

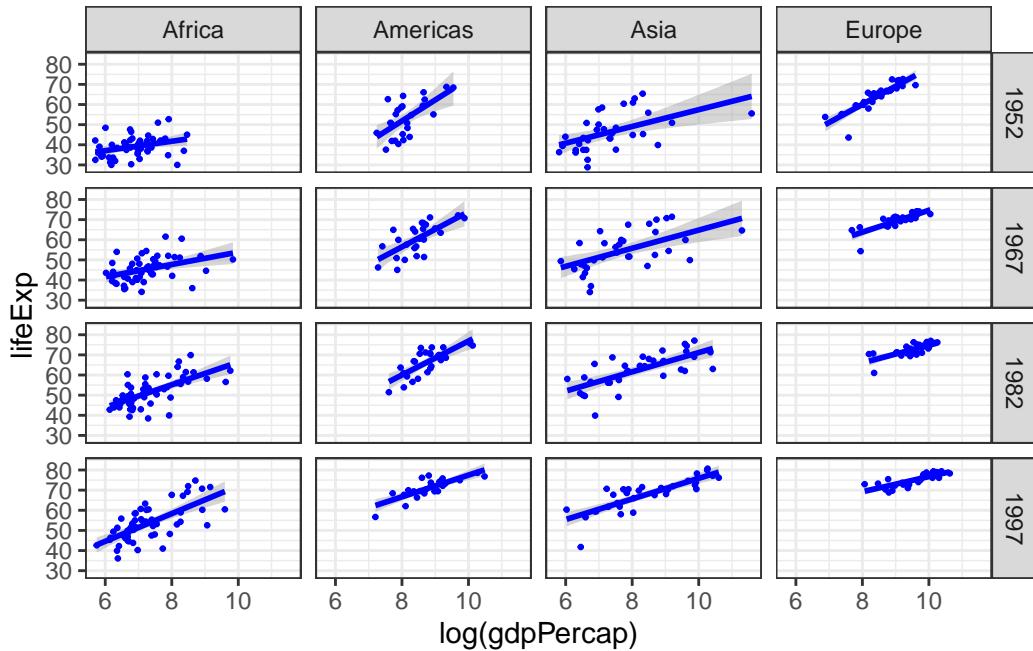
AE-11

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First Model

```
gapminder %>%
  filter(
    year %in% c(1952, 1967, 1982, 1997),
    continent != "Oceania"
  ) %>%
  ggplot(aes(x = log(gdpPercap), y = lifeExp)) +
  geom_smooth(color = "blue", method = "lm") +
  geom_point(color = "blue", size = 0.5) +
  facet_grid(year ~ continent) +
  theme_bw()

`geom_smooth()` using formula = 'y ~ x'
```



```
lm_data <- gapminder |>
  nest(data = -c(continent, year))
```

```
lm_data
```

```
# A tibble: 60 x 3
  continent year data
  <fct>     <int> <list>
  1 Asia      1952 <tibble [33 x 4]>
  2 Asia      1957 <tibble [33 x 4]>
  3 Asia      1962 <tibble [33 x 4]>
  4 Asia      1967 <tibble [33 x 4]>
  5 Asia      1972 <tibble [33 x 4]>
  6 Asia      1977 <tibble [33 x 4]>
  7 Asia      1982 <tibble [33 x 4]>
  8 Asia      1987 <tibble [33 x 4]>
  9 Asia      1992 <tibble [33 x 4]>
  10 Asia     1997 <tibble [33 x 4]>
# i 50 more rows
```

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```
gapminder %>% group_by(continent, year) %>%
  nest() %>%
  mutate(model = map(data, ~lm(lifeExp ~ log(gdpPercap), data = .x)))
```

```
# A tibble: 60 x 4
# Groups:   continent, year [60]
  continent  year data          model
  <fct>     <int> <list>        <list>
1 Asia       1952 <tibble [33 x 4]> <lm>
2 Asia       1957 <tibble [33 x 4]> <lm>
3 Asia       1962 <tibble [33 x 4]> <lm>
4 Asia       1967 <tibble [33 x 4]> <lm>
5 Asia       1972 <tibble [33 x 4]> <lm>
6 Asia       1977 <tibble [33 x 4]> <lm>
7 Asia       1982 <tibble [33 x 4]> <lm>
8 Asia       1987 <tibble [33 x 4]> <lm>
9 Asia       1992 <tibble [33 x 4]> <lm>
10 Asia      1997 <tibble [33 x 4]> <lm>
# i 50 more rows
```

```
#anonymous function example
```

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```
gapminder %>%
  group_by(continent, year) %>%
  nest() %>%
  mutate(
    model = map(data, ~lm(lifeExp ~ log(gdpPercap), data = .x)),
    tidy_out = map(model, tidy)
  )
```

```
# A tibble: 60 x 5
# Groups:   continent, year [60]
  continent  year data          model  tidy_out
```

```

<fct>    <int> <list>          <list> <list>
1 Asia      1952 <tibble [33 x 4]> <lm>   <tibble [2 x 5]>
2 Asia      1957 <tibble [33 x 4]> <lm>   <tibble [2 x 5]>
3 Asia      1962 <tibble [33 x 4]> <lm>   <tibble [2 x 5]>
4 Asia      1967 <tibble [33 x 4]> <lm>   <tibble [2 x 5]>
5 Asia      1972 <tibble [33 x 4]> <lm>   <tibble [2 x 5]>
6 Asia      1977 <tibble [33 x 4]> <lm>   <tibble [2 x 5]>
7 Asia      1982 <tibble [33 x 4]> <lm>   <tibble [2 x 5]>
8 Asia      1987 <tibble [33 x 4]> <lm>   <tibble [2 x 5]>
9 Asia      1992 <tibble [33 x 4]> <lm>   <tibble [2 x 5]>
10 Asia     1997 <tibble [33 x 4]> <lm>   <tibble [2 x 5]>
# i 50 more rows

```

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```

gapminder %>%
  group_by(continent, year) %>%
  nest() %>%
  mutate(
    model = map(data , ~lm(lifeExp ~ log(gdpPercap), data = .x)),
    tidy_out = map(model, tidy)
  ) %>%
  unnest(tidy_out)

```

```

# A tibble: 120 x 9
# Groups:   continent, year [60]
  continent year data   model term    estimate std.error statistic p.value
  <fct>    <int> <list> <list> <chr>      <dbl>     <dbl>     <dbl>    <dbl>
1 Asia      1952 <tibble> <lm>   (Intercept 15.8      9.27    1.71 9.78e-2
2 Asia      1952 <tibble> <lm>   log(gdp~ 4.16      1.25    3.33 2.28e-3
3 Asia      1957 <tibble> <lm>   (Intercept 18.1      9.70    1.86 7.20e-2
4 Asia      1957 <tibble> <lm>   log(gdp~ 4.17      1.28    3.26 2.71e-3
5 Asia      1962 <tibble> <lm>   (Intercept 16.6      9.52    1.74 9.11e-2
6 Asia      1962 <tibble> <lm>   log(gdp~ 4.59      1.24    3.72 7.94e-4
7 Asia      1967 <tibble> <lm>   (Intercept 19.8      9.05    2.19 3.64e-2
8 Asia      1967 <tibble> <lm>   log(gdp~ 4.50      1.15    3.90 4.77e-4
9 Asia      1972 <tibble> <lm>   (Intercept 21.9      8.14    2.69 1.13e-2
10 Asia     1972 <tibble> <lm>   log(gdp~ 4.44      1.01    4.41 1.16e-4
# i 110 more rows

```

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```
gapminder %>%
  filter(continent != "Oceania") %>%
  group_by(continent, year) %>%
  nest() %>%
  mutate(
    model = map(data, ~lm(lifeExp ~ log(gdpPercap), data = .x)),
    tidy_out = map(model, tidy)
  ) %>%
  unnest(tidy_out) %>%
  filter(term != "(Intercept)") %>%
  select(-data, -model)
```

```
# A tibble: 48 x 7
# Groups:   continent, year [48]
  continent year term      estimate std.error statistic     p.value
  <fct>     <int> <chr>     <dbl>     <dbl>     <dbl>     <dbl>
1 Asia       1952 log(gdpPercap) 4.16      1.25      3.33 0.00228
2 Asia       1957 log(gdpPercap) 4.17      1.28      3.26 0.00271
3 Asia       1962 log(gdpPercap) 4.59      1.24      3.72 0.000794
4 Asia       1967 log(gdpPercap) 4.50      1.15      3.90 0.000477
5 Asia       1972 log(gdpPercap) 4.44      1.01      4.41 0.000116
6 Asia       1977 log(gdpPercap) 4.87      1.03      4.75 0.0000442
7 Asia       1982 log(gdpPercap) 4.78      0.852     5.61 0.00000377
8 Asia       1987 log(gdpPercap) 5.17      0.727     7.12 0.0000000531
9 Asia       1992 log(gdpPercap) 5.09      0.649     7.84 0.00000000760
10 Asia      1997 log(gdpPercap) 5.11      0.628     8.15 0.00000000335
# i 38 more rows
```

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```
gapminder %>%
  filter(continent != "Oceania") %>%
  group_by(continent, year) %>%
  nest() %>%
  mutate(
    model = map(data, ~lm(lifeExp ~ log(gdpPercap), data = .x)),
```

```

tidy_out = map(model, tidy)
) %>%
unnest(tidy_out) %>%
filter(term == "log(gdpPercap)") %>%
mutate(
  conf.low = estimate - 1.96 * std.error,
  conf.high = estimate + 1.96 * std.error
) %>%
ggplot(aes(x = year, y = estimate, color = continent)) +
  geom_pointrange(aes(ymax = conf.high, ymin = conf.low), fatten = 2) +
  labs(
    title = "Effect of GDP per capita on life expectancy",
    y = "Coefficient of log GDP per capita",
    x = "Year"
) +
  theme_minimal(base_size = 14)

```

