

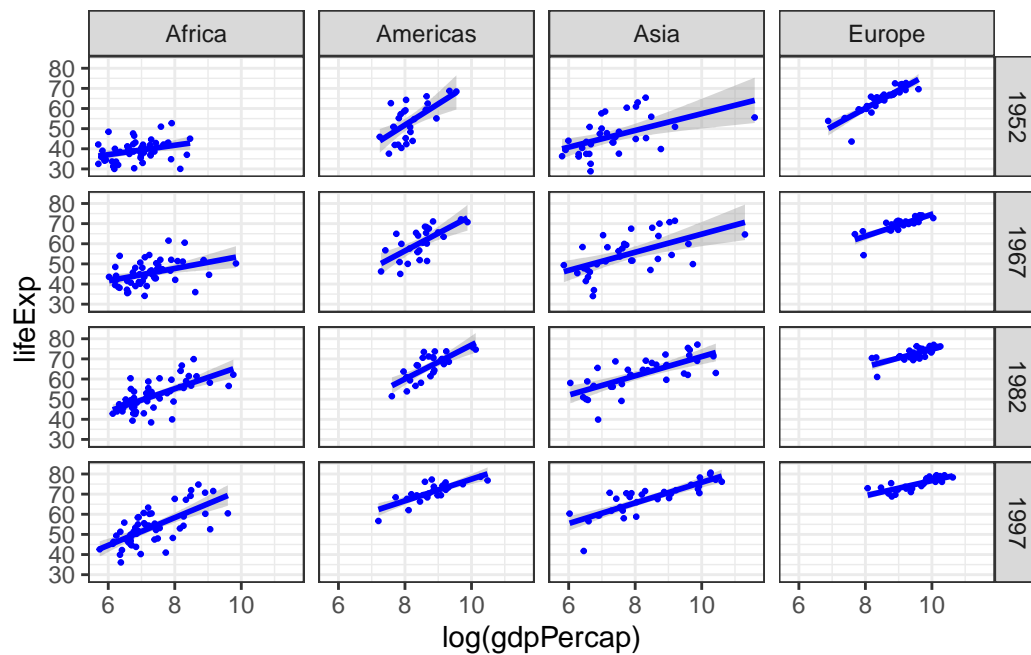
AE-11

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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>    (Interc~   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>    (Interc~   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>    (Interc~   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>    (Interc~   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>    (Interc~   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(ymin = conf.low, ymax = conf.high), 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)

```

