

Life Expectancies for selected populations

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2022-07-23

Aim

This appendix will show the life expectancies for the populations compared in the paper.

Data

```
library(tidyverse)

## -- Attaching packages ----- tidyverse 1.3.1 --
## v ggplot2 3.3.6      v purrr  0.3.4
## v tibble  3.1.7      v dplyr  1.0.9
## v tidyr   1.2.0      v stringr 1.4.0
## v readr   2.1.2      v forcats 0.5.1

## -- Conflicts ----- tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()

# load data
hmd_lt <- read_rds("https://github.com/JonMinton/change-in-ex/blob/main/data/lifetables.rds?raw=true")

# Labels for codes
country_code_lookup <-
  tribble(
    ~code, ~country,
    "DEUTNP", "Germany",
    "DEUTE", "East Germany",
    "DEUTW", "West Germany",
    "ESP", "Spain",
    "FRATNP", "France",
    "ITA", "Italy",
    "GBRTENW", "England & Wales",
    "GBR_SCO", "Scotland",
    "DEUTSYNTH", "Synthetic Germany",
    "NLD", "Netherlands"
  )

countries_of_interest <- c(
  "GBRTENW",
  "GBR_SCO",
  "GBR_UK",
```

```

"FRATNP",
"ESP",
"ITA",
"DEUTNP",
"DEUTE",
"DEUTW",
"NLD"
)

source("https://raw.githubusercontent.com/JonMinton/change-in-ex/main/R/make_synthetic_germany_function.R")

source("https://raw.githubusercontent.com/JonMinton/change-in-ex/main/R/make_pop_selection.R")

```

Graphs

Life Expectancy at birth

```

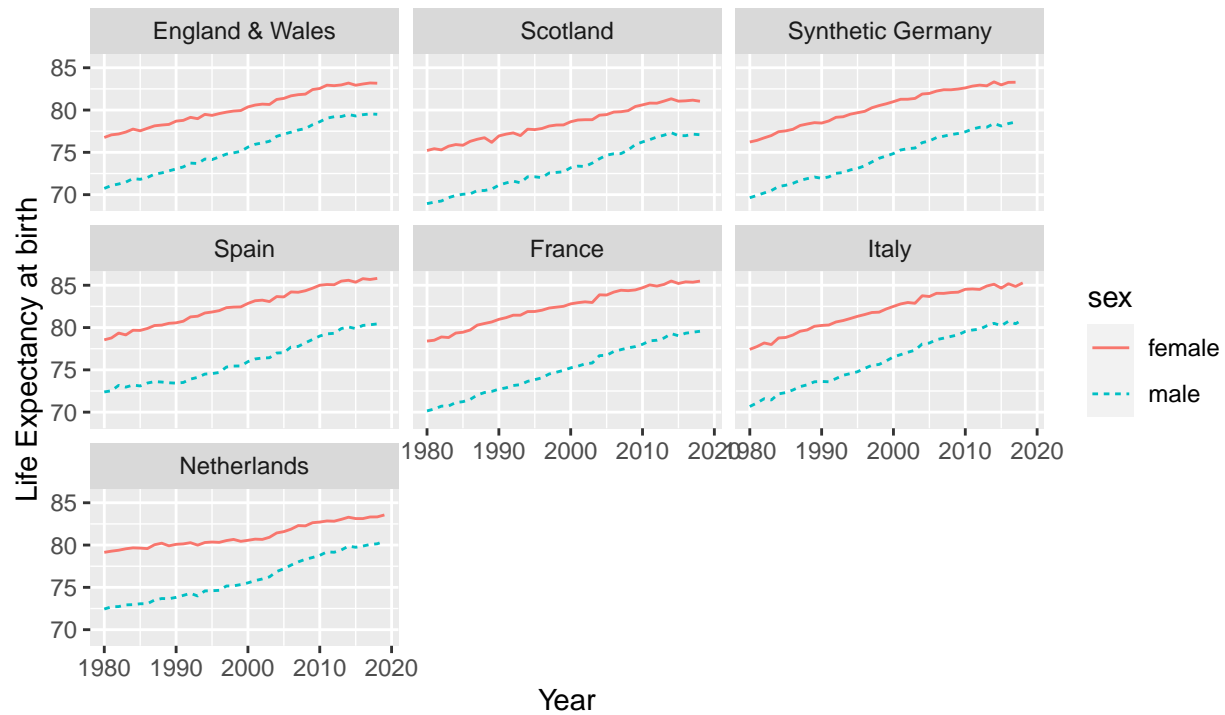
hmd_ex_selected_countries_with_synth %>%
  left_join(country_code_lookup) %>%
  mutate(country = factor(country, levels = c("England & Wales", "Scotland", "Synthetic Germany", "Spain")))
  filter(!is.na(country)) %>%
  filter(between(year, 1980, 2020)) %>%
  filter(x == 0) %>%
  ggplot(aes(x = year, y = ex, group = sex, colour = sex, linetype = sex)) +
  geom_line() +
  facet_wrap(~country) +
  labs(
    x = "Year",
    y = "Life Expectancy at birth",
    title = "Life expectancies at birth for selected nations",
    subtitle = "1980 to 2020 or latest available year",
    caption = "Source: Human Mortality Database"
  )

## Joining, by = "code"

```

Life expectancies at birth for selected nations

1980 to 2020 or latest available year



Source: Human Mortality Database

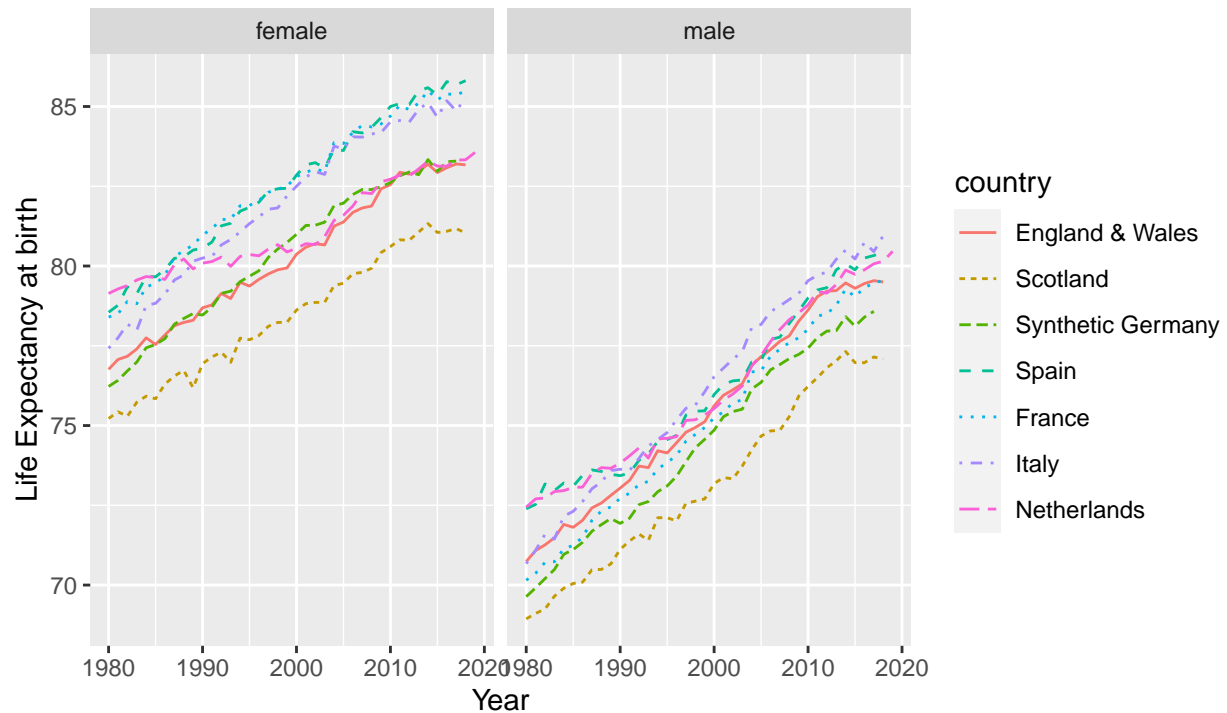
Equivalently

```
hmd_ex_selected_countries_with_synth %>%
  left_join(country_code_lookup) %>%
  mutate(country = factor(country, levels = c("England & Wales", "Scotland", "Synthetic Germany", "Spain", "France", "Italy", "Netherlands"))) %>%
  filter(!is.na(country)) %>%
  filter(between(year, 1980, 2020)) %>%
  filter(x == 0) %>%
  ggplot(aes(x = year, y = ex, group = country, colour = country, linetype = country)) +
  geom_line() +
  facet_wrap(~sex) +
  labs(
    x = "Year",
    y = "Life Expectancy at birth",
    title = "Life expectancies at birth for selected nations",
    subtitle = "1980 to 2020 or latest available year",
    caption = "Source: Human Mortality Database"
  )
```

```
## Joining, by = "code"
```

Life expectancies at birth for selected nations

1980 to 2020 or latest available year



Source: Human Mortality Database

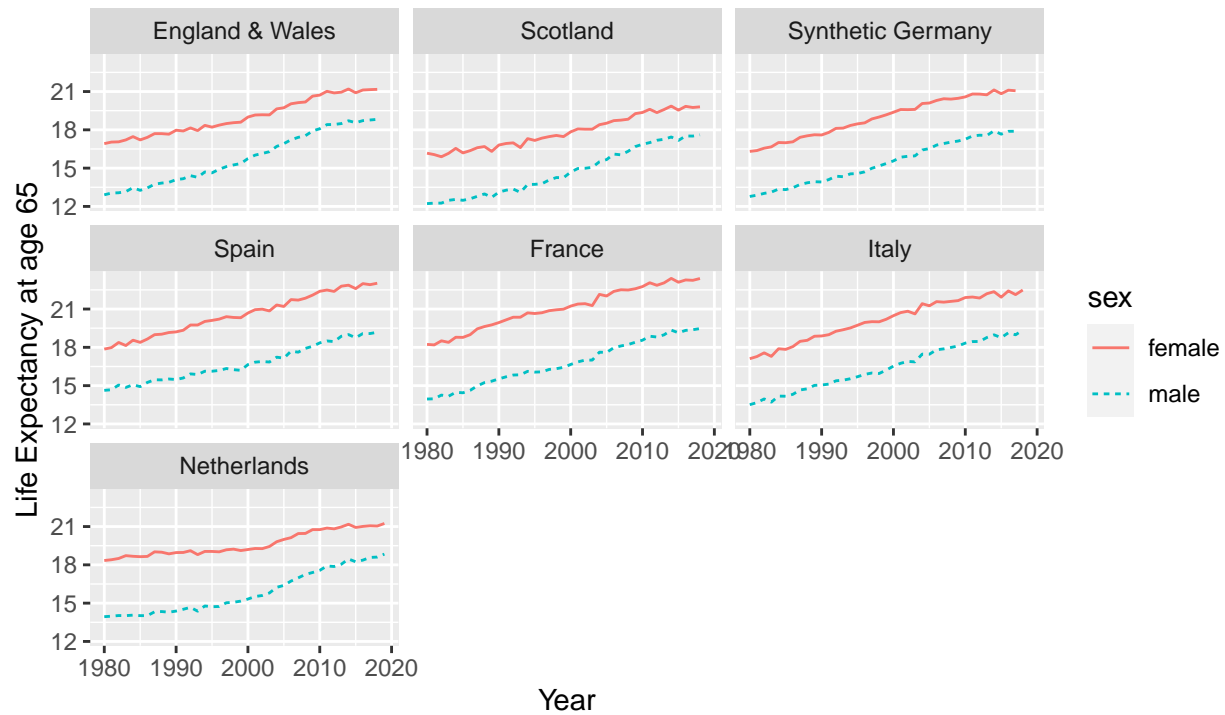
Life expectancy at age 65

```
hmd_ex_selected_countries_with_synth %>%
  left_join(country_code_lookup) %>%
  mutate(country = factor(country, levels = c("England & Wales", "Scotland", "Synthetic Germany", "Spain", "France", "Italy", "Netherlands"))) %>%
  filter(!is.na(country)) %>%
  filter(between(year, 1980, 2020)) %>%
  filter(x == 65) %>%
  ggplot(aes(x = year, y = ex, group = sex, colour = sex, linetype = sex)) +
  geom_line() +
  facet_wrap(~country) +
  labs(
    x = "Year",
    y = "Life Expectancy at age 65",
    title = "Life expectancies at age 65 years for selected nations",
    subtitle = "1980 to 2020 or latest available year",
    caption = "Source: Human Mortality Database"
  )
```

```
## Joining, by = "code"
```

Life expectancies at age 65 years for selected nations

1980 to 2020 or latest available year



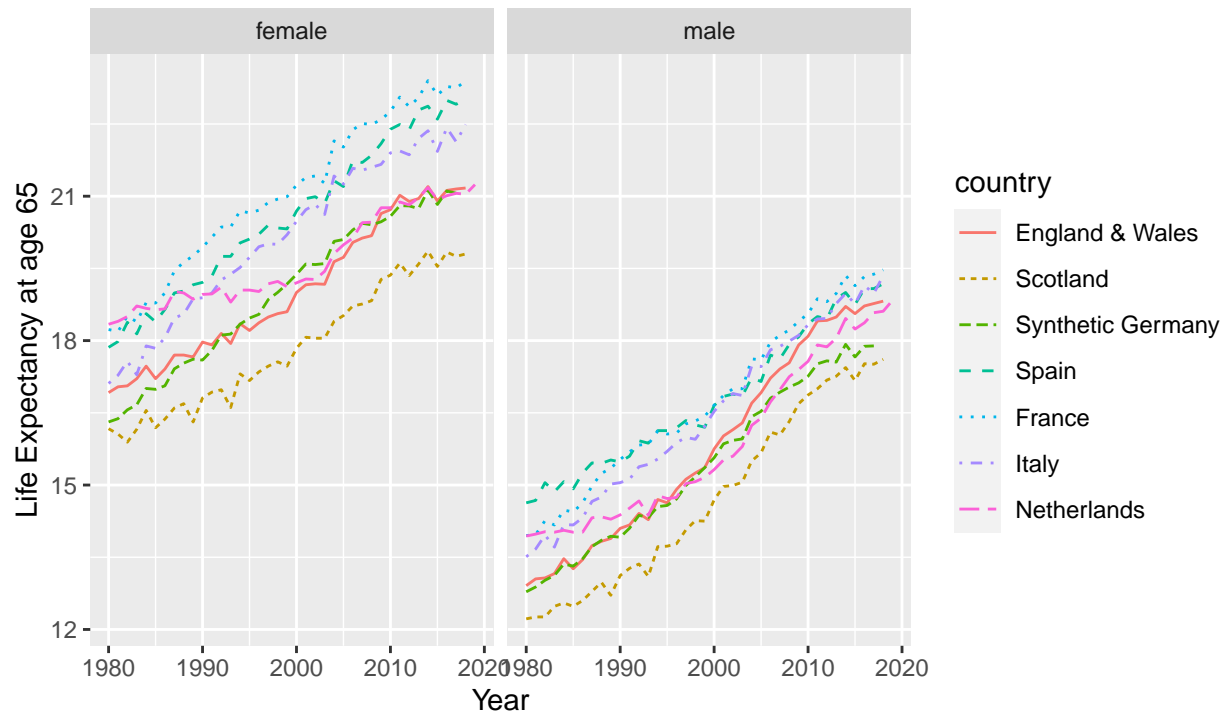
Source: Human Mortality Database

Equivalently:

```
hmd_ex_selected_countries_with_synth %>%
  left_join(country_code_lookup) %>%
  mutate(country = factor(country, levels = c("England & Wales", "Scotland", "Synthetic Germany", "Spain", "France", "Italy", "Netherlands"))) %>%
  filter(!is.na(country)) %>%
  filter(between(year, 1980, 2020)) %>%
  filter(x == 65) %>%
  ggplot(aes(x = year, y = ex, group = country, colour = country, linetype = country)) +
  geom_line() +
  facet_wrap(~sex) +
  labs(
    x = "Year",
    y = "Life Expectancy at age 65",
    title = "Life expectancies at age 65 years for selected nations",
    subtitle = "1980 to 2020 or latest available year",
    caption = "Source: Human Mortality Database"
  )
```

```
## Joining, by = "code"
```

Life expectancies at age 65 years for selected nations 1980 to 2020 or latest available year



Source: Human Mortality Database

Average life expectancy change

The following shows the average change in life expectancy for each population over the full period, and including East Germany and West Germany as separate populations

```
hmd_ex_selected_countries_with_synth %>%
  filter(year >= 1979) %>%
  group_by(code, x, sex) %>%
  arrange(year) %>%
  mutate(delta_ex = ex - lag(ex)) %>%
  nest() %>%
  mutate(
    rwd_model = map(data, ~lm(delta_ex ~ 1, data = .)),
    ar_model = map(data, ~lm(delta_ex ~ lag(delta_ex), data = .))
  ) %>%
  mutate(
    aic_rwd = map_dbl(rwd_model, AIC),
    aic_ar = map_dbl(ar_model, AIC)
  ) %>%
  mutate(
    diff_aic = aic_ar - aic_rwd
  ) %>%
  # filter(diff_aic > 0)
  mutate(
    tidied_ar_model = map(ar_model, broom::tidy)
  ) %>%
  unnest(tidied_ar_model) %>%
  filter(term == "(Intercept)") %>%
```

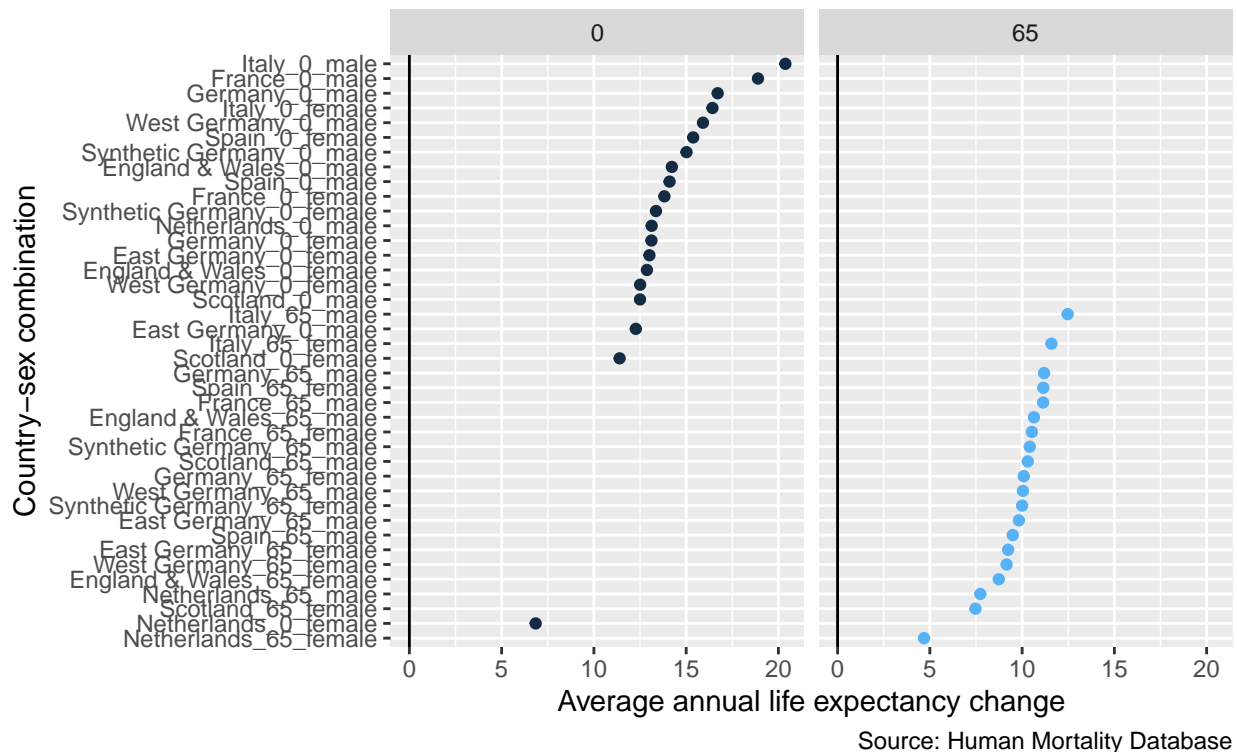
```

arrange(desc(estimate)) %>%
left_join(country_code_lookup) %>%
mutate(country = factor(country, levels = c("England & Wales", "Scotland", "East Germany", "West Germany", "Spain", "France", "Italy", "Netherlands", "Synthetic Germany"))) %>%
select(code, country, x, sex, estimate, std.error) %>%
mutate(display_label = glue::glue("{country}_{x}_{sex}")) %>%
mutate(estimate_weeks = estimate * 52.25) %>%
ggplot(aes(estimate_weeks, fct_reorder(display_label, estimate_weeks))) +
geom_point(aes(colour = x), show.legend = FALSE) +
expand_limits(x = 0) +
geom_vline(xintercept = 0) +
labs(
  x = "Average annual life expectancy change",
  y = "Country-sex combination",
  title = "Average annual improvements by country and sex",
  subtitle = "Range: 1980 to 2020 or nearest available years",
  caption = "Source: Human Mortality Database"
) +
facet_wrap(~x)

```

Joining, by = "code"

Average annual improvements by country and sex
Range: 1980 to 2020 or nearest available years



The figure below shows the same for those populations considered in the main paper.

```

hmd_ex_selected_countries_with_synth %>%
  filter(year >= 1979) %>%
  filter(!(code %in% c("DEUTE", "DEUTW", "DEUTNP"))) %>% # Using only synthetic germany for longer t
  group_by(code, x, sex) %>%

```

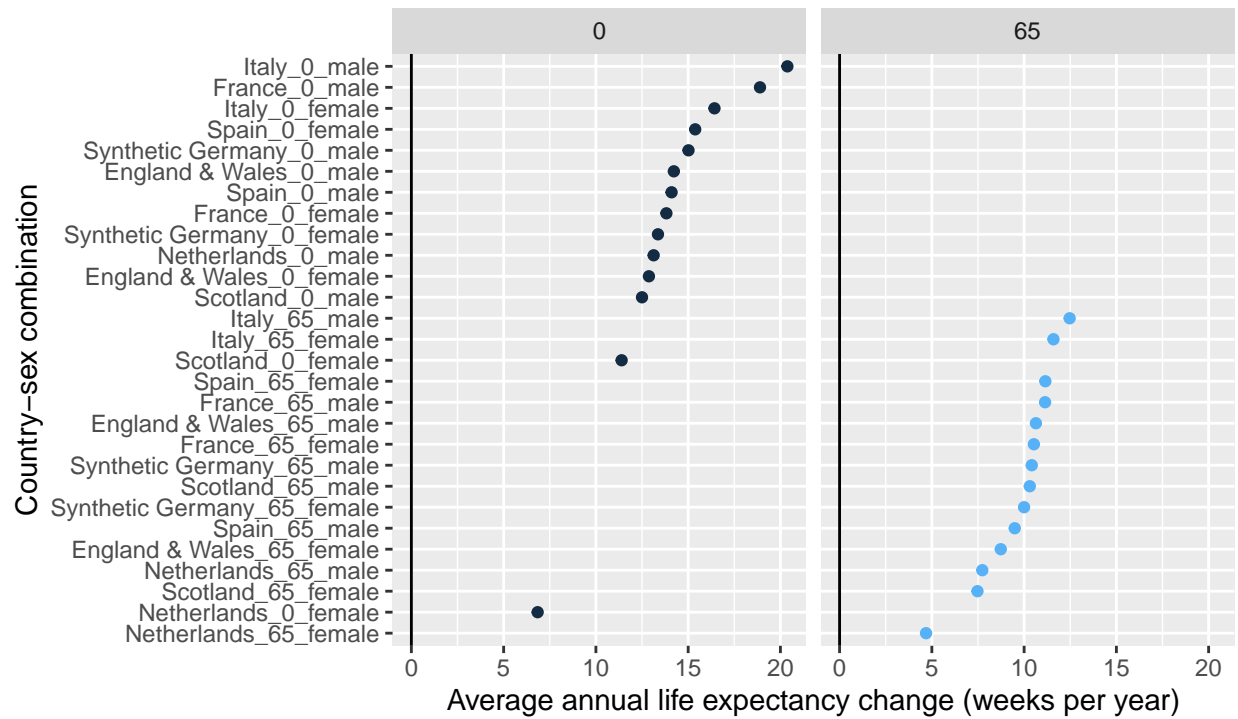
```

arrange(year) %>%
mutate(delta_ex = ex - lag(ex)) %>%
nest() %>%
mutate(
  rwd_model = map(data, ~lm(delta_ex ~ 1, data = . )),
  ar_model = map(data, ~lm(delta_ex ~ lag(delta_ex), data = .))
) %>%
mutate(
  aic_rwd = map_dbl(rwd_model, AIC),
  aic_ar = map_dbl(ar_model, AIC)
) %>%
mutate(
  diff_aic = aic_ar - aic_rwd
) %>%
# filter(diff_aic > 0)
mutate(
  tidied_ar_model = map(ar_model, broom::tidy)
) %>%
unnest(tidied_ar_model) %>%
filter(term == "(Intercept)") %>%
arrange(desc(estimate)) %>%
left_join(country_code_lookup) %>%
mutate(country = factor(country, levels = c("England & Wales", "Scotland", "Synthetic Germany", "Spain")))
filter(!is.na(country)) %>%
select(code, country, x, sex, estimate, std.error) %>%
mutate(display_label = glue::glue("{country}_{x}_{sex}")) %>%
mutate(estimate_weeks = estimate * 52.25) %>%
ggplot(aes(estimate_weeks, fct_reorder(display_label, estimate_weeks))) +
geom_point(aes(colour = x), show.legend = FALSE) +
expand_limits(x = 0) +
geom_vline(xintercept = 0) +
labs(
  x = "Average annual life expectancy change (weeks per year)",
  y = "Country-sex combination",
  title = "Average annual improvements by country and sex",
  subtitle = "Range: 1980 to 2020 or nearest available years",
  caption = "Source: Human Mortality Database"
) +
facet_wrap(~x)

```

Joining, by = "code"

Average annual improvements by country and sex Range: 1980 to 2020 or nearest available years



Source: Human Mortality Database