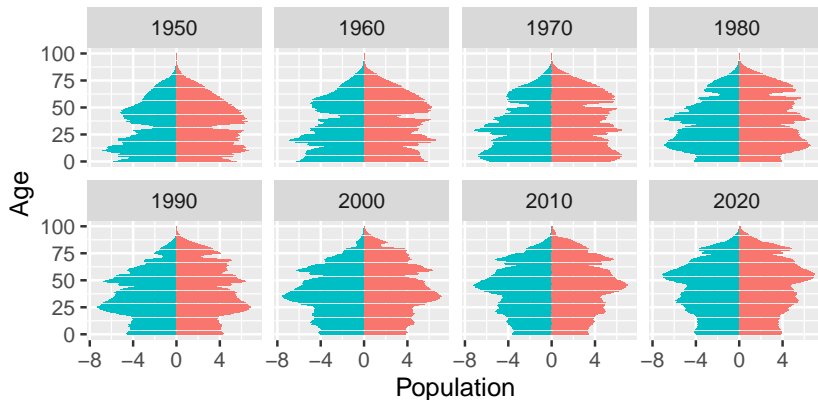
```
country_year_age_sex |>  
  filter(Country=="France") |>  
  ggplot(aes(x = Age, y = Population, fill = Sex)) +  
  geom_col() +  
  coord_flip() +  
  facet_wrap(~Year, ncol = 4, nrow = 2) +  
  theme(legend.position = "none")
```



Germany

Wars even more evident for Germany → sex ratio imbalances due to war deaths

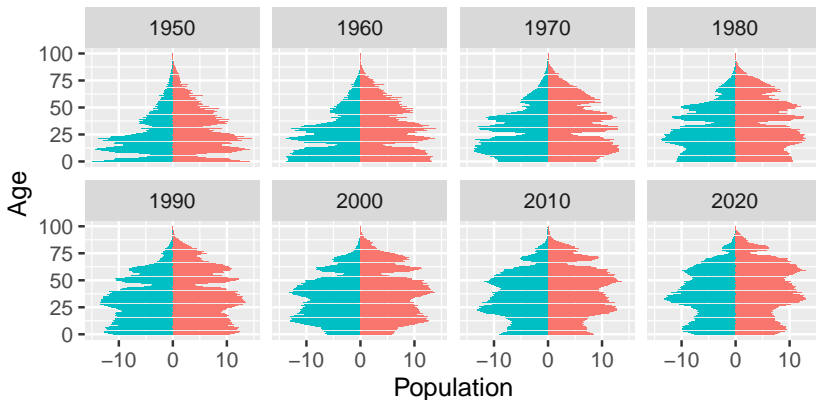
```
country_year_age_sex |>  
  filter(Country=="Germany") |>  
  ggplot(aes(x = Age, y = Population, fill = Sex)) +  
  geom_col() +  
  coord_flip() +  
  facet_wrap(~Year, ncol = 4, nrow = 2) +  
  theme(legend.position = "none")
```



Russia

Russia's case especially messy

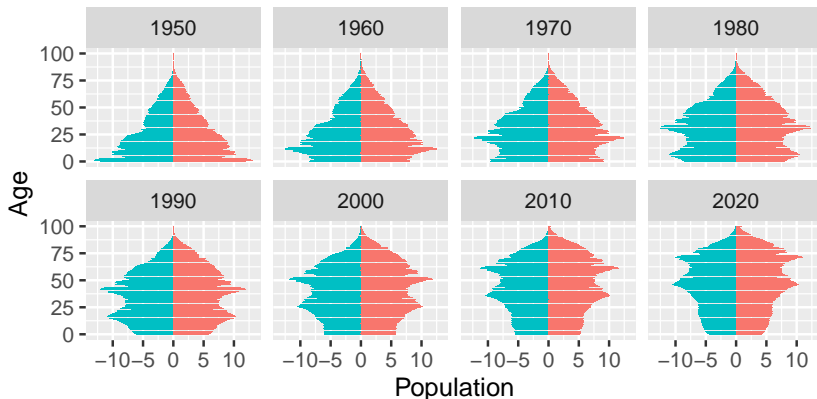
```
country_year_age_sex |>  
  filter(Country=="Russian Federation") |>  
  ggplot(aes(x = Age, y = Population, fill = Sex)) +  
  geom_col() +  
  coord_flip() +  
  facet_wrap(~Year, ncol = 4, nrow = 2) +  
  theme(legend.position = "none")
```



Japan

Can see WWII in Japan too; also look for Year of the Fire Horse (1966)

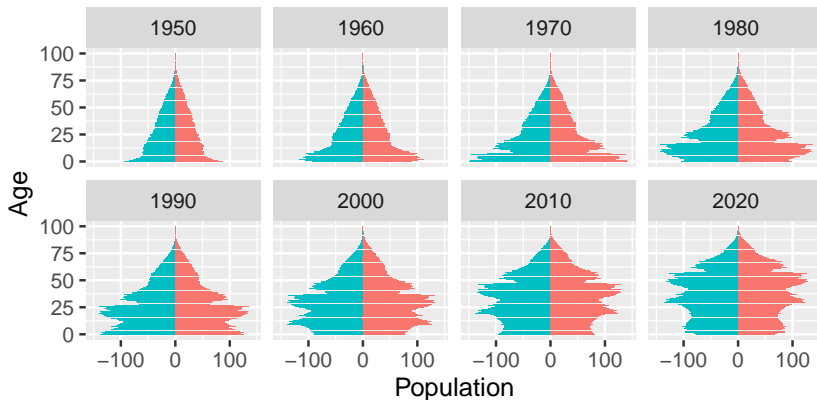
```
country_year_age_sex |>  
  filter(Country=="Japan") |>  
  ggplot(aes(x = Age, y = Population, fill = Sex)) +  
  geom_col() +  
  coord_flip() +  
  facet_wrap(~Year, ncol = 4, nrow = 2) +  
  theme(legend.position = "none")
```



China

Can see Great Leap Forward (c. 1960), and then fertility decline in 1970s

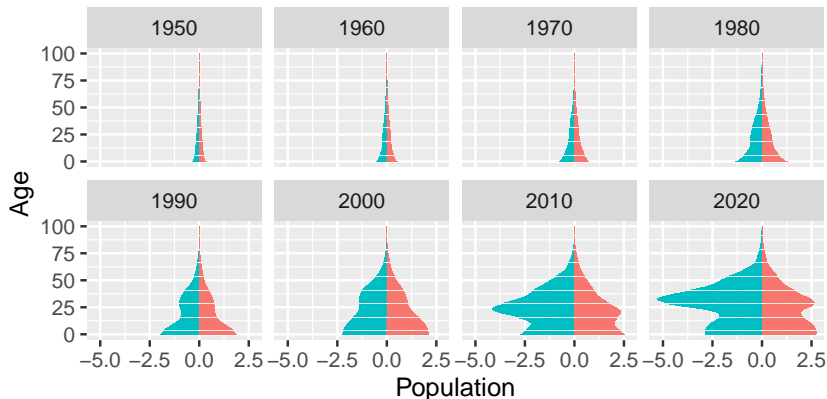
```
country_year_age_sex |>  
  filter(Country=="China") |>  
  ggplot(aes(x = Age, y = Population, fill = Sex)) +  
  geom_col() +  
  coord_flip() +  
  facet_wrap(~Year, ncol = 4, nrow = 2) +  
  theme(legend.position = "none")
```



Saudi Arabia

Lots of male migrant workers

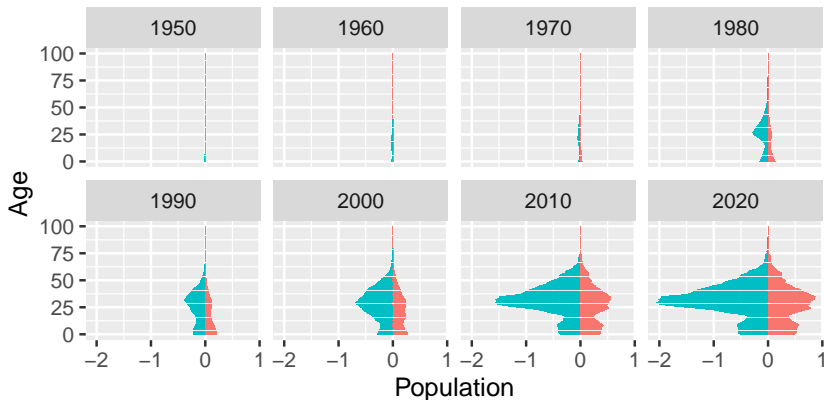
```
country_year_age_sex |>  
  filter(Country=="Saudi Arabia") |>  
  ggplot(aes(x = Age, y = Population, fill = Sex)) +  
  geom_col() +  
  coord_flip() +  
  facet_wrap(~Year, ncol = 4, nrow = 2) +  
  theme(legend.position = "none")
```



United Arab Emirates

Even more extreme than Saudi

```
country_year_age_sex |>  
  filter(Country=="United Arab Emirates") |>  
  ggplot(aes(x = Age, y = Population, fill = Sex)) +  
  geom_col() +  
  coord_flip() +  
  facet_wrap(~Year, ncol = 4, nrow = 2) +  
  theme(legend.position = "none")
```



Nepal

Nepal today sends many male migrant workers

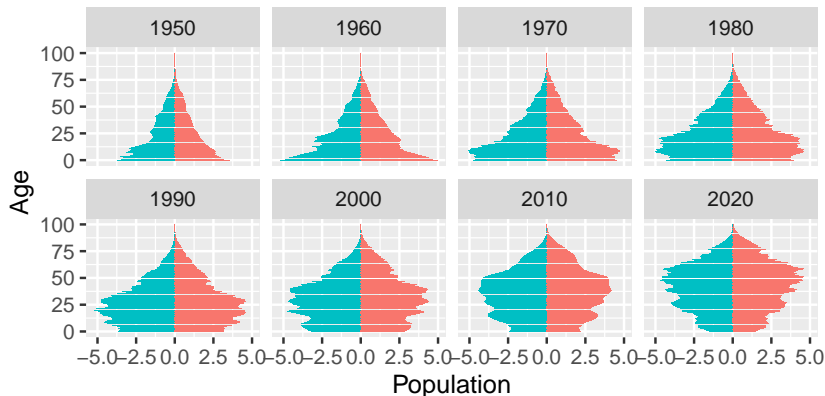
```
country_year_age_sex |>
  filter(Country=="Nepal") |>
  ggplot(aes(x = Age, y = Population, fill = Sex)) +
  geom_col() +
  coord_flip() +
  facet_wrap(~Year, ncol = 4, nrow = 2) +
  theme(legend.position = "none")
```



South Korea

South Korea gets us back to talking about aging - from pyramid to beehive

```
country_year_age_sex |>  
  filter(Country=="Republic of Korea") |>  
  ggplot(aes(x = Age, y = Population, fill = Sex)) +  
  geom_col() +  
  coord_flip() +  
  facet_wrap(~Year, ncol = 4, nrow = 2) +  
  theme(legend.position = "none")
```



Dependency ratios

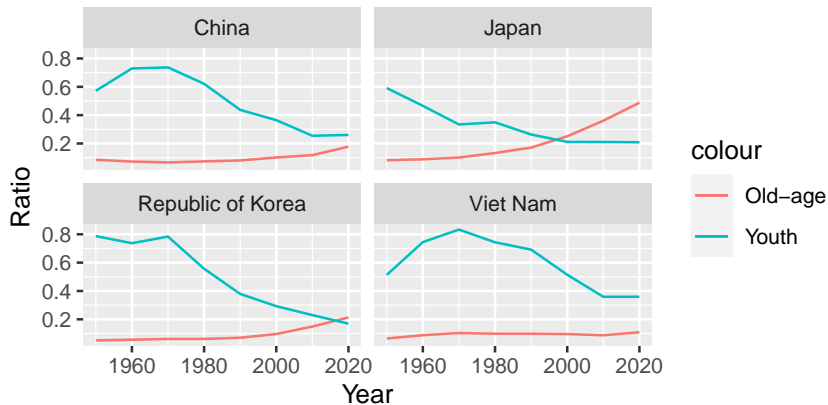
We can summarize the pyramids with dependency ratios (youth and old-age)

Necessitates switch to country-year data

```
country_year <-  
  country_year_age_sex |>  
  mutate(P_0_14 = if_else(Age<15, Count, 0),  
         P_15_64 = if_else(Age>=15&Age<65, Count, 0),  
         P_65plus = if_else(Age>=65, Count, 0)) |>  
  group_by(Country, Year) |>  
  summarise(Pop_0_14 = sum(P_0_14),  
            Pop_15_64 = sum(P_15_64),  
            Pop_65plus = sum(P_65plus)) |>  
  mutate(OldRatio = Pop_65plus/Pop_15_64,  
         YoungRatio = Pop_0_14/Pop_15_64,  
         DepRatio = OldRatio + YoungRatio)
```

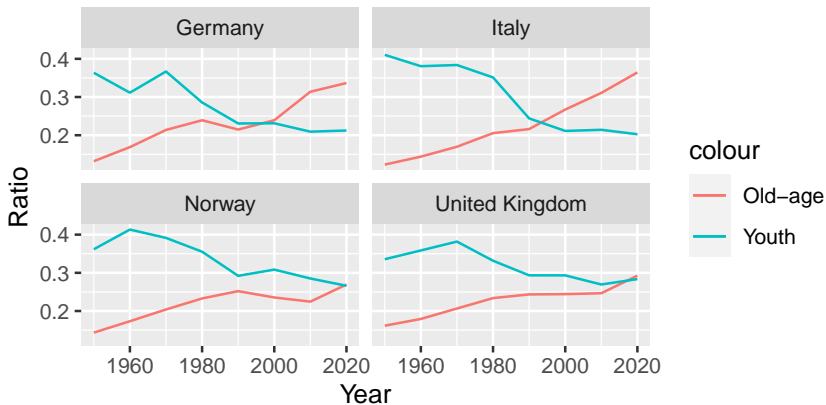
Dependency Ratios in 4 Asian Countries

```
country_year |>
  filter(Country=="China"|Country=="Japan"|
         Country=="Republic of Korea"|Country=="Viet Nam") |>
  ggplot(aes(x = Year)) +
  geom_line(aes(y = OldRatio, color = "Old-age")) +
  geom_line(aes(y = YoungRatio, color = "Youth")) +
  labs(y = "Ratio", x = "Year") +
  facet_wrap(~Country)
```



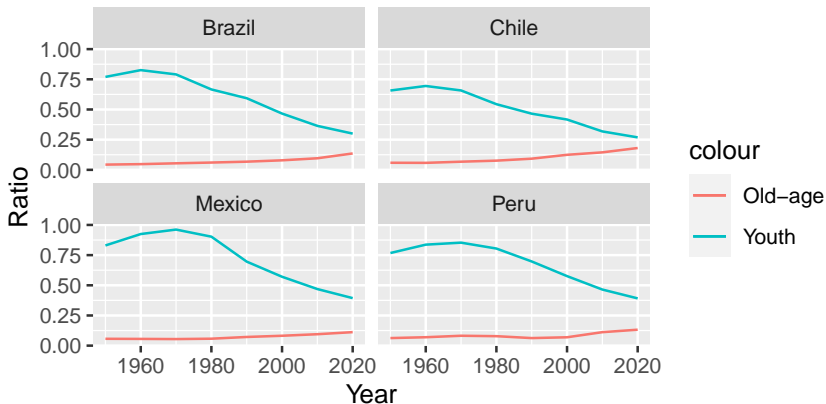
Dependency Ratios in 4 European Countries

```
country_year |>
  filter(Country=="Germany" | Country=="Italy" |
         Country=="Norway" | Country=="United Kingdom") |>
  ggplot(aes(x = Year)) +
  geom_line(aes(y = OldRatio, color = "Old-age")) +
  geom_line(aes(y = YoungRatio, color = "Youth")) +
  labs(y = "Ratio", x = "Year") +
  facet_wrap(~Country)
```



Dependency Ratios in 4 Latin American Countries

```
country_year |>
  filter(Country=="Brazil"|Country=="Chile"|
         Country=="Peru"|Country=="Mexico") |>
  ggplot(aes(x = Year)) +
  geom_line(aes(y = OldRatio, color = "Old-age")) +
  geom_line(aes(y = YoungRatio, color = "Youth")) +
  labs(y = "Ratio", x = "Year") +
  facet_wrap(~Country)
```



Dependency Ratios in 4 African Countries

```
country_year |>
  filter(Country=="Kenya"|Country=="Niger"|
         Country=="Nigeria"|Country=="South Africa") |>
  ggplot(aes(x = Year)) +
  geom_line(aes(y = OldRatio, color = "Old-age")) +
  geom_line(aes(y = YoungRatio, color = "Youth")) +
  labs(y = "Ratio", x = "Year") +
  facet_wrap(~Country)
```

