lab2

May 18, 2023

1 - Załadowanie biblioteki matplotlib i innych potrzebnych bibliotek

```
[4]: %matplotlib inline

import matplotlib.pyplot as plt
import numpy as np
import pandas as pd
```

2 - załadowanie danych

```
[5]: df = pd.read_csv("IHME_GBD_2019_SMOKING_TOB_1990_2019_NUM_SMOKERS_Y2021M05D27.

csv", encoding = "utf-8")

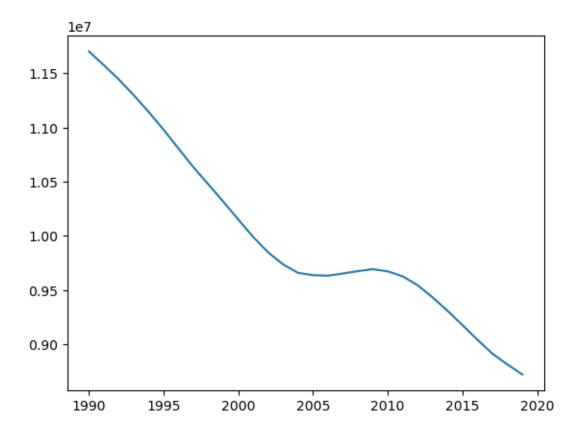
df
```

```
[5]:
                  measure_name
                                 location_id location_name
                                                              sex_id sex_name
     0
            Number of Smokers
                                            1
                                                      Global
                                                                    1
                                                                          Male
     1
            Number of Smokers
                                            1
                                                      Global
                                                                    2
                                                                        Female
     2
                                            1
            Number of Smokers
                                                      Global
                                                                    3
                                                                          Both
     3
            Number of Smokers
                                            1
                                                      Global
                                                                    1
                                                                          Male
     4
                                                                    2
                                                                        Female
             Number of Smokers
                                            1
                                                      Global
     20965
            Number of Smokers
                                          522
                                                       Sudan
                                                                    2
                                                                        Female
     20966
            Number of Smokers
                                          522
                                                       Sudan
                                                                    3
                                                                          Both
     20967
            Number of Smokers
                                          522
                                                       Sudan
                                                                    1
                                                                          Male
                                                                    2
     20968
            Number of Smokers
                                          522
                                                       Sudan
                                                                        Female
     20969
            Number of Smokers
                                          522
                                                       Sudan
                                                                    3
                                                                          Both
             age_group_id age_group_name
                                            year_id
                                                               val
                                                                             upper
     0
                       29
                                15+ years
                                               1990
                                                      8.031015e+08
                                                                     8.096221e+08
     1
                       29
                                15+ years
                                               1990
                                                      1.891488e+08
                                                                     1.930929e+08
     2
                       29
                                15+ years
                                               1990
                                                      9.922503e+08
                                                                     1.000161e+09
     3
                                15+ years
                       29
                                               1991
                                                      8.138972e+08
                                                                     8.200339e+08
     4
                       29
                                15+ years
                                                      1.905375e+08
                                                                     1.944249e+08
                                               1991
     20965
                       29
                                15+ years
                                               2018
                                                      2.435999e+05
                                                                     3.286166e+05
     20966
                       29
                                15+ years
                                               2018
                                                      2.610672e+06
                                                                     2.833943e+06
                       29
                                15+ years
     20967
                                               2019
                                                      2.439150e+06
                                                                     2.656579e+06
     20968
                       29
                                15+ years
                                               2019
                                                      2.500800e+05
                                                                     3.345384e+05
```

```
20969
                       29
                               15+ years
                                              2019 2.689230e+06 2.918332e+06
                   lower
     0
            7.959086e+08
     1
            1.855595e+08
     2
            9.847880e+08
     3
            8.069514e+08
     4
            1.869744e+08
     20965
            1.752508e+05
     20966
            2.409108e+06
     20967
            2.236450e+06
     20968
            1.816686e+05
     20969
            2.480656e+06
     [20970 rows x 11 columns]
    3 - użycie matplotlib
[3]: matplot = df[(df["sex_name"] == "Both") & (df["location_name"] == "Poland")]
     matplot
[3]:
                              location_id location_name sex_id sex_name
                measure_name
           Number of Smokers
                                                   Poland
                                                                 3
     4322
                                        51
                                                                       Both
     4325
           Number of Smokers
                                        51
                                                   Poland
                                                                 3
                                                                       Both
     4328
          Number of Smokers
                                        51
                                                   Poland
                                                                 3
                                                                       Both
           Number of Smokers
                                                                 3
     4331
                                        51
                                                   Poland
                                                                       Both
     4334 Number of Smokers
                                        51
                                                   Poland
                                                                 3
                                                                       Both
     4337
           Number of Smokers
                                        51
                                                   Poland
                                                                 3
                                                                       Both
     4340 Number of Smokers
                                        51
                                                                 3
                                                                       Both
                                                   Poland
     4343 Number of Smokers
                                                                       Both
                                        51
                                                   Poland
                                                                 3
     4346
           Number of Smokers
                                        51
                                                                 3
                                                   Poland
                                                                       Both
     4349 Number of Smokers
                                        51
                                                   Poland
                                                                 3
                                                                       Both
     4352
           Number of Smokers
                                        51
                                                   Poland
                                                                 3
                                                                       Both
     4355 Number of Smokers
                                        51
                                                   Poland
                                                                 3
                                                                       Both
     4358
           Number of Smokers
                                        51
                                                   Poland
                                                                 3
                                                                       Both
     4361 Number of Smokers
                                                   Poland
                                                                 3
                                        51
                                                                       Both
     4364 Number of Smokers
                                        51
                                                   Poland
                                                                 3
                                                                       Both
                                                                 3
     4367
           Number of Smokers
                                        51
                                                   Poland
                                                                       Both
     4370
           Number of Smokers
                                        51
                                                   Poland
                                                                 3
                                                                       Both
     4373
           Number of Smokers
                                        51
                                                   Poland
                                                                 3
                                                                       Both
     4376 Number of Smokers
                                        51
                                                   Poland
                                                                 3
                                                                       Both
     4379
           Number of Smokers
                                        51
                                                   Poland
                                                                 3
                                                                       Both
     4382 Number of Smokers
                                        51
                                                   Poland
                                                                 3
                                                                       Both
                                                                 3
     4385
           Number of Smokers
                                        51
                                                   Poland
                                                                       Both
     4388 Number of Smokers
                                        51
                                                   Poland
                                                                 3
                                                                       Both
     4391 Number of Smokers
                                        51
                                                   Poland
                                                                 3
                                                                       Both
```

```
4394
     Number of Smokers
                                    51
                                               Poland
                                                              3
                                                                    Both
      Number of Smokers
                                    51
                                                              3
4397
                                               Poland
                                                                    Both
                                                              3
4400
      Number of Smokers
                                    51
                                               Poland
                                                                    Both
                                                              3
4403
      Number of Smokers
                                    51
                                               Poland
                                                                    Both
4406
      Number of Smokers
                                               Poland
                                                              3
                                                                    Both
                                    51
      Number of Smokers
4409
                                    51
                                               Poland
                                                              3
                                                                    Both
      age_group_id age_group_name
                                     year_id
                                                                      upper
                                                         val
4322
                          15+ years
                                                               1.201222e+07
                 29
                                         1990
                                               1.170448e+07
4325
                 29
                          15+ years
                                         1991
                                               1.157647e+07
                                                               1.188570e+07
                          15+ years
4328
                 29
                                         1992
                                               1.144506e+07
                                                               1.175827e+07
4331
                 29
                          15+ years
                                         1993
                                                               1.162928e+07
                                               1.129936e+07
4334
                 29
                          15+ years
                                         1994
                                               1.114488e+07
                                                               1.147066e+07
4337
                 29
                          15+ years
                                         1995
                                               1.097960e+07
                                                               1.132458e+07
                 29
4340
                          15+ years
                                         1996
                                                               1.115800e+07
                                               1.080558e+07
4343
                 29
                          15+ years
                                         1997
                                               1.063264e+07
                                                               1.098329e+07
                 29
                          15+ years
                                         1998
4346
                                               1.047442e+07
                                                               1.083031e+07
                 29
4349
                          15+ years
                                         1999
                                               1.031418e+07
                                                               1.068428e+07
4352
                 29
                          15+ years
                                         2000
                                               1.014975e+07
                                                               1.051794e+07
4355
                 29
                          15+ years
                                         2001
                                               9.988362e+06
                                                               1.032469e+07
                 29
4358
                          15+ years
                                         2002
                                               9.845932e+06
                                                               1.014307e+07
                 29
4361
                          15+ years
                                         2003
                                               9.735058e+06
                                                               1.002336e+07
4364
                 29
                          15+ years
                                         2004
                                                               9.922015e+06
                                               9.657597e+06
                 29
                                               9.636582e+06
4367
                          15+ years
                                         2005
                                                               9.878019e+06
4370
                 29
                          15+ years
                                         2006
                                               9.631582e+06
                                                               9.875923e+06
4373
                 29
                          15+ years
                                         2007
                                               9.651840e+06
                                                               9.889532e+06
                          15+ years
                                               9.674385e+06
4376
                 29
                                         2008
                                                               9.914297e+06
                 29
4379
                          15+ years
                                         2009
                                               9.691581e+06
                                                               9.917740e+06
4382
                 29
                          15+ years
                                         2010
                                               9.671307e+06
                                                               9.904838e+06
                 29
4385
                          15+ years
                                         2011
                                               9.625299e+06
                                                               9.869306e+06
                 29
4388
                          15+ years
                                         2012
                                               9.542767e+06
                                                               9.789413e+06
                 29
4391
                          15+ years
                                         2013
                                               9.430694e+06
                                                               9.689100e+06
                 29
4394
                          15+ years
                                         2014
                                               9.306823e+06
                                                               9.564203e+06
4397
                 29
                          15+ years
                                         2015
                                               9.174107e+06
                                                               9.438002e+06
4400
                 29
                          15+ years
                                         2016
                                               9.038816e+06
                                                               9.326490e+06
4403
                 29
                          15+ years
                                         2017
                                               8.910715e+06
                                                               9.215457e+06
4406
                 29
                          15+ years
                                         2018
                                               8.811197e+06
                                                               9.135481e+06
4409
                 29
                          15+ years
                                         2019
                                               8.719168e+06
                                                              9.075511e+06
             lower
      1.138875e+07
4322
      1.125896e+07
4325
4328
      1.112616e+07
4331
      1.097590e+07
4334
      1.080890e+07
4337
      1.062839e+07
4340
      1.045887e+07
```

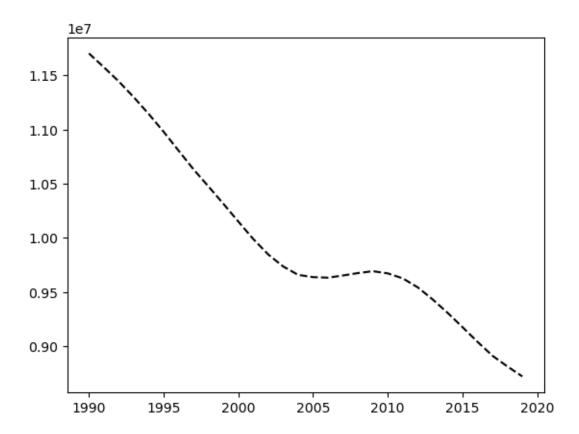
```
4343
          1.027121e+07
    4346
          1.012083e+07
    4349
          9.960286e+06
    4352
          9.794037e+06
    4355
          9.655642e+06
    4358
          9.532336e+06
    4361
          9.443244e+06
    4364
          9.384474e+06
    4367
          9.380627e+06
    4370
          9.394114e+06
    4373
          9.426812e+06
    4376
          9.444482e+06
    4379
          9.441793e+06
    4382
          9.416823e+06
    4385
          9.364238e+06
    4388
          9.278873e+06
    4391
          9.175417e+06
    4394
          9.048851e+06
    4397
          8.910913e+06
    4400
          8.764274e+06
    4403 8.620903e+06
    4406
          8.490369e+06
    4409 8.370563e+06
[4]: plt.plot(matplot["year_id"], matplot["val"])
```



4 - style rysowanie

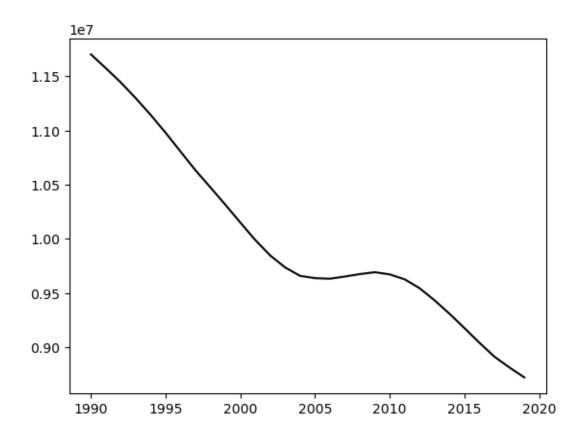
```
[5]: plt.plot(matplot["year_id"], matplot["val"], 'k--')
```

[5]: [<matplotlib.lines.Line2D at 0x2618938d600>]



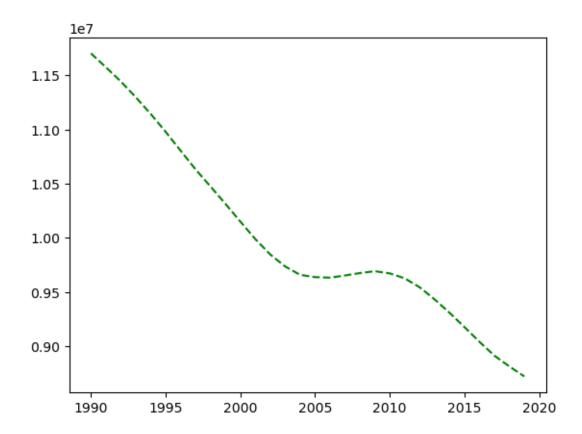
```
[6]: plt.plot(matplot["year_id"], matplot["val"], 'k-')
```

[6]: [<matplotlib.lines.Line2D at 0x26189bd33d0>]



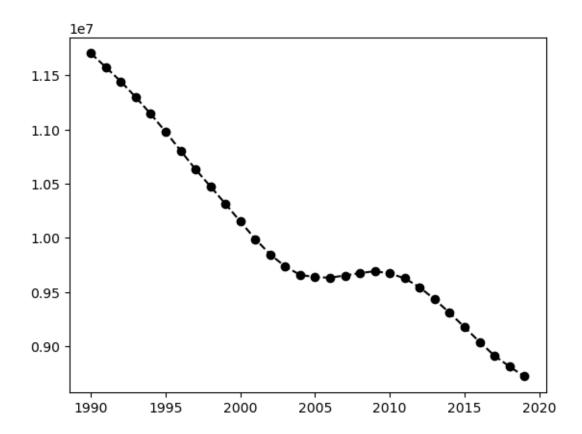
```
[10]: plt.plot(matplot["year_id"], matplot["val"], 'g--')
```

[10]: [<matplotlib.lines.Line2D at 0x26189479870>]

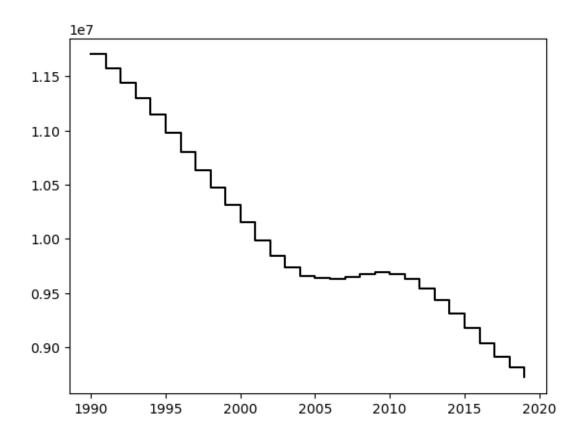


```
[11]: plt.plot(matplot["year_id"], matplot["val"], 'ko--')
```

[11]: [<matplotlib.lines.Line2D at 0x26189ea7d60>]



[12]: [<matplotlib.lines.Line2D at 0x2618a7fd870>]



5 - zapisywanie rysunków do pliku

```
[13]: plt.savefig('figpath.png', dpi=400, bbox_inches='tight')
```

<Figure size 640x480 with 0 Axes>

6 - wykresy liniowe

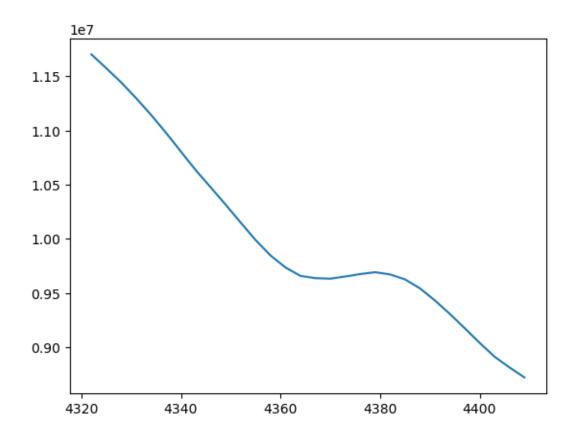
```
[14]: liniowy_series = df[(df["sex_name"] == "Both") & (df["location_name"] == U ← "Poland")] liniowy_series
```

```
[14]:
                                location_id location_name
                                                            sex_id sex_name \
                 measure_name
            Number of Smokers
                                                   Poland
                                                                 3
                                                                       Both
      4322
      4325
            Number of Smokers
                                                   Poland
                                                                       Both
                                         51
                                                                 3
      4328
            Number of Smokers
                                         51
                                                   Poland
                                                                 3
                                                                       Both
      4331 Number of Smokers
                                         51
                                                   Poland
                                                                 3
                                                                       Both
      4334 Number of Smokers
                                         51
                                                   Poland
                                                                 3
                                                                       Both
      4337 Number of Smokers
                                         51
                                                   Poland
                                                                 3
                                                                       Both
      4340 Number of Smokers
                                         51
                                                   Poland
                                                                 3
                                                                       Both
      4343 Number of Smokers
                                         51
                                                   Poland
                                                                 3
                                                                       Both
      4346 Number of Smokers
                                                   Poland
                                                                 3
                                                                       Both
                                         51
```

4349	Number	of	Smokers		51	Poland	3	Both	
4352	Number	of	${\tt Smokers}$		51	Poland	3	Both	
4355	Number	of	Smokers		51	Poland	3	Both	
4358			Smokers		51	Poland	3	Both	
4361			Smokers		51	Poland	3	Both	
4364			Smokers		51	Poland	3	Both	
4367			Smokers		51	Poland	3	Both	
4370			Smokers		51	Poland	3	Both	
4373			Smokers		51	Poland	3	Both	
4376			Smokers		51 51	Poland	3	Both Both	
4379 4382			Smokers Smokers		51 51	Poland Poland	3 3	Both Both	
4385			Smokers		51	Poland	3	Both	
4388			Smokers		51	Poland	3	Both	
4391			Smokers		51	Poland	3	Both	
4394			Smokers		51	Poland	3	Both	
4397			Smokers		51	Poland	3	Both	
4400			Smokers		51	Poland	3	Both	
4403			Smokers		51	Poland	3	Both	
4406			Smokers		51	Poland	3	Both	
4409	Number	of	Smokers		51	Poland	3	Both	
						_			\
	age_gr	oup.		group_name	-	val		upper	\
4322	age_gro	oup.	29	15+ years	1990	1.170448e+07		1222e+07	`
4325	age_gr	oup _.	29 29	15+ years 15+ years	1990 1991	1.170448e+07 1.157647e+07	1.18	1222e+07 8570e+07	`
4325 4328	age_gr	oup _.	29 29 29	15+ years 15+ years 15+ years	1990 1991 1992	1.170448e+07 1.157647e+07 1.144506e+07	1.18 1.17	1222e+07 8570e+07 5827e+07	`
4325 4328 4331	age_gr	oup _.	29 29 29 29	15+ years 15+ years 15+ years 15+ years	1990 1991 1992 1993	1.170448e+07 1.157647e+07 1.144506e+07 1.129936e+07	1.18 1.17 1.16	1222e+07 8570e+07 5827e+07 2928e+07	`
4325 4328 4331 4334	age_gro	oup _.	29 29 29 29 29	15+ years 15+ years 15+ years 15+ years 15+ years	1990 1991 1992 1993 1994	1.170448e+07 1.157647e+07 1.144506e+07 1.129936e+07 1.114488e+07	1.18 1.17 1.16 1.14	1222e+07 8570e+07 5827e+07 2928e+07 7066e+07	`
4325 4328 4331 4334 4337	age_gro	oup _.	29 29 29 29 29 29	15+ years 15+ years 15+ years 15+ years 15+ years 15+ years	1990 1991 1992 1993 1994 1995	1.170448e+07 1.157647e+07 1.144506e+07 1.129936e+07 1.114488e+07 1.097960e+07	1.18 1.17 1.16 1.14 1.13	1222e+07 8570e+07 5827e+07 2928e+07 7066e+07 22458e+07	`
4325 4328 4331 4334 4337 4340	age_gro	oup _.	29 29 29 29 29 29 29	15+ years 15+ years 15+ years 15+ years 15+ years 15+ years 15+ years	1990 1991 1992 1993 1994 1995 1996	1.170448e+07 1.157647e+07 1.144506e+07 1.129936e+07 1.114488e+07 1.097960e+07	1.18 1.17 1.16 1.14 1.13	1222e+07 8570e+07 5827e+07 2928e+07 7066e+07 2458e+07 5800e+07	`
4325 4328 4331 4334 4337 4340 4343	age_gro	oup _.	29 29 29 29 29 29 29 29	15+ years 15+ years 15+ years 15+ years 15+ years 15+ years 15+ years	1990 1991 1992 1993 1994 1995 1996	1.170448e+07 1.157647e+07 1.144506e+07 1.129936e+07 1.114488e+07 1.097960e+07 1.080558e+07	1.18 1.17 1.16 1.14 1.13 1.11	1222e+07 8570e+07 5827e+07 2928e+07 7066e+07 2458e+07 5800e+07 8329e+07	`
4325 4328 4331 4334 4337 4340 4343 4346	age_gro	oup _.	29 29 29 29 29 29 29	15+ years 15+ years 15+ years 15+ years 15+ years 15+ years 15+ years 15+ years	1990 1991 1992 1993 1994 1995 1996 1997 1998	1.170448e+07 1.157647e+07 1.144506e+07 1.129936e+07 1.114488e+07 1.097960e+07	1.18 1.17 1.16 1.14 1.13 1.11 1.09	1222e+07 8570e+07 5827e+07 2928e+07 7066e+07 2458e+07 5800e+07	`
4325 4328 4331 4334 4337 4340 4343 4346 4349	age_gro	oup.	29 29 29 29 29 29 29 29 29 29	15+ years 15+ years 15+ years 15+ years 15+ years 15+ years 15+ years 15+ years 15+ years	1990 1991 1992 1993 1994 1995 1996 1997 1998	1.170448e+07 1.157647e+07 1.144506e+07 1.129936e+07 1.114488e+07 1.097960e+07 1.080558e+07 1.063264e+07 1.047442e+07	1.18 1.17 1.16 1.14 1.13 1.11 1.09 1.08	1222e+07 8570e+07 5827e+07 2928e+07 7066e+07 2458e+07 5800e+07 8329e+07	(
4325 4328 4331 4334 4337 4340 4343 4346	age_gro	oup _.	29 29 29 29 29 29 29 29 29	15+ years 15+ years 15+ years 15+ years 15+ years 15+ years 15+ years 15+ years 15+ years 15+ years	1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000	1.170448e+07 1.157647e+07 1.144506e+07 1.129936e+07 1.114488e+07 1.097960e+07 1.080558e+07 1.063264e+07 1.047442e+07	1.18 1.17 1.16 1.14 1.13 1.11 1.09 1.08 1.06	1222e+07 8570e+07 5827e+07 2928e+07 7066e+07 2458e+07 5800e+07 8329e+07 3031e+07	•
4325 4328 4331 4334 4337 4340 4343 4346 4349 4352	age_gro	oup.	29 29 29 29 29 29 29 29 29 29 29	15+ years 15+ years 15+ years 15+ years 15+ years 15+ years 15+ years 15+ years 15+ years	1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001	1.170448e+07 1.157647e+07 1.144506e+07 1.129936e+07 1.114488e+07 1.097960e+07 1.080558e+07 1.063264e+07 1.047442e+07 1.031418e+07 1.014975e+07	1.18 1.17 1.16 1.14 1.13 1.11 1.09 1.08 1.05 1.05	1222e+07 8570e+07 5827e+07 2928e+07 7066e+07 2458e+07 5800e+07 8329e+07 3031e+07 8428e+07	
4325 4328 4331 4334 4337 4340 4343 4346 4349 4352 4355	age_gro	oup _.	29 29 29 29 29 29 29 29 29 29 29	15+ years 15+ years	1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002	1.170448e+07 1.157647e+07 1.144506e+07 1.129936e+07 1.114488e+07 1.097960e+07 1.080558e+07 1.063264e+07 1.047442e+07 1.031418e+07 1.014975e+07 9.988362e+06	1.18 1.17 1.16 1.14 1.13 1.11 1.09 1.08 1.06 1.05 1.03	1222e+07 8570e+07 5827e+07 2928e+07 7066e+07 2458e+07 5800e+07 8329e+07 3031e+07 8428e+07 1794e+07	
4325 4328 4331 4334 4337 4340 4343 4346 4349 4352 4355 4358	age_gro	oup.	29 29 29 29 29 29 29 29 29 29 29 29	15+ years 15+ years	1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003	1.170448e+07 1.157647e+07 1.144506e+07 1.129936e+07 1.114488e+07 1.097960e+07 1.080558e+07 1.063264e+07 1.047442e+07 1.031418e+07 1.014975e+07 9.988362e+06 9.845932e+06	1.18 1.17 1.16 1.14 1.13 1.11 1.09 1.08 1.06 1.05 1.03 1.01	1222e+07 8570e+07 5827e+07 2928e+07 7066e+07 2458e+07 5800e+07 8329e+07 3031e+07 8428e+07 1794e+07 2469e+07 4307e+07	
4325 4328 4331 4334 4337 4340 4343 4346 4349 4352 4355 4358 4361	age_gro	oup	29 29 29 29 29 29 29 29 29 29 29 29 29	15+ years 15+ years	1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004	1.170448e+07 1.157647e+07 1.144506e+07 1.129936e+07 1.114488e+07 1.097960e+07 1.080558e+07 1.063264e+07 1.047442e+07 1.031418e+07 1.014975e+07 9.988362e+06 9.845932e+06 9.735058e+06	1.18 1.17 1.16 1.14 1.13 1.11 1.09 1.08 1.05 1.05 1.03 1.01 1.00 9.92	1222e+07 8570e+07 5827e+07 2928e+07 7066e+07 2458e+07 5800e+07 8329e+07 3031e+07 8428e+07 1794e+07 2469e+07 4307e+07 2336e+07	
4325 4328 4331 4334 4337 4340 4343 4346 4349 4352 4355 4358 4361 4364	age_gro	oup.	29 29 29 29 29 29 29 29 29 29 29 29 29 2	15+ years 15+ years	1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005	1.170448e+07 1.157647e+07 1.144506e+07 1.129936e+07 1.114488e+07 1.097960e+07 1.080558e+07 1.063264e+07 1.047442e+07 1.014975e+07 9.988362e+06 9.845932e+06 9.735058e+06 9.657597e+06	1.18 1.17 1.16 1.14 1.13 1.11 1.09 1.08 1.05 1.03 1.01 1.00 9.92 9.87	1222e+07 8570e+07 5827e+07 2928e+07 7066e+07 2458e+07 5800e+07 8329e+07 3031e+07 8428e+07 1794e+07 2469e+07 4307e+07 2336e+07 2015e+06	
4325 4328 4331 4334 4337 4340 4343 4346 4349 4352 4355 4358 4361 4364 4367	age_gro	oup.	29 29 29 29 29 29 29 29 29 29 29 29 29 2	15+ years 15+ years	1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006	1.170448e+07 1.157647e+07 1.144506e+07 1.129936e+07 1.114488e+07 1.097960e+07 1.080558e+07 1.063264e+07 1.047442e+07 1.031418e+07 1.014975e+07 9.988362e+06 9.845932e+06 9.735058e+06 9.657597e+06 9.636582e+06	1.18 1.17 1.16 1.14 1.13 1.11 1.09 1.08 1.05 1.03 1.01 1.00 9.92 9.87 9.87	1222e+07 1222e+07 12928e+07 12928e+07 12928e+07 12458e+07 13031e+07 13031e+07 1428e+07 1794e+07 12469e+07 12336e+07 12015e+06 18019e+06	
4325 4328 4331 4334 4337 4340 4343 4346 4349 4352 4355 4358 4361 4364 4367 4370	age_gro	oup	29 29 29 29 29 29 29 29 29 29 29 29 29 2	15+ years 15+ years	1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007	1.170448e+07 1.157647e+07 1.144506e+07 1.129936e+07 1.114488e+07 1.097960e+07 1.080558e+07 1.063264e+07 1.047442e+07 1.031418e+07 1.014975e+07 9.988362e+06 9.845932e+06 9.735058e+06 9.657597e+06 9.636582e+06 9.631582e+06	1.18 1.17 1.16 1.14 1.13 1.11 1.09 1.08 1.05 1.03 1.01 1.00 9.92 9.87 9.87 9.88	1222e+07 8570e+07 5827e+07 2928e+07 7066e+07 2458e+07 5800e+07 8329e+07 3031e+07 8428e+07 1794e+07 2469e+07 4307e+07 2336e+07 2015e+06 8019e+06 5923e+06	
4325 4328 4331 4334 4337 4340 4343 4346 4349 4352 4355 4358 4361 4364 4367 4370 4373	age_gro	oup	29 29 29 29 29 29 29 29 29 29 29 29 29 2	15+ years 15+ years	1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008	1.170448e+07 1.157647e+07 1.144506e+07 1.129936e+07 1.114488e+07 1.097960e+07 1.080558e+07 1.063264e+07 1.047442e+07 1.014975e+07 9.988362e+06 9.735058e+06 9.735058e+06 9.657597e+06 9.631582e+06 9.651840e+06	1.18 1.17 1.16 1.14 1.13 1.11 1.09 1.06 1.05 1.03 1.01 1.00 9.92 9.87 9.87 9.88 9.91	1222e+07 8570e+07 5827e+07 2928e+07 7066e+07 2458e+07 5800e+07 8329e+07 3031e+07 8428e+07 1794e+07 2336e+07 2336e+07 2015e+06 8019e+06 5923e+06 9532e+06	
4325 4328 4331 4334 4337 4340 4343 4346 4349 4352 4355 4361 4364 4367 4370 4373 4376 4379 4382	age_gro	oup.	29 29 29 29 29 29 29 29 29 29 29 29 29 2	15+ years 15+ years	1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010	1.170448e+07 1.157647e+07 1.144506e+07 1.129936e+07 1.114488e+07 1.097960e+07 1.080558e+07 1.063264e+07 1.047442e+07 1.014975e+07 9.988362e+06 9.735058e+06 9.657597e+06 9.631582e+06 9.651840e+06 9.674385e+06 9.691581e+06 9.671307e+06	1.18 1.17 1.16 1.14 1.13 1.11 1.09 1.08 1.05 1.03 1.01 1.00 9.92 9.87 9.87 9.88 9.91 9.91 9.90	1222e+07 8570e+07 5827e+07 2928e+07 2928e+07 2458e+07 5800e+07 8329e+07 3031e+07 2469e+07 4307e+07 2336e+07 2015e+06 8019e+06 5923e+06 4297e+06 7740e+06 4838e+06	
4325 4328 4331 4334 4337 4340 4343 4346 4349 4355 4355 4358 4361 4364 4367 4370 4373 4376 4379 4382 4385	age_gro	oup	29 29 29 29 29 29 29 29 29 29 29 29 29 2	15+ years 15+ years	1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011	1.170448e+07 1.157647e+07 1.144506e+07 1.129936e+07 1.114488e+07 1.097960e+07 1.080558e+07 1.063264e+07 1.047442e+07 1.014975e+07 9.988362e+06 9.845932e+06 9.735058e+06 9.657597e+06 9.636582e+06 9.631582e+06 9.651840e+06 9.674385e+06 9.671307e+06 9.675299e+06	1.18 1.17 1.16 1.14 1.13 1.11 1.09 1.08 1.05 1.03 1.01 1.00 9.92 9.87 9.87 9.88 9.91 9.90 9.86	1222e+07 8570e+07 5827e+07 2928e+07 7066e+07 2458e+07 8329e+07 3031e+07 8428e+07 1794e+07 2469e+07 4307e+07 2336e+07 2015e+06 8019e+06 5923e+06 4297e+06 7740e+06 4838e+06 9306e+06	
4325 4328 4331 4334 4337 4340 4343 4346 4349 4352 4355 4361 4364 4367 4370 4373 4376 4379 4382	age_gro	oup.	29 29 29 29 29 29 29 29 29 29 29 29 29 2	15+ years 15+ years	1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012	1.170448e+07 1.157647e+07 1.144506e+07 1.129936e+07 1.114488e+07 1.097960e+07 1.080558e+07 1.063264e+07 1.047442e+07 1.014975e+07 9.988362e+06 9.735058e+06 9.657597e+06 9.631582e+06 9.651840e+06 9.674385e+06 9.691581e+06 9.671307e+06	1.18 1.17 1.16 1.14 1.13 1.11 1.09 1.08 1.05 1.03 1.01 1.00 9.92 9.87 9.87 9.87 9.91 9.91 9.91 9.90 9.86 9.78	1222e+07 8570e+07 5827e+07 2928e+07 2928e+07 2458e+07 5800e+07 8329e+07 3031e+07 2469e+07 4307e+07 2336e+07 2015e+06 8019e+06 5923e+06 4297e+06 7740e+06 4838e+06	

```
4394
                      29
                              15+ years
                                           2014 9.306823e+06
                                                               9.564203e+06
     4397
                      29
                              15+ years
                                           2015
                                                9.174107e+06
                                                               9.438002e+06
                              15+ years
     4400
                      29
                                           2016
                                                 9.038816e+06
                                                               9.326490e+06
     4403
                      29
                              15+ years
                                           2017
                                                 8.910715e+06
                                                               9.215457e+06
     4406
                      29
                              15+ years
                                           2018
                                                 8.811197e+06
                                                               9.135481e+06
     4409
                      29
                              15+ years
                                           2019
                                                 8.719168e+06
                                                               9.075511e+06
                  lower
     4322 1.138875e+07
     4325
           1.125896e+07
     4328
           1.112616e+07
     4331 1.097590e+07
     4334 1.080890e+07
     4337
           1.062839e+07
     4340
          1.045887e+07
     4343
           1.027121e+07
     4346
           1.012083e+07
     4349 9.960286e+06
     4352 9.794037e+06
     4355
           9.655642e+06
     4358 9.532336e+06
     4361 9.443244e+06
     4364 9.384474e+06
     4367
           9.380627e+06
     4370 9.394114e+06
     4373 9.426812e+06
     4376
           9.444482e+06
     4379 9.441793e+06
     4382 9.416823e+06
     4385 9.364238e+06
     4388
          9.278873e+06
     4391 9.175417e+06
     4394 9.048851e+06
     4397 8.910913e+06
     4400 8.764274e+06
     4403 8.620903e+06
     4406 8.490369e+06
     4409 8.370563e+06
[15]: w_liniowy_series = pd.Series(liniowy_series["val"])
     w_liniowy_series.plot()
```

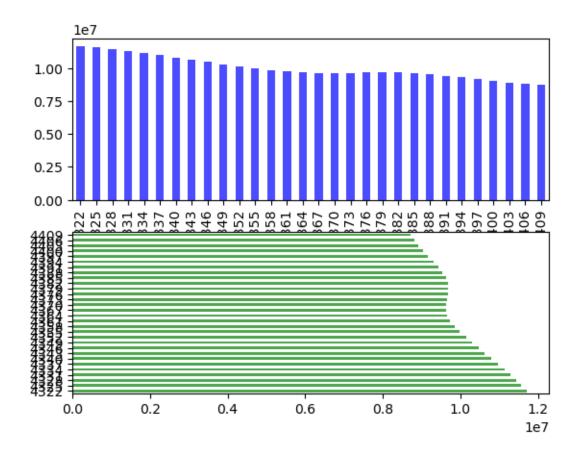
[15]: <Axes: >



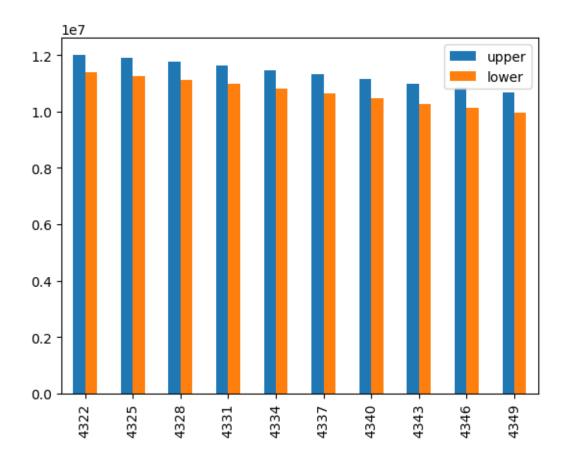
7 - wykresy kolumnowe

```
[19]: fig, axes = plt.subplots(2, 1)
data = df[(df["sex_name"] == "Both") & (df["location_name"] == "Poland")]
data = pd.Series(liniowy_series["val"])
data.plot.bar(ax=axes[0], color='b', alpha=0.7)
data.plot.barh(ax=axes[1], color='g', alpha=0.7)
```

[19]: <Axes: >

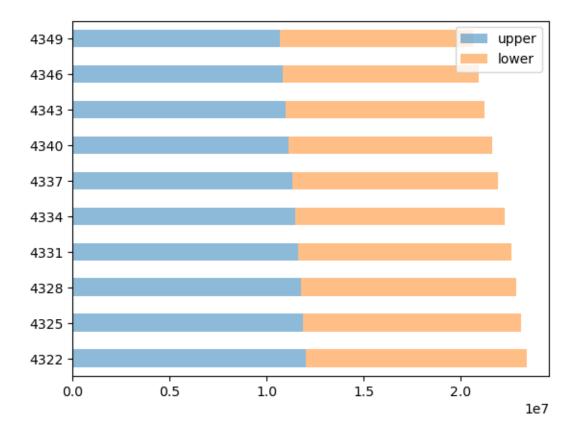


```
[23]: w_kolumnowy = df[(df["sex_name"] == "Both") & (df["location_name"] == "Poland")]
     w_kolumnowy = w_kolumnowy[["upper", "lower"]]
     w_kolumnowy = w_kolumnowy.head(10)
     w_kolumnowy
[23]:
                 upper
                               lower
     4322 12012219.84
                        1.138875e+07
     4325 11885703.34 1.125896e+07
     4328 11758271.45 1.112616e+07
     4331 11629281.89
                       1.097590e+07
     4334 11470659.42 1.080890e+07
     4337 11324575.92 1.062839e+07
     4340 11158004.92 1.045887e+07
     4343 10983286.74
                        1.027121e+07
     4346 10830307.69
                        1.012083e+07
     4349 10684277.63 9.960286e+06
[24]: w_kolumnowy.plot.bar()
[24]: <Axes: >
```



[26]: w_kolumnowy.plot.barh(stacked=True, alpha=0.5)

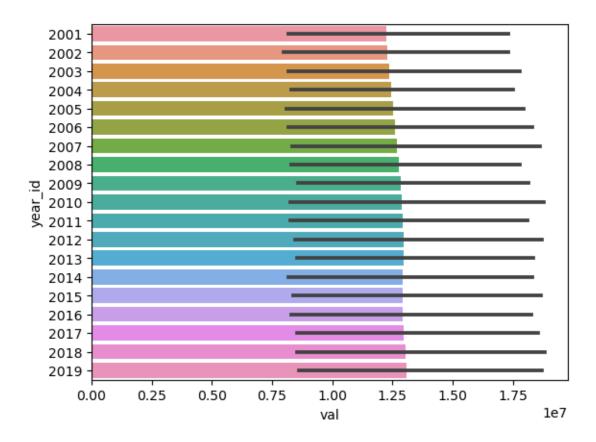
[26]: <Axes: >



8 - seaborn

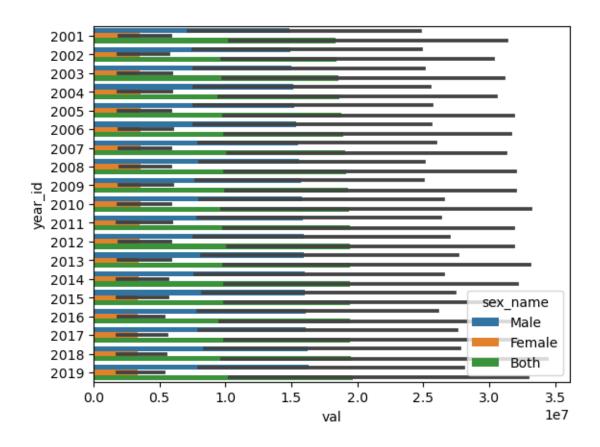
```
[10]: import seaborn as sns
 [8]: sb = df
      sb = sb[sb["year_id"] > 2000]
      sb
 [8]:
                  measure_name location_id location_name
                                                            sex_id sex_name
      33
             Number of Smokers
                                            1
                                                     Global
                                                                   1
                                                                         Male
      34
             Number of Smokers
                                            1
                                                     Global
                                                                   2
                                                                       Female
      35
             Number of Smokers
                                            1
                                                                   3
                                                     Global
                                                                         Both
      36
             Number of Smokers
                                            1
                                                     Global
                                                                   1
                                                                         Male
      37
                                            1
                                                                   2
             Number of Smokers
                                                     Global
                                                                       Female
                                                        ...
             Number of Smokers
                                                      Sudan
                                                                   2
      20965
                                          522
                                                                       Female
      20966
             Number of Smokers
                                          522
                                                      Sudan
                                                                   3
                                                                         Both
      20967
             Number of Smokers
                                          522
                                                      Sudan
                                                                   1
                                                                         Male
      20968
             Number of Smokers
                                          522
                                                      Sudan
                                                                   2
                                                                       Female
      20969
             Number of Smokers
                                          522
                                                      Sudan
                                                                   3
                                                                         Both
```

```
age_group_id age_group_name
                                           year_id
                                                                          upper
                                                              val
      33
                                              2001
                                                                   8.709454e+08
                       29
                                15+ years
                                                    8.653357e+08
      34
                       29
                                15+ years
                                              2001
                                                    2.043228e+08
                                                                   2.078411e+08
                                15+ years
      35
                       29
                                              2001
                                                    1.069659e+09
                                                                   1.076377e+09
      36
                       29
                                15+ years
                                              2002
                                                   8.697218e+08
                                                                   8.753433e+08
                                                                   2.086136e+08
      37
                       29
                                15+ years
                                              2002
                                                    2.051251e+08
                                                                  3.286166e+05
     20965
                       29
                                15+ years
                                              2018 2.435999e+05
     20966
                       29
                                15+ years
                                                    2.610672e+06
                                                                  2.833943e+06
                                              2018
     20967
                       29
                                15+ years
                                                    2.439150e+06
                                                                   2.656579e+06
                                              2019
                       29
                                15+ years
                                                    2.500800e+05
                                                                   3.345384e+05
     20968
                                              2019
     20969
                       29
                                15+ years
                                              2019 2.689230e+06
                                                                   2.918332e+06
                    lower
      33
             8.597397e+08
             2.011226e+08
      34
             1.062829e+09
      35
      36
             8.642284e+08
      37
             2.019433e+08
     20965
             1.752508e+05
     20966
             2.409108e+06
     20967
             2.236450e+06
     20968
             1.816686e+05
     20969
             2.480656e+06
      [13281 rows x 11 columns]
[11]: sns.barplot(x='val', y='year_id', data=sb, orient='h')
[11]: <Axes: xlabel='val', ylabel='year_id'>
```



```
[12]: sns.barplot(x='val', y='year_id', hue= "sex_name", data=sb, orient='h')
```

[12]: <Axes: xlabel='val', ylabel='year_id'>



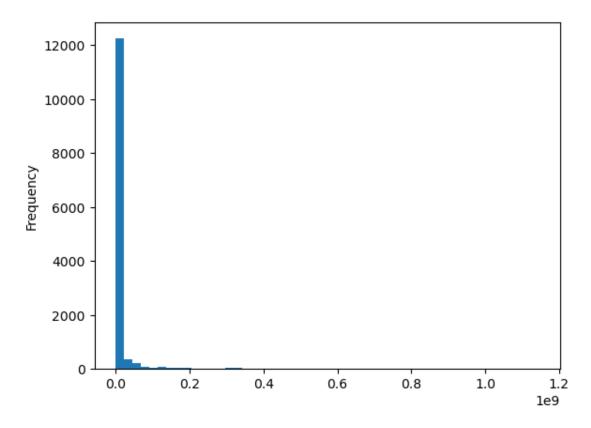
9 - histogramy i wykresy gęstosci rozkładu

```
[21]: histogram = df[df["year_id"] > 2000]
histogram = histogram["val"]
histogram
```

```
[21]: 33
               8.653357e+08
               2.043228e+08
      34
      35
               1.069659e+09
      36
               8.697218e+08
               2.051251e+08
      37
      20965
               2.435999e+05
      20966
               2.610672e+06
      20967
               2.439150e+06
      20968
               2.500800e+05
      20969
               2.689230e+06
      Name: val, Length: 13281, dtype: float64
```

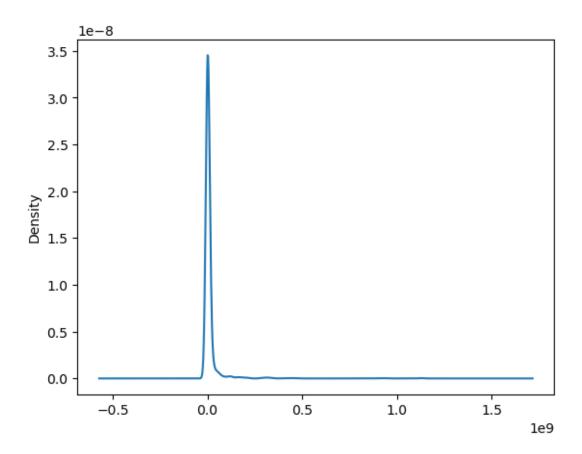
[22]: histogram.plot.hist(bins=50)

[22]: <Axes: ylabel='Frequency'>



[23]: histogram.plot.kde()

[23]: <Axes: ylabel='Density'>



10 - wykresy punktowe i wykresy bitowe

```
[24]: punkt = df
punkt = punkt[punkt["year_id"] > 2000]
punkt
```

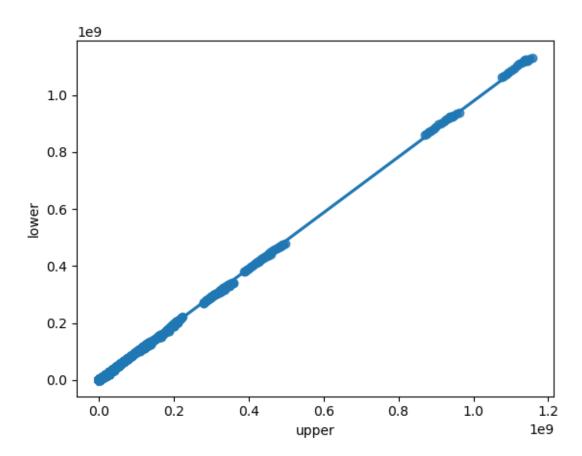
```
[24]:
                  measure_name
                                 location_id location_name
                                                              sex_id sex_name \
      33
             Number of Smokers
                                                     Global
                                                                   1
                                                                         Male
      34
             Number of Smokers
                                                     Global
                                                                   2
                                                                       Female
      35
             Number of Smokers
                                            1
                                                     Global
                                                                   3
                                                                         Both
      36
             Number of Smokers
                                            1
                                                     Global
                                                                   1
                                                                         Male
      37
                                            1
                                                                   2
             Number of Smokers
                                                     Global
                                                                       Female
      20965
             Number of Smokers
                                          522
                                                                   2
                                                       Sudan
                                                                       Female
                                                                   3
      20966
             Number of Smokers
                                          522
                                                       Sudan
                                                                         Both
      20967
             Number of Smokers
                                          522
                                                       Sudan
                                                                   1
                                                                         Male
             Number of Smokers
                                                       Sudan
                                                                   2
                                                                       Female
      20968
                                          522
      20969
             Number of Smokers
                                          522
                                                       Sudan
                                                                   3
                                                                         Both
             age_group_id age_group_name year_id
                                                                            upper
                                                               val
      33
                        29
                                15+ years
                                               2001 8.653357e+08 8.709454e+08
```

```
34
                 29
                         15+ years
                                       2001 2.043228e+08 2.078411e+08
35
                 29
                         15+ years
                                       2001 1.069659e+09
                                                          1.076377e+09
36
                 29
                         15+ years
                                       2002 8.697218e+08 8.753433e+08
                 29
                                             2.051251e+08 2.086136e+08
37
                         15+ years
                                       2002
                          •••
                 29
                         15+ years
                                             2.435999e+05 3.286166e+05
20965
                                       2018
                         15+ years
20966
                 29
                                             2.610672e+06 2.833943e+06
                                       2018
                         15+ years
                                             2.439150e+06 2.656579e+06
20967
                 29
                                       2019
                         15+ years
20968
                 29
                                             2.500800e+05 3.345384e+05
                                       2019
20969
                 29
                         15+ years
                                       2019 2.689230e+06 2.918332e+06
              lower
33
       8.597397e+08
       2.011226e+08
34
35
       1.062829e+09
36
       8.642284e+08
37
       2.019433e+08
      1.752508e+05
20965
20966
       2.409108e+06
20967
       2.236450e+06
20968
      1.816686e+05
20969 2.480656e+06
```

[13281 rows x 11 columns]

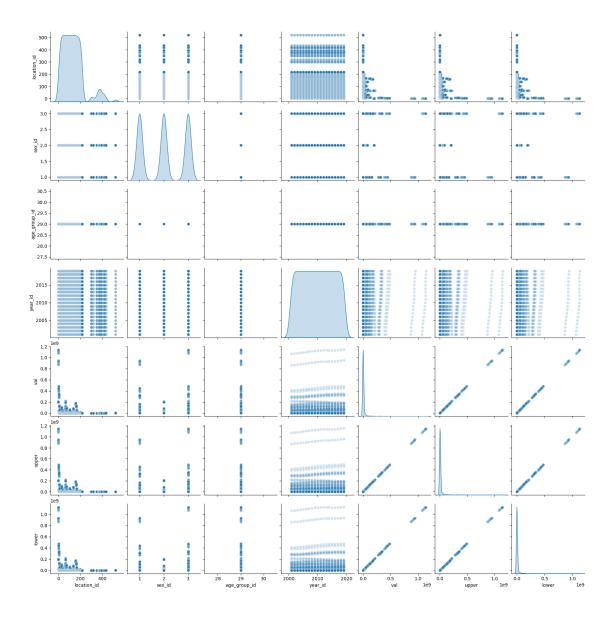
```
[26]: sns.regplot(x='upper', y='lower', data=punkt)
```

[26]: <Axes: xlabel='upper', ylabel='lower'>



```
[27]: sns.pairplot(punkt, diag_kind='kde', plot_kws={'alpha': 0.2})
```

[27]: <seaborn.axisgrid.PairGrid at 0x21902b823b0>



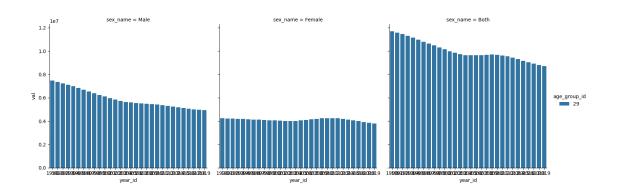
11 - dane kategoryczne

```
[32]: katego = df
katego = katego[(katego["location_name"] == "Poland")]
katego
```

```
[32]:
                 measure_name
                              location_id location_name
                                                          sex_id sex_name \
      4320 Number of Smokers
                                        51
                                                  Poland
                                                                1
                                                                      Male
      4321
           Number of Smokers
                                                  Poland
                                                                2
                                                                    Female
                                        51
                                                                      Both
      4322
           Number of Smokers
                                        51
                                                  Poland
                                                                3
      4323 Number of Smokers
                                                  Poland
                                                                      Male
                                        51
                                                                1
      4324 Number of Smokers
                                        51
                                                  Poland
                                                                2
                                                                    Female
```

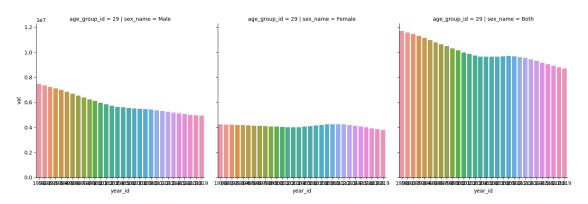
```
4405 Number of Smokers
                                        51
                                                  Poland
                                                               2
                                                                   Female
      4406 Number of Smokers
                                        51
                                                               3
                                                                     Both
                                                  Poland
     4407 Number of Smokers
                                        51
                                                  Poland
                                                               1
                                                                     Male
     4408 Number of Smokers
                                                               2
                                        51
                                                  Poland
                                                                   Female
      4409 Number of Smokers
                                        51
                                                  Poland
                                                               3
                                                                     Both
            age_group_id age_group_name year_id
                                                                        upper
                                                           val
      4320
                              15+ years
                      29
                                            1990 7.468990e+06
                                                                7.679963e+06
      4321
                              15+ years
                      29
                                            1990 4.235491e+06
                                                                4.465004e+06
      4322
                      29
                              15+ years
                                            1990
                                                  1.170448e+07
                                                                1.201222e+07
      4323
                      29
                              15+ years
                                            1991
                                                  7.358603e+06
                                                                7.564003e+06
      4324
                      29
                              15+ years
                                            1991
                                                 4.217866e+06 4.454244e+06
                                •••
      4405
                      29
                              15+ years
                                            2018 3.848206e+06 4.116964e+06
      4406
                      29
                              15+ years
                                            2018 8.811197e+06 9.135481e+06
      4407
                      29
                              15+ years
                                            2019 4.938503e+06 5.166168e+06
                      29
      4408
                              15+ years
                                            2019 3.780665e+06
                                                                4.072287e+06
      4409
                      29
                              15+ years
                                            2019 8.719168e+06 9.075511e+06
                   lower
      4320 7.261637e+06
      4321 3.987365e+06
      4322 1.138875e+07
      4323 7.154446e+06
      4324 3.968376e+06
      4405 3.595334e+06
      4406 8.490369e+06
      4407 4.737903e+06
      4408 3.504634e+06
      4409 8.370563e+06
      [90 rows x 11 columns]
[35]: sns.catplot(x='year_id', y='val', hue='age_group_id', col='sex_name',_
       ⇔kind='bar', data=katego)
```

[35]: <seaborn.axisgrid.FacetGrid at 0x21905c0ee60>



[36]: sns.catplot(x='year_id', y='val', row='age_group_id', col='sex_name', \(\text{shind='bar'}, \) data=katego)

[36]: <seaborn.axisgrid.FacetGrid at 0x2190adce170>



[]: