In [1]:
```
import pandas as pd
import matplotlib.pyplot as plt
from matplotlib import style
import warnings
warnings.filterwarnings('ignore')
```

In [2]:
```
#theme used for all plots
style.use("ggplot")
```

In [3]:
```
#read csv file
worldData = pd.read_csv("world_data.csv")
worldData
```

Out[3]:

	Country Name	Country Code	Series Name	Series Code	2014 [YR2014]	2015 [YR2015]	2016 [YR2016]	2017 [YR2017]	2018 [YR2018]
0	United States	USA	GDP (current US$)	NY.GDP.MKTP.CD	1.752175e+13	1.821930e+13	1.870719e+13	1.948539e+13	2.049410e+13
1	United States	USA	Military expenditure (current USD)	MS.MIL.XPND.CD	6.099140e+11	5.961046e+11	6.001064e+11	6.058029e+11	6.487983e+11
2	United States	USA	Population, total	SP.POP.TOTL	3.183864e+08	3.207427e+08	3.230713e+08	3.251471e+08	3.271674e+08
3	China	CHN	GDP (current US$)	NY.GDP.MKTP.CD	1.043853e+13	1.101554e+13	1.113795e+13	1.214349e+13	1.360815e+13
4	China	CHN	Military expenditure (current USD)	MS.MIL.XPND.CD	2.007722e+11	2.140931e+11	2.160313e+11	2.278294e+11	2.499969e+11
5	China	CHN	Population, total	SP.POP.TOTL	1.364270e+09	1.371220e+09	1.378665e+09	1.386395e+09	1.392730e+09
6	Russian Federation	RUS	GDP (current US$)	NY.GDP.MKTP.CD	2.059984e+12	1.363594e+12	1.282724e+12	1.578624e+12	1.657554e+12
7	Russian Federation	RUS	Military expenditure (current USD)	MS.MIL.XPND.CD	8.469650e+10	6.641871e+10	6.924531e+10	6.652730e+10	6.138755e+10
8	Russian Federation	RUS	Population, total	SP.POP.TOTL	1.438197e+08	1.440969e+08	1.443424e+08	1.444967e+08	1.444780e+08
9	Germany	DEU	GDP (current US$)	NY.GDP.MKTP.CD	3.898727e+12	3.381389e+12	3.495163e+12	3.693204e+12	3.996759e+12
10	Germany	DEU	Military expenditure (current USD)	MS.MIL.XPND.CD	4.610267e+10	3.981258e+10	4.157949e+10	4.538172e+10	4.947063e+10
11	Germany	DEU	Population, total	SP.POP.TOTL	8.098250e+07	8.168661e+07	8.234867e+07	8.265700e+07	8.292792e+07
12	United Kingdom	GBR	GDP (current US$)	NY.GDP.MKTP.CD	3.034729e+12	2.896421e+12	2.659239e+12	2.637866e+12	2.825208e+12
13	United Kingdom	GBR	Military expenditure (current USD)	MS.MIL.XPND.CD	5.918286e+10	5.386219e+10	4.811894e+10	4.643330e+10	4.999719e+10
14	United Kingdom	GBR	Population, total	SP.POP.TOTL	6.461316e+07	6.512886e+07	6.559556e+07	6.605886e+07	6.648899e+07
15	France	FRA	GDP (current US$)	NY.GDP.MKTP.CD	2.852166e+12	2.438208e+12	2.471286e+12	2.586285e+12	2.777535e+12
16	France	FRA	Military expenditure (current USD)	MS.MIL.XPND.CD	6.361357e+10	5.534213e+10	5.735841e+10	6.041750e+10	6.379968e+10
17	France	FRA	Population, total	SP.POP.TOTL	6.631610e+07	6.659337e+07	6.685977e+07	6.686514e+07	6.698724e+07

	Country Name	Country Code	Series Name	Series Code	2014 [YR2014]	2015 [YR2015]	2016 [YR2016]	2017 [YR2017]	2018 [YR2018]
18	Italy	ITA	GDP (current US$)	NY.GDP.MKTP.CD	2.151733e+12	1.832273e+12	1.869202e+12	1.946570e+12	2.073902e+12
19	Italy	ITA	Military expenditure (current USD)	MS.MIL.XPND.CD	2.770103e+10	2.218085e+10	2.503303e+10	2.644789e+10	2.780751e+10
20	Italy	ITA	Population, total	SP.POP.TOTL	6.078914e+07	6.073058e+07	6.062750e+07	6.053671e+07	6.043128e+07
21	Saudi Arabia	SAU	GDP (current US$)	NY.GDP.MKTP.CD	7.563503e+11	6.542699e+11	6.449355e+11	6.885861e+11	7.824835e+11
22	Saudi Arabia	SAU	Military expenditure (current USD)	MS.MIL.XPND.CD	8.076240e+10	8.718587e+10	6.367280e+10	7.040000e+10	6.755467e+10
23	Saudi Arabia	SAU	Population, total	SP.POP.TOTL	3.091699e+07	3.171767e+07	3.244257e+07	3.309915e+07	3.369995e+07
24	Korea, Rep.	KOR	GDP (current US$)	NY.GDP.MKTP.CD	1.411334e+12	1.382764e+12	1.414804e+12	1.530751e+12	1.619424e+12
25	Korea, Rep.	KOR	Military expenditure (current USD)	MS.MIL.XPND.CD	3.755233e+10	3.657077e+10	3.688528e+10	3.917068e+10	4.306997e+10
26	Korea, Rep.	KOR	Population, total	SP.POP.TOTL	5.074666e+07	5.101495e+07	5.124571e+07	5.146620e+07	5.163526e+07
27	Israel	ISR	GDP (current US$)	NY.GDP.MKTP.CD	3.100079e+11	3.004708e+11	3.193779e+11	3.532684e+11	3.696904e+11
28	Israel	ISR	Military expenditure (current USD)	MS.MIL.XPND.CD	1.848583e+10	1.696943e+10	1.478381e+10	1.558161e+10	1.594679e+10
29	Israel	ISR	Population, total	SP.POP.TOTL	8.215700e+06	8.380100e+06	8.546000e+06	8.713300e+06	8.883800e+06
30	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
31	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
32	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
33	Data from database: World Development Indicators	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
34	Last Updated: 10/02/2019	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN

In [4]:

```
# Cleaning
#drop NaN rows
worldData.dropna(axis=0,inplace=True)

#drop irrelevant columns
worldData.drop(["Series Code","Country Code"],axis=1,inplace=True)

#rename the column names to easier names
worldData.rename(columns={"2014 [YR2014]":"2014","2015 [YR2015]":"2015","2016 [YR2016]":"2016",\
                          "2017 [YR2017]":"2017","2018 [YR2018]":"2018"},inplace=True)

#rename "Series Name" column to easier names
worldData.loc[worldData["Series Name"]=="GDP (current US$)","Series Name"] = "GDP"
worldData.loc[worldData["Series Name"]=="Military expenditure (current USD)","Series Name"] = "Military Expenditure"
worldData.loc[worldData["Series Name"]=="Population, total","Series Name"] = "Population"

#update Korea,Rep to South Korea
worldData.loc[worldData["Country Name"] == "Korea, Rep.","Country Name"] = "South Korea"

worldData
```

Out[4]:

	Country Name	Series Name	2014	2015	2016	2017	2018
0	United States	GDP	1.752175e+13	1.821930e+13	1.870719e+13	1.948539e+13	2.049410e+13
1	United States	Military Expenditure	6.099140e+11	5.961046e+11	6.001064e+11	6.058029e+11	6.487983e+11
2	United States	Population	3.183864e+08	3.207427e+08	3.230713e+08	3.251471e+08	3.271674e+08
3	China	GDP	1.043853e+13	1.101554e+13	1.113795e+13	1.214349e+13	1.360815e+13
4	China	Military Expenditure	2.007722e+11	2.140931e+11	2.160313e+11	2.278294e+11	2.499969e+11
5	China	Population	1.364270e+09	1.371220e+09	1.378665e+09	1.386395e+09	1.392730e+09
6	Russian Federation	GDP	2.059984e+12	1.363594e+12	1.282724e+12	1.578624e+12	1.657554e+12
7	Russian Federation	Military Expenditure	8.469650e+10	6.641871e+10	6.924531e+10	6.652730e+10	6.138755e+10
8	Russian Federation	Population	1.438197e+08	1.440969e+08	1.443424e+08	1.444967e+08	1.444780e+08
9	Germany	GDP	3.898727e+12	3.381389e+12	3.495163e+12	3.693204e+12	3.996759e+12
10	Germany	Military Expenditure	4.610267e+10	3.981258e+10	4.157949e+10	4.538172e+10	4.947063e+10
11	Germany	Population	8.098250e+07	8.168661e+07	8.234867e+07	8.265700e+07	8.292792e+07
12	United Kingdom	GDP	3.034729e+12	2.896421e+12	2.659239e+12	2.637866e+12	2.825208e+12
13	United Kingdom	Military Expenditure	5.918286e+10	5.386219e+10	4.811894e+10	4.643330e+10	4.999719e+10
14	United Kingdom	Population	6.461316e+07	6.512886e+07	6.559556e+07	6.605886e+07	6.648899e+07
15	France	GDP	2.852166e+12	2.438208e+12	2.471286e+12	2.586285e+12	2.777535e+12
16	France	Military Expenditure	6.361357e+10	5.534213e+10	5.735841e+10	6.041750e+10	6.379968e+10
17	France	Population	6.631610e+07	6.659337e+07	6.685977e+07	6.686514e+07	6.698724e+07
18	Italy	GDP	2.151733e+12	1.832273e+12	1.869202e+12	1.946570e+12	2.073902e+12
19	Italy	Military Expenditure	2.770103e+10	2.218085e+10	2.503303e+10	2.644789e+10	2.780751e+10
20	Italy	Population	6.078914e+07	6.073058e+07	6.062750e+07	6.053671e+07	6.043128e+07
21	Saudi Arabia	GDP	7.563503e+11	6.542699e+11	6.449355e+11	6.885861e+11	7.824835e+11
22	Saudi Arabia	Military Expenditure	8.076240e+10	8.718587e+10	6.367280e+10	7.040000e+10	6.755467e+10
23	Saudi Arabia	Population	3.091699e+07	3.171767e+07	3.244257e+07	3.309915e+07	3.369995e+07
24	South Korea	GDP	1.411334e+12	1.382764e+12	1.414804e+12	1.530751e+12	1.619424e+12
25	South Korea	Military Expenditure	3.755233e+10	3.657077e+10	3.688528e+10	3.917068e+10	4.306997e+10
26	South Korea	Population	5.074666e+07	5.101495e+07	5.124571e+07	5.146620e+07	5.163526e+07
27	Israel	GDP	3.100079e+11	3.004708e+11	3.193779e+11	3.532684e+11	3.696904e+11
28	Israel	Military Expenditure	1.848583e+10	1.696943e+10	1.478381e+10	1.558161e+10	1.594679e+10

	Country Name	Series Name	2014	2015	2016	2017	2018
29	Israel	Population	8.215700e+06	8.380100e+06	8.546000e+06	8.713300e+06	8.883800e+06

In [5]:
```
# Preprocessing
worldData = worldData.set_index(["Country Name","Series Name"]).stack().unstack(1).unstack(1)
worldData
```

Out[5]:

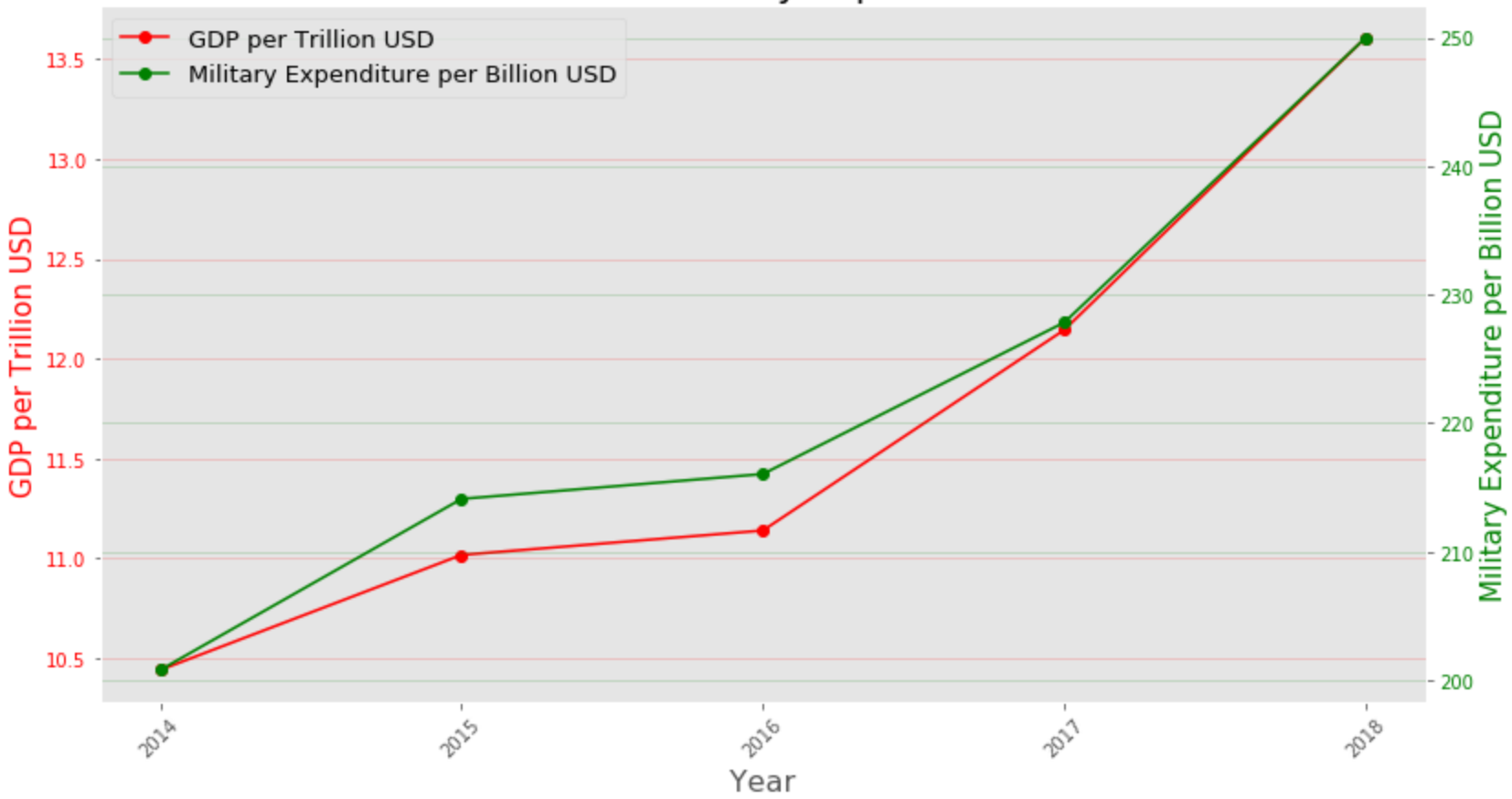
Series Name	GDP					Military Expenditure				
	2014	2015	2016	2017	2018	2014	2015	2016	2017	2018
Country Name										
China	1.043853e+13	1.101554e+13	1.113795e+13	1.214349e+13	1.360815e+13	2.007722e+11	2.140931e+11	2.160313e+11	2.278294e+11	2.499
France	2.852166e+12	2.438208e+12	2.471286e+12	2.586285e+12	2.777535e+12	6.361357e+10	5.534213e+10	5.735841e+10	6.041750e+10	6.379
Germany	3.898727e+12	3.381389e+12	3.495163e+12	3.693204e+12	3.996759e+12	4.610267e+10	3.981258e+10	4.157949e+10	4.538172e+10	4.947
Israel	3.100079e+11	3.004708e+11	3.193779e+11	3.532684e+11	3.696904e+11	1.848583e+10	1.696943e+10	1.478381e+10	1.558161e+10	1.594
Italy	2.151733e+12	1.832273e+12	1.869202e+12	1.946570e+12	2.073902e+12	2.770103e+10	2.218085e+10	2.503303e+10	2.644789e+10	2.780
Russian Federation	2.059984e+12	1.363594e+12	1.282724e+12	1.578624e+12	1.657554e+12	8.469650e+10	6.641871e+10	6.924531e+10	6.652730e+10	6.138
Saudi Arabia	7.563503e+11	6.542699e+11	6.449355e+11	6.885861e+11	7.824835e+11	8.076240e+10	8.718587e+10	6.367280e+10	7.040000e+10	6.755
South Korea	1.411334e+12	1.382764e+12	1.414804e+12	1.530751e+12	1.619424e+12	3.755233e+10	3.657077e+10	3.688528e+10	3.917068e+10	4.306
United Kingdom	3.034729e+12	2.896421e+12	2.659239e+12	2.637866e+12	2.825208e+12	5.918286e+10	5.386219e+10	4.811894e+10	4.643330e+10	4.999
United States	1.752175e+13	1.821930e+13	1.870719e+13	1.948539e+13	2.049410e+13	6.099140e+11	5.961046e+11	6.001064e+11	6.058029e+11	6.487

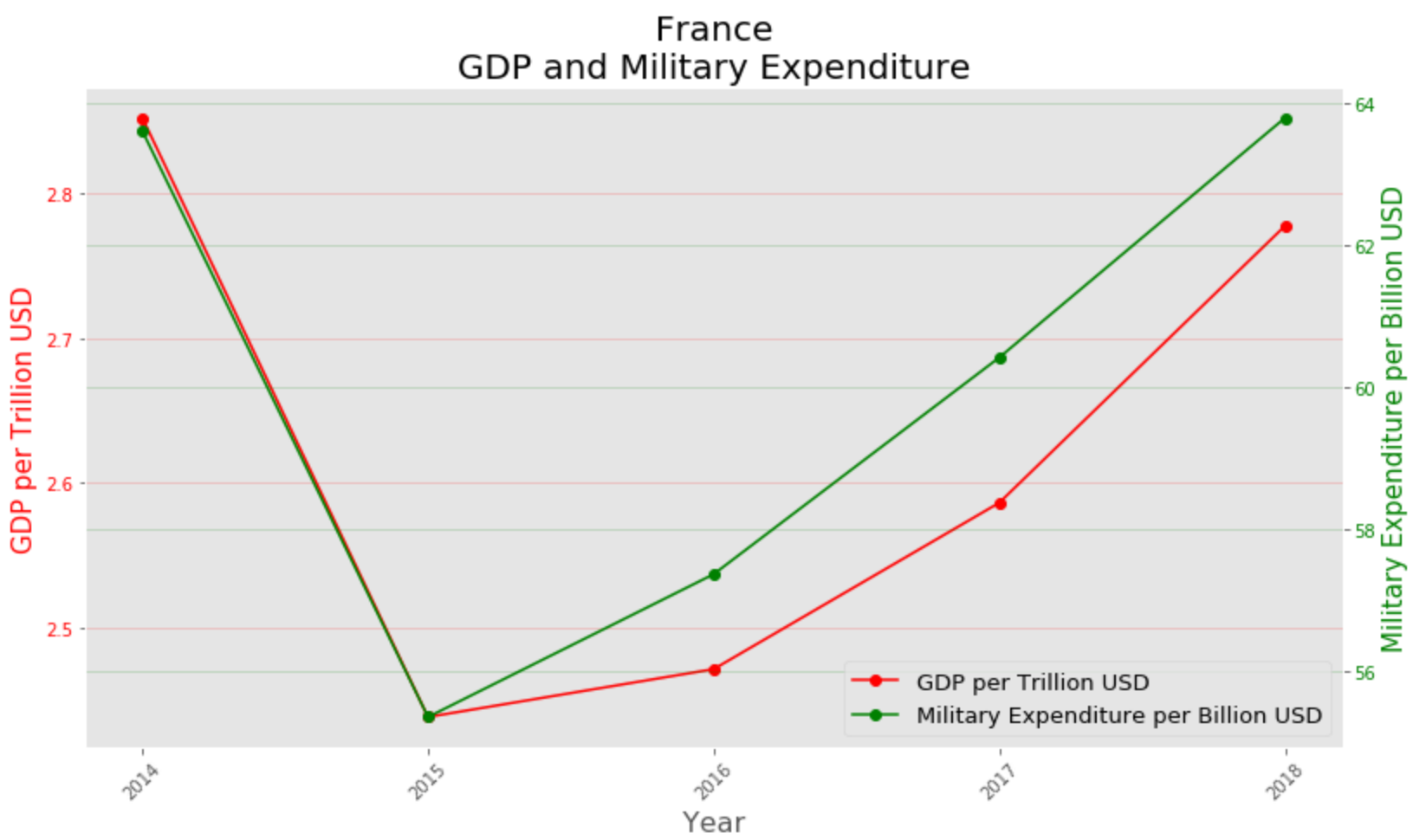
In [6]:

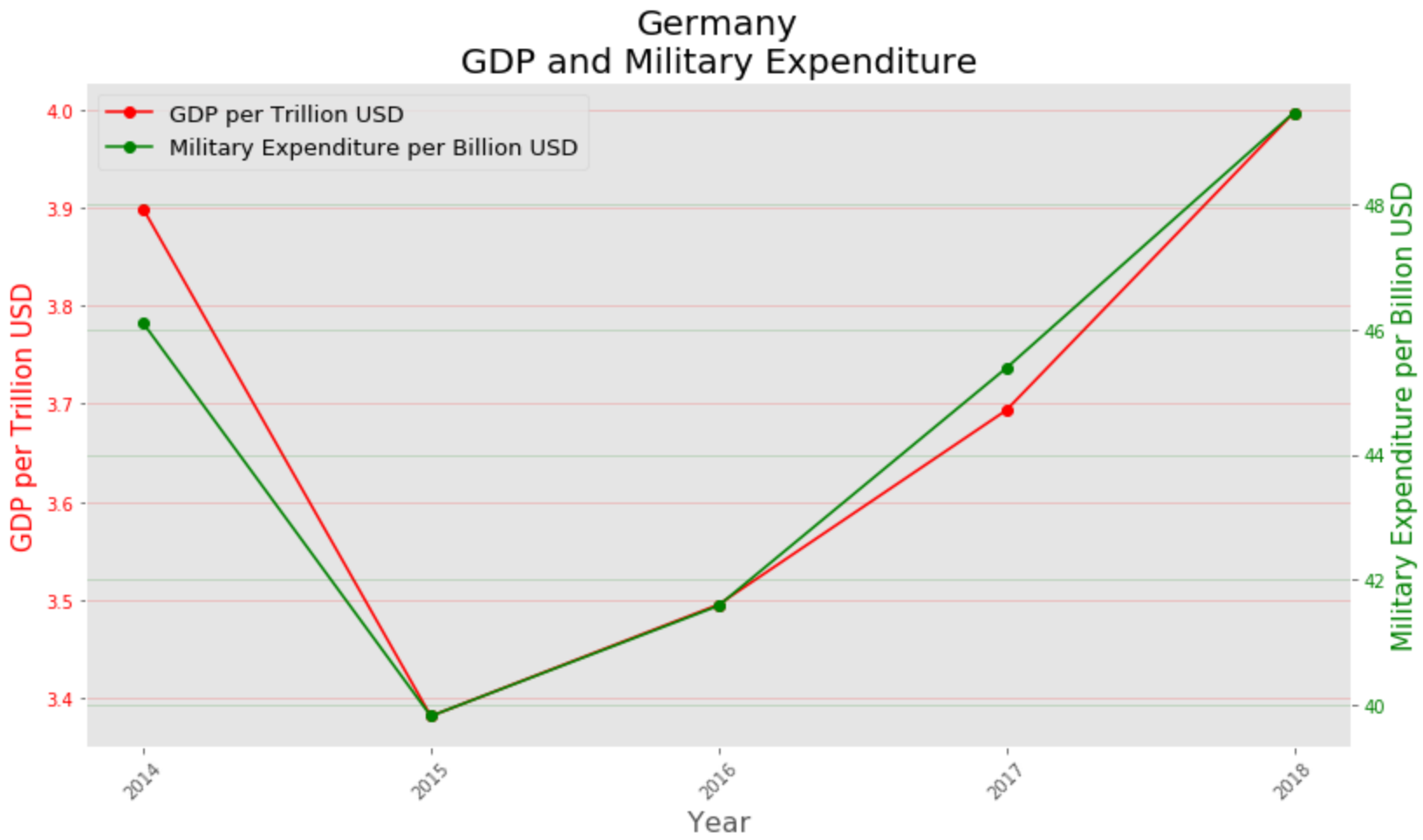
```
def parasiteAxesLinePlot(y1AxisData, y2AxisData, xLabel, y1Label, y2Label, y1Color, y2Color, title):
    ''' Creates a dual Y axes Line Plot with a common X axis '''
    fig = plt.figure(figsize = (13,7))
    plt.xticks(rotation=45)

    y1 = fig.add_subplot(111)
    y1.plot(y1AxisData, label = y1Label, color = y1Color, marker = "o")
    y1.set_xlabel(xLabel, fontsize = 16)

    #set y axis label
    y1.set_ylabel(y1Label, fontsize = 15, color = y1Color)
    #set y axis tick color
    y1.tick_params(axis="y", labelcolor = y1Color)
    #set y axis grid color
    y1.yaxis.grid(True, color = y1Color, alpha = 0.2)

    #hide x axis grid
    y1.xaxis.grid(False)

    #twin 'y1' plot keeping x-axis data common
    y2 = y1.twinx()

    y2.plot(y2AxisData, label = y2Label, color = y2Color, marker = "o")

    #set y axis label
    y2.set_ylabel(y2Label, fontsize = 15, color = y2Color)
    #set y axis tick color
    y2.tick_params(axis = "y", labelcolor = y2Color)
    #set y axis grid color
    y2.yaxis.grid(True, color = y2Color, alpha = 0.2)

    #hide x axis grid
    y2.xaxis.grid(False)

    lines, labels = y1.get_legend_handles_labels()
    lines2, labels2 = y2.get_legend_handles_labels()

    #to handle legends for parasite axes plot
    plt.legend(lines + lines2, labels + labels2, loc="best", fontsize = 13)
    plt.title(title, fontsize = 20)
    plt.show()
```

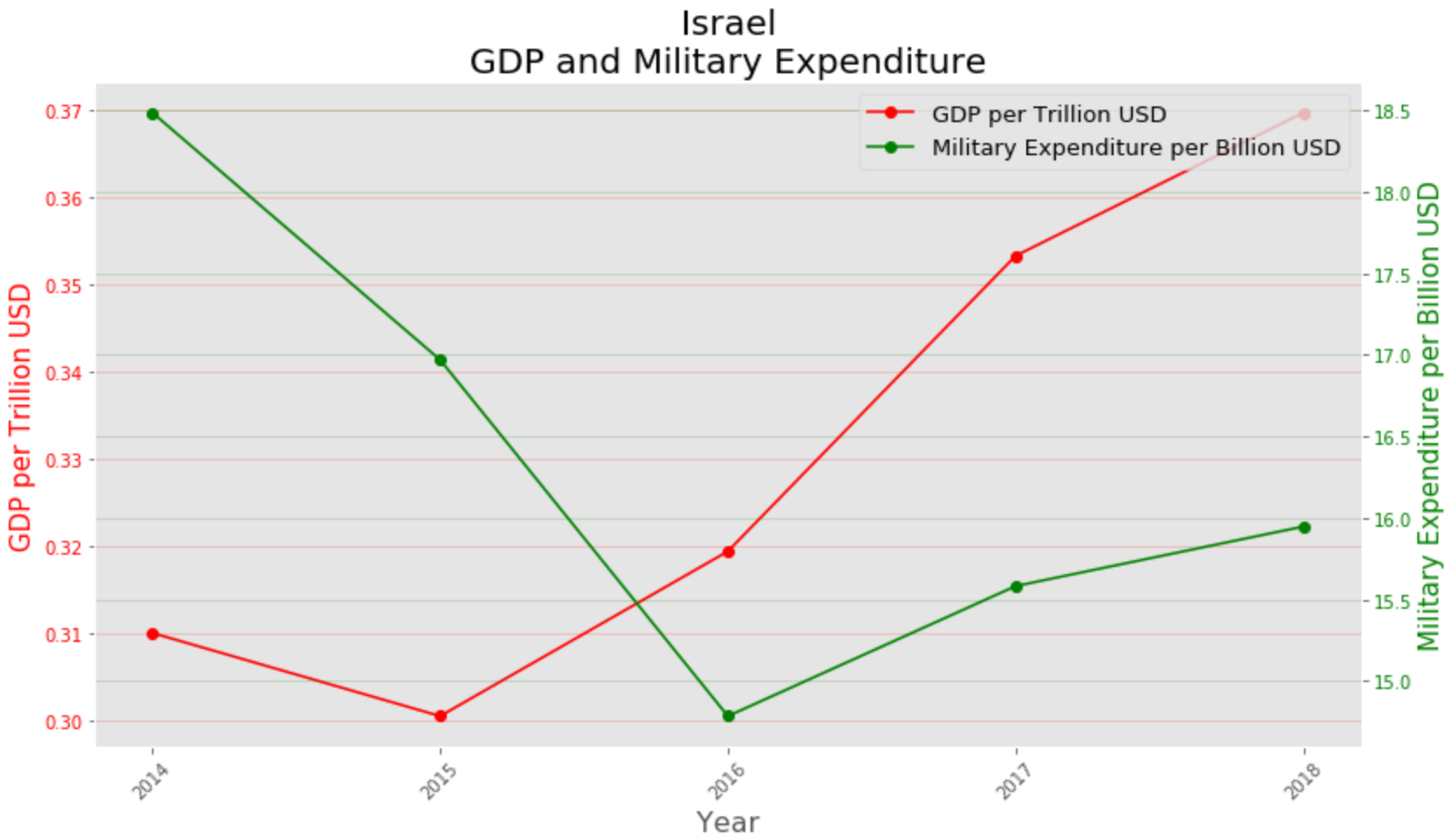
In [7]:

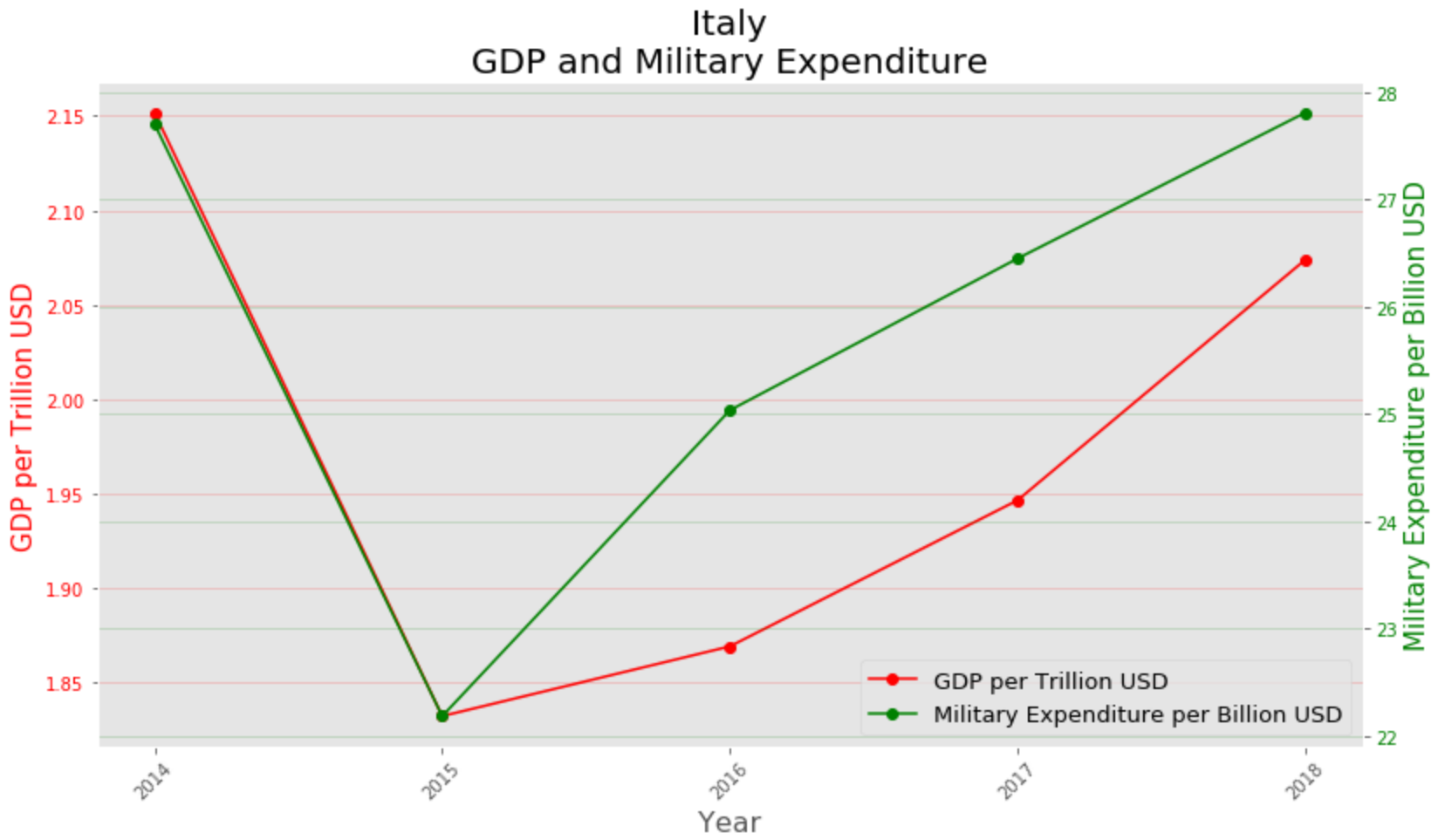
```
# Compare the military data to that country's GDP
#iterate over all countries
for country in worldData.index.get_level_values(0).unique():
    parasiteAxesLinePlot(
        # divide by 10**12 to get data in trillions
        y1AxisData = worldData.loc[country,"GDP"]/(10**12),
        # divide by 10**9 to get data in billions
        y2AxisData = worldData.loc[country,"Military Expenditure"]/(10**9),
        xLabel = "Year",
        y1Label = "GDP per Trillion USD",
        y2Label = "Military Expenditure per Billion USD",
        y1Color = "Red",
        y2Color = "Green",
        title = country+"\nGDP and Military Expenditure"
    )
```

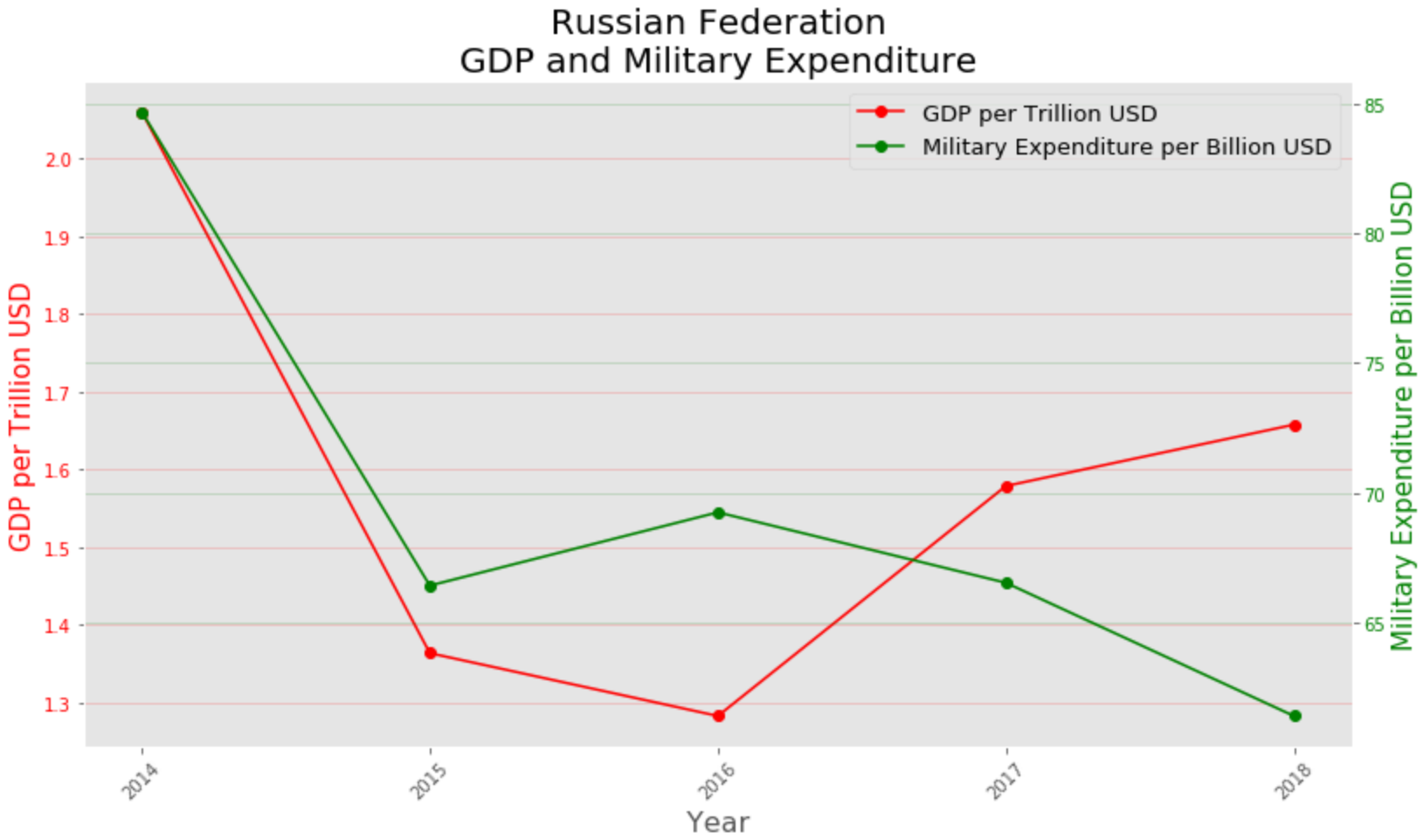

China
GDP and Military Expenditure
GDP per Trillion USD
Military Expenditure per Billion USD
GDP per Trillion USD
Military Expenditure per Billion USD
13.5
13.0
12.5
12.0
11.5
11.0
10.5
250
240
230
220
210
200
2014
2015
2016
2017
2018
Year

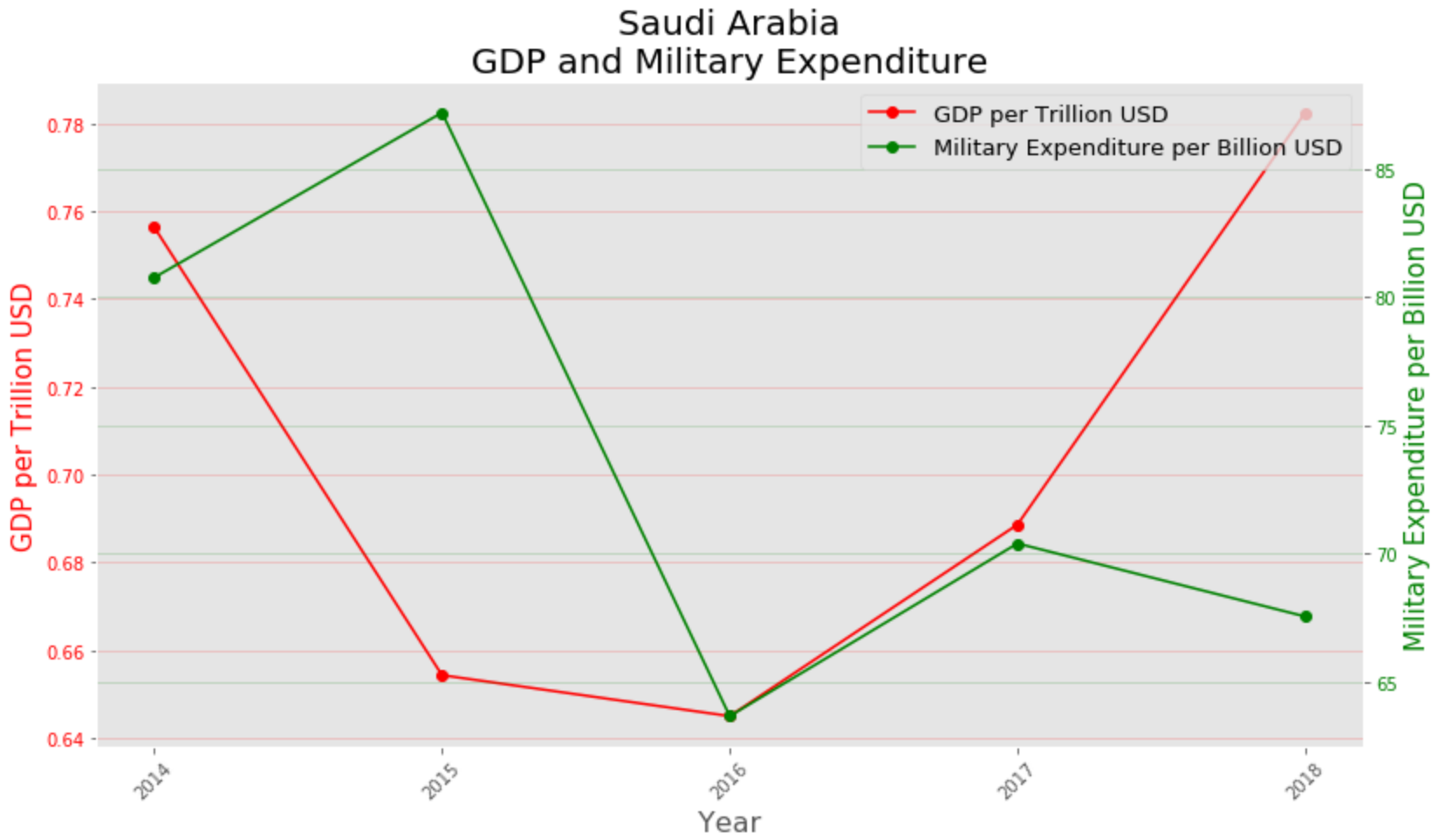

France
GDP and Military Expenditure
GDP per Trillion USD
Military Expenditure per Billion USD
2.8
2.7
2.6
2.5
64
62
60
58
56
2014
2015
2016
2017
2018
Year
GDP per Trillion USD
Military Expenditure per Billion USD

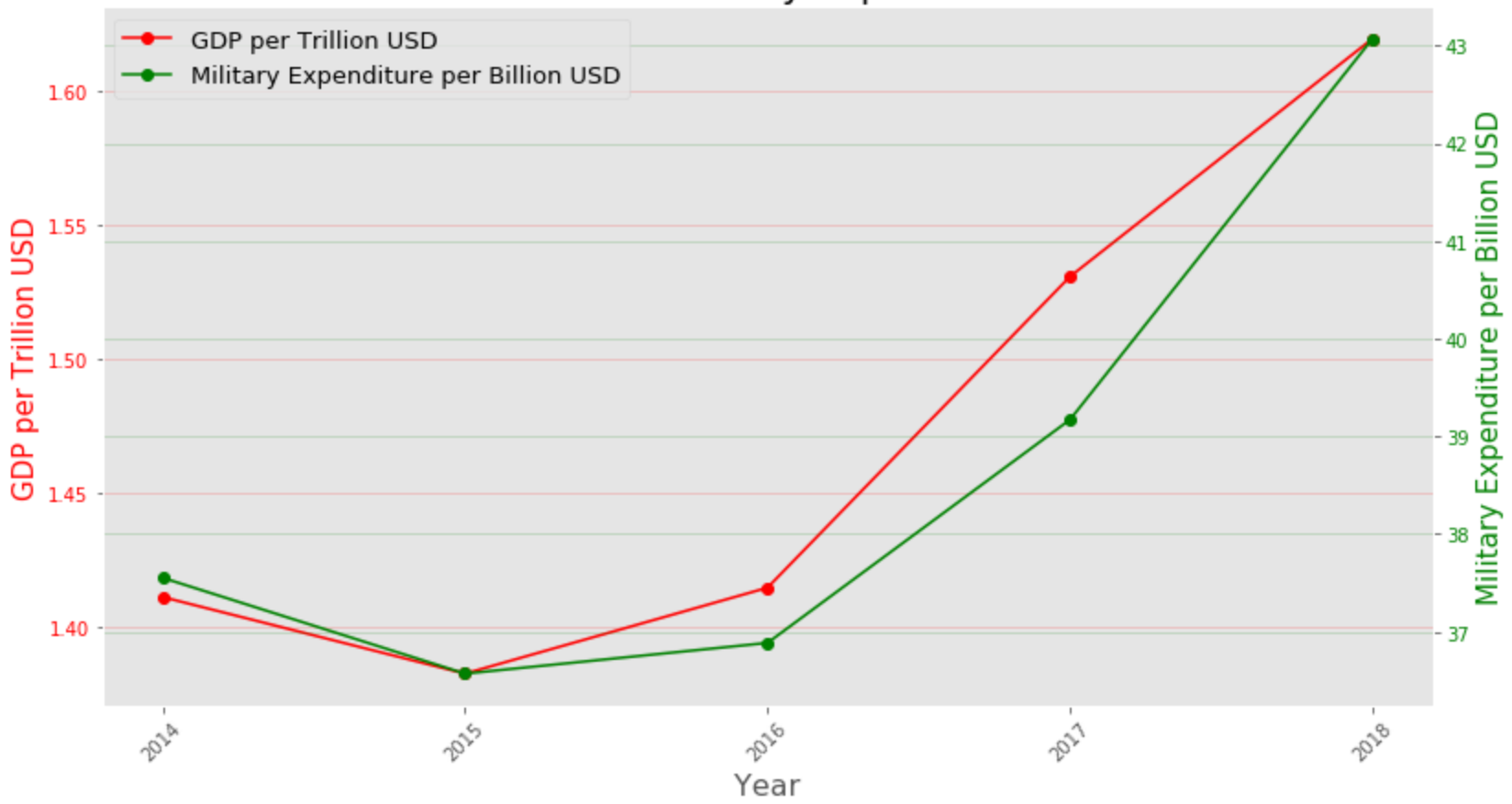

Germany
GDP and Military Expenditure
GDP per Trillion USD
Military Expenditure per Billion USD
4.0
3.9
3.8
3.7
3.6
3.5
3.4
48
46
44
42
40
2014
2015
2016
2017
2018
Year

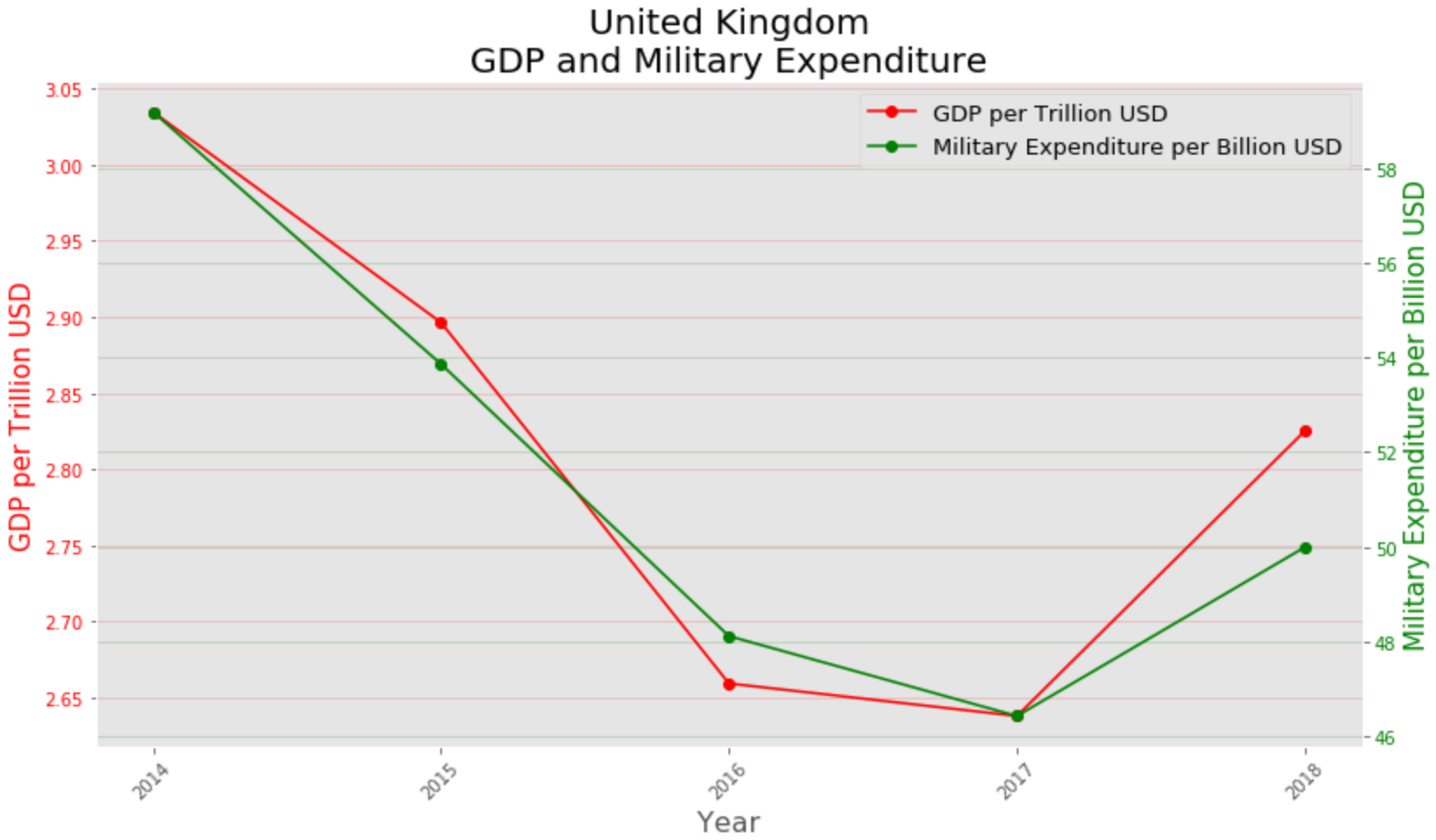

Israel
GDP and Military Expenditure
GDP per Trillion USD
Military Expenditure per Billion USD
0.37
0.36
0.35
0.34
0.33
0.32
0.31
0.30
18.5
18.0
17.5
17.0
16.5
16.0
15.5
15.0
2014
2015
2016
2017
2018
Year

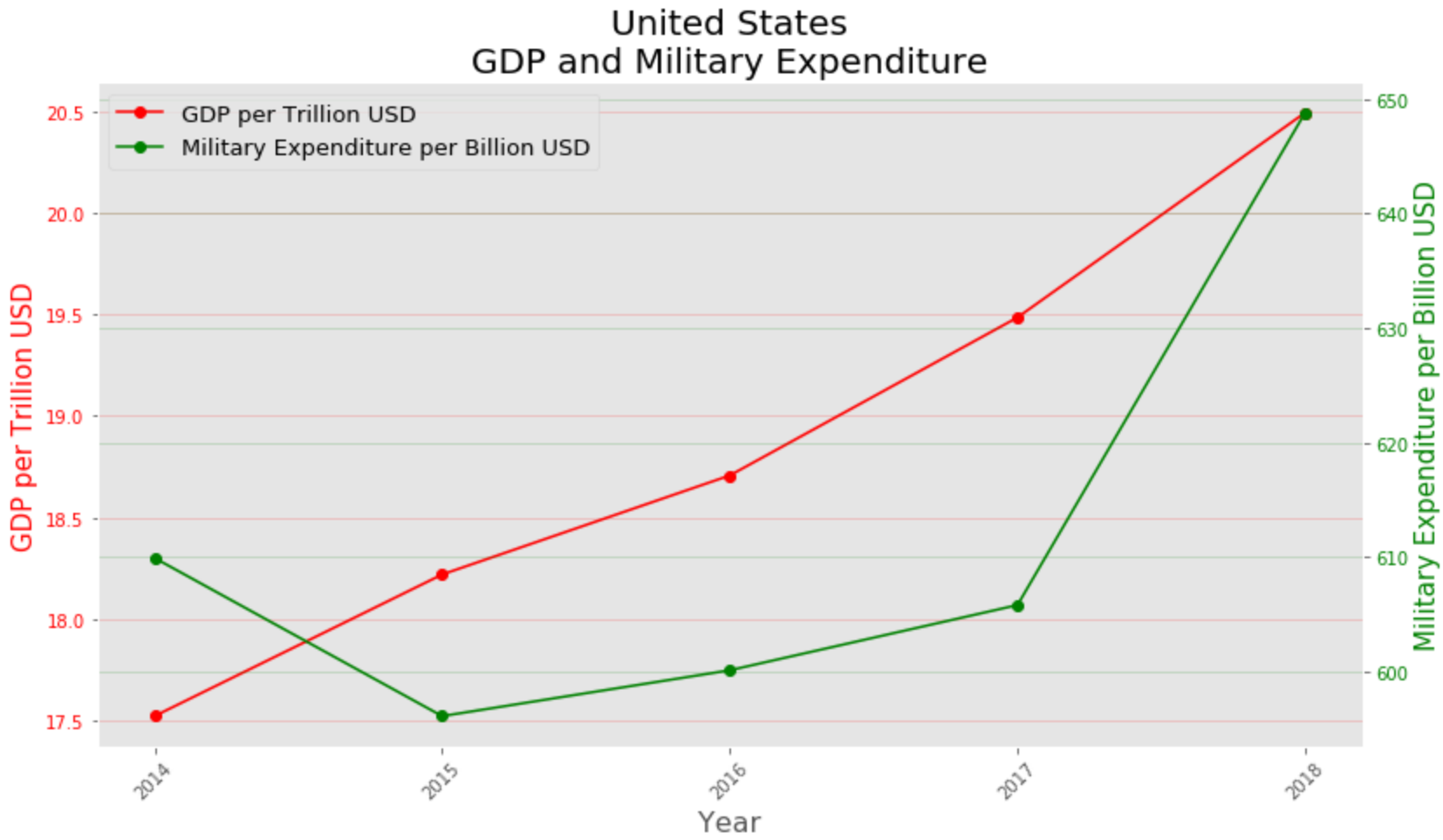

Italy
GDP and Military Expenditure
GDP per Trillion USD
Military Expenditure per Billion USD
Year
2.15
2.10
2.05
2.00
1.95
1.90
1.85
28
27
26
25
24
23
22
2014
2015
2016
2017
2018
GDP per Trillion USD
Military Expenditure per Billion USD


Russian Federation
GDP and Military Expenditure
GDP per Trillion USD
Military Expenditure per Billion USD
GDP per Trillion USD
Military Expenditure per Billion USD
Year
2014
2015
2016
2017
2018
20
19
18
17
16
15
14
13
85
80
75
70
65


Saudi Arabia
GDP and Military Expenditure
GDP per Trillion USD
Military Expenditure per Billion USD
0.78
0.76
0.74
0.72
0.70
0.68
0.66
0.64
85
80
75
70
65
2014
2015
2016
2017
2018
Year

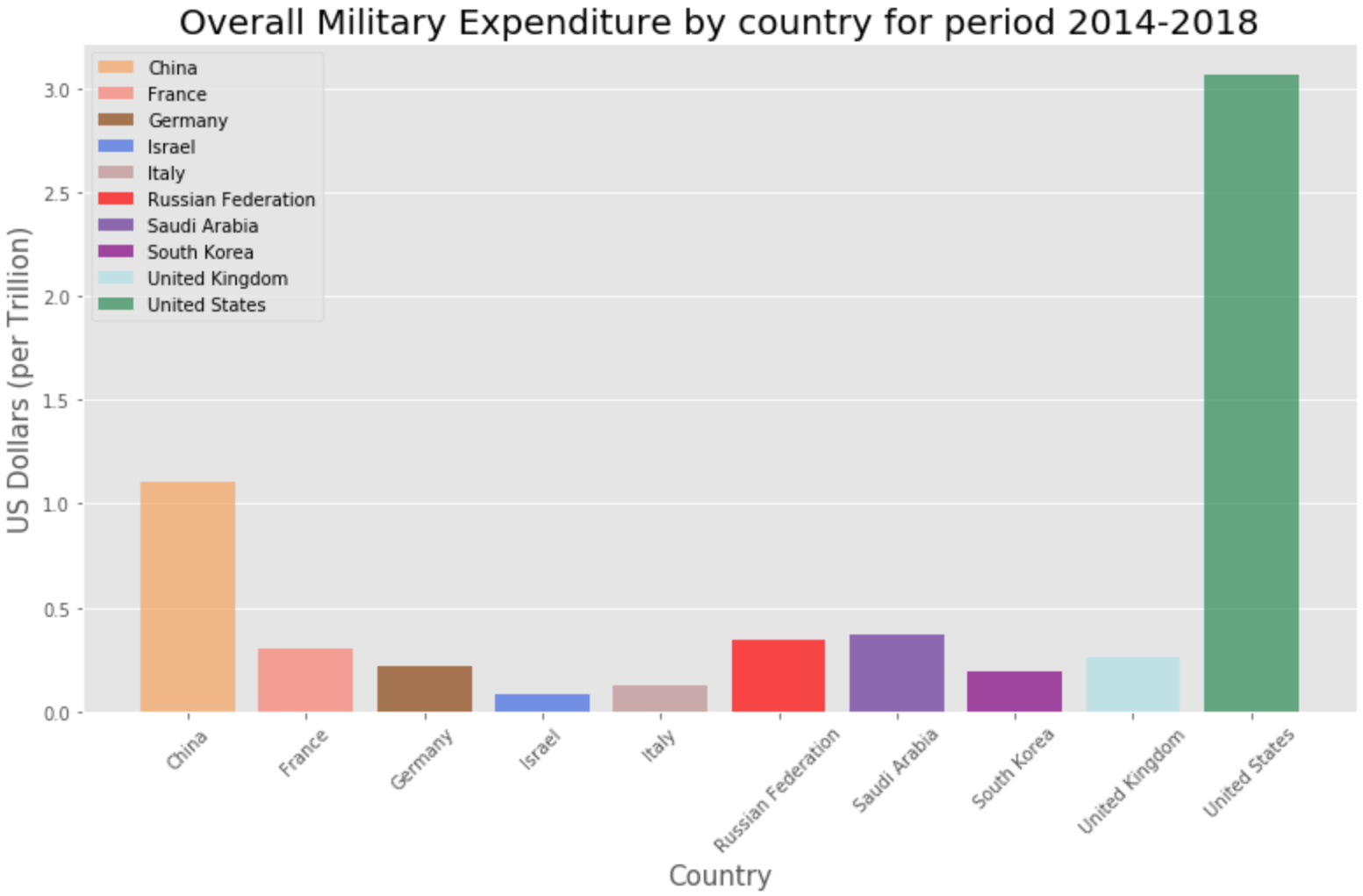

South Korea
GDP and Military Expenditure
GDP per Trillion USD
Military Expenditure per Billion USD
GDP per Trillion USD
Military Expenditure per Billion USD
1.60
1.55
1.50
1.45
1.40
43
42
41
40
39
38
37
2014
2015
2016
2017
2018
Year


United Kingdom
GDP and Military Expenditure
GDP per Trillion USD
Military Expenditure per Billion USD
3.05
3.00
2.95
2.90
2.85
2.80
2.75
2.70
2.65
58
56
54
52
50
48
46
2014
2015
2016
2017
2018
Year



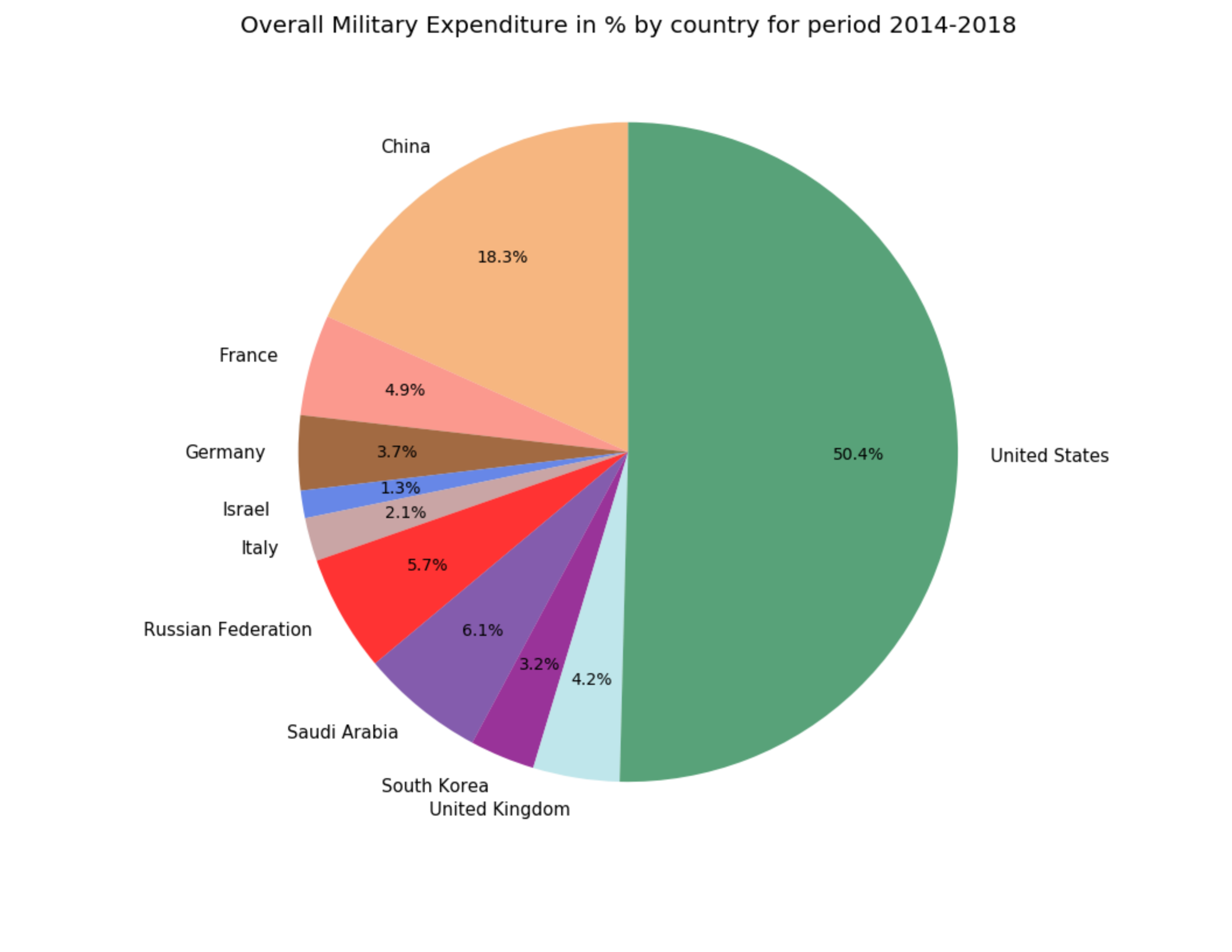
In [8]:
```
# common color cycle
colorArr = ["sandybrown","salmon","saddlebrown","royalblue","rosybrown","red","rebeccapurple","purple","powderblue","seagreen"]
```

In [9]:
```
# Compare the overall military spending of the all 10 countries in absolute values
fig = plt.figure(figsize=(13,7))
fig1 = fig.add_subplot(111)

for i,country in enumerate(worldData.index.get_level_values(0).unique()):
    # divide by 10**12 to get data in trillions
    fig1.bar(country,((worldData.loc[country]["Military Expenditure"]).sum())/10**12,label=country,
             alpha=0.7,color=colorArr[i])

fig1.title.set_text("Overall Military Expenditure by country for period 2014-2018")
fig1.title.set_size(20)
fig1.xaxis.grid(False)
fig1.set_ylabel("US Dollars (per Trillion)",fontsize=15)
fig1.set_xlabel("Country",fontsize=15)

plt.xticks(rotation=45)
plt.legend()
plt.show()
```

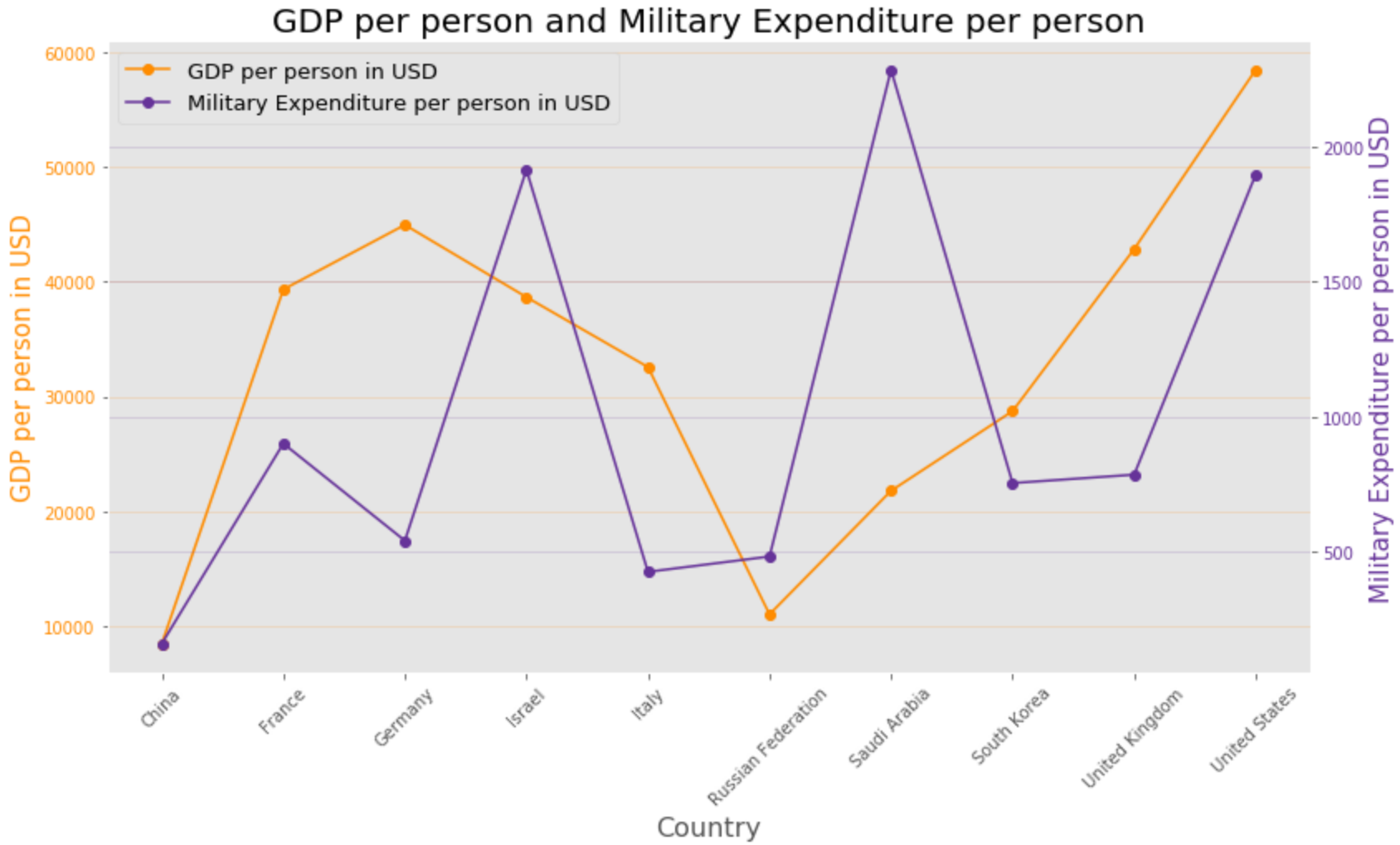

Overall Military Expenditure by country for period 2014-2018
China
France
Germany
Israel
Italy
Russian Federation
Saudi Arabia
South Korea
United Kingdom
United States
US Dollars (per Trillion)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
China
France
Germany
Israel
Italy
Russian Federation
Saudi Arabia
South Korea
United Kingdom
United States
Country

In [10]:

```
# Compare the overall military spending of the all 10 countries in percentages
#get all unique countries
countries = worldData.index.get_level_values(0).unique()

totalMilitarySpendingPerCountry = []
for country in countries:
    # sum all military expenditure for country for all years
    totalMilitarySpendingPerCountry.append(worldData.loc[country]["Military Expenditure"].sum())

fig = plt.figure(figsize=(13,13))
fig1 = fig.add_subplot(111)
fig1.title.set_text("Overall Military Expenditure in % by country for period 2014-2018")
fig1.title.set_size(20)

#plot the pie chart
wedges, texts, autotexts = fig1.pie(
    #totalMilitarySpendingPerCountry list contains data to plot
    totalMilitarySpendingPerCountry,
    labels=countries,
    autopct="%1.1f%%",
    startangle=90,
    pctdistance=0.7,
    #colors uses the colorArr which contains our custom colors
    colors=colorArr
)

#sets the size for the percentage text inside each wedge
for autotext in autotexts:
    autotext.set_size(14)

#sets the size of label for each wedge
for text in texts:
    text.set_size(15)

#sets opacity property for each edge
for wedge in wedges:
    wedge.set_alpha(0.8)

plt.show()
```

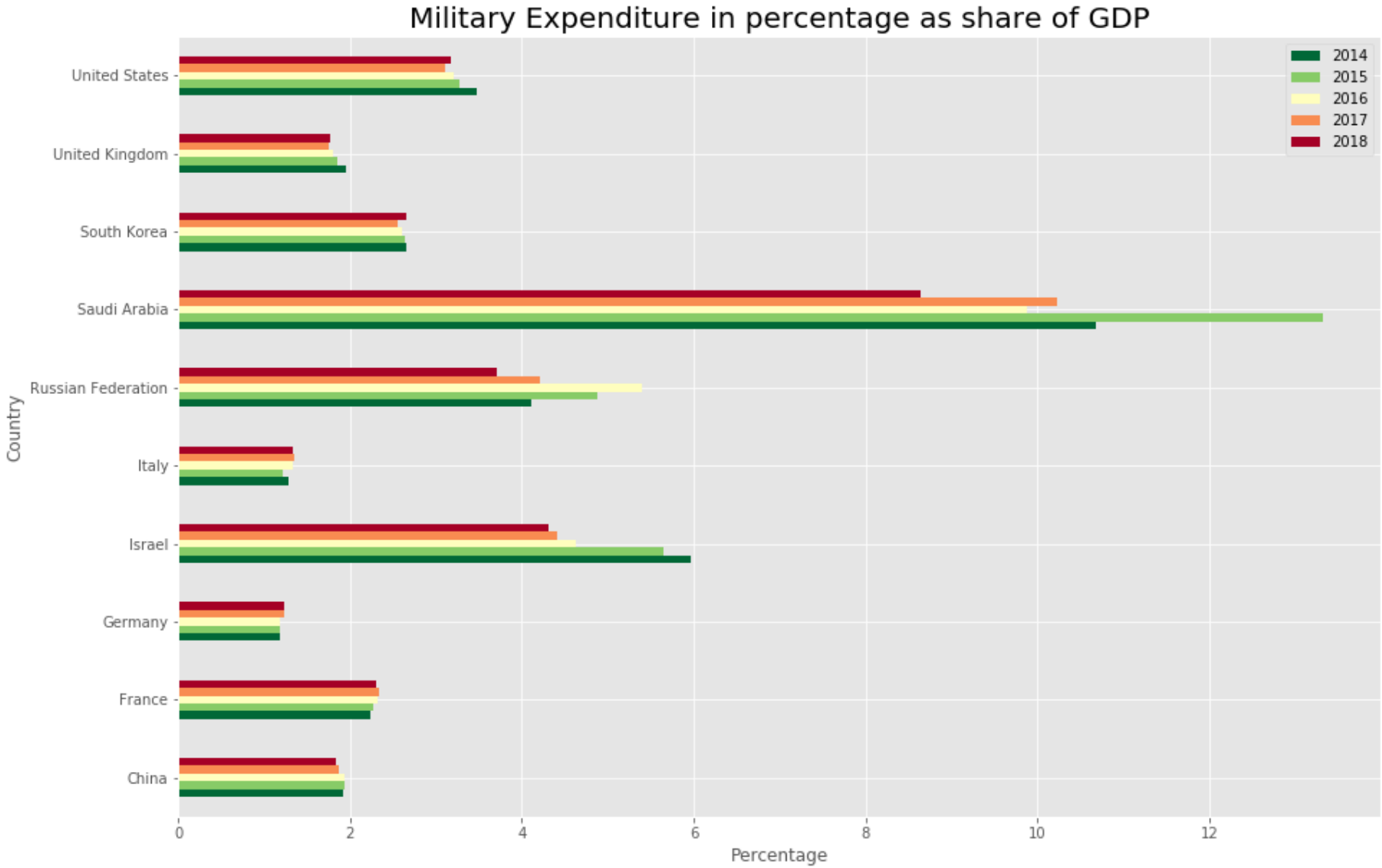

Overall Military Expenditure in % by country for period 2014-2018
China
18.3%
France
4.9%
Germany
3.7%
Israel
1.3%
Italy
2.1%
Russian Federation
5.7%
Saudi Arabia
6.1%
South Korea
3.2%
United Kingdom
4.2%
United States
50.4%

In [11]:
```
# Compare the per person military spending to the per person GDP in absolute
parasiteAxesLinePlot(
    # per person GDP
    y1AxisData = worldData["GDP"].mean(axis=1)/(worldData["Population"]).mean(axis=1),
    # per person military spending
    y2AxisData = worldData["Military Expenditure"].mean(axis=1)/(worldData["Population"].mean(axis=1)),
    xLabel = "Country",
    y1Label = "GDP per person in USD",
    y2Label = "Military Expenditure per person in USD",
    y1Color = "darkorange",
    y2Color = "rebeccapurple",
    title="GDP per person and Military Expenditure per person"
)
```



In [12]:

```
# Compare the per person military expenditure in percentage as a share of GDP.
# create new dataframe which contains percentage of military expenditure as a share of GDP
militaryExpenditureAsGdp = pd.DataFrame()

for country in worldData.index.get_level_values(0).unique():
    # append military expenditure as share of GDP to militaryExpenditureAsGdp dataframe
    militaryExpenditureAsGdp = militaryExpenditureAsGdp.append(
                        ((worldData.loc[country]["Military Expenditure"] / worldData.loc[country]["Population"])
                                                                /
                        (worldData.loc[country]["GDP"]/worldData.loc[country]["Population"]))* 100)


militaryExpenditureAsGdp.plot(kind='barh',figsize=(15,10),colormap="RdYlGn_r")
plt.title("Military Expenditure in percentage as share of GDP",fontsize=20)
plt.xlabel("Percentage")
plt.ylabel("Country")
plt.legend(loc="best")
plt.show()
```


Military Expenditure in percentage as share of GDP
2014
2015
2016
2017
2018
United States
United Kingdom
South Korea
Saudi Arabia
Russian Federation
Italy
Israel
Germany
France
China
Country
0
2
4
6
8
10
12
Percentage

In [13]:
```
# Single out the fastest growing countries in military spending in absolute values
worldData["Military Expenditure"]
```

Out[13]:

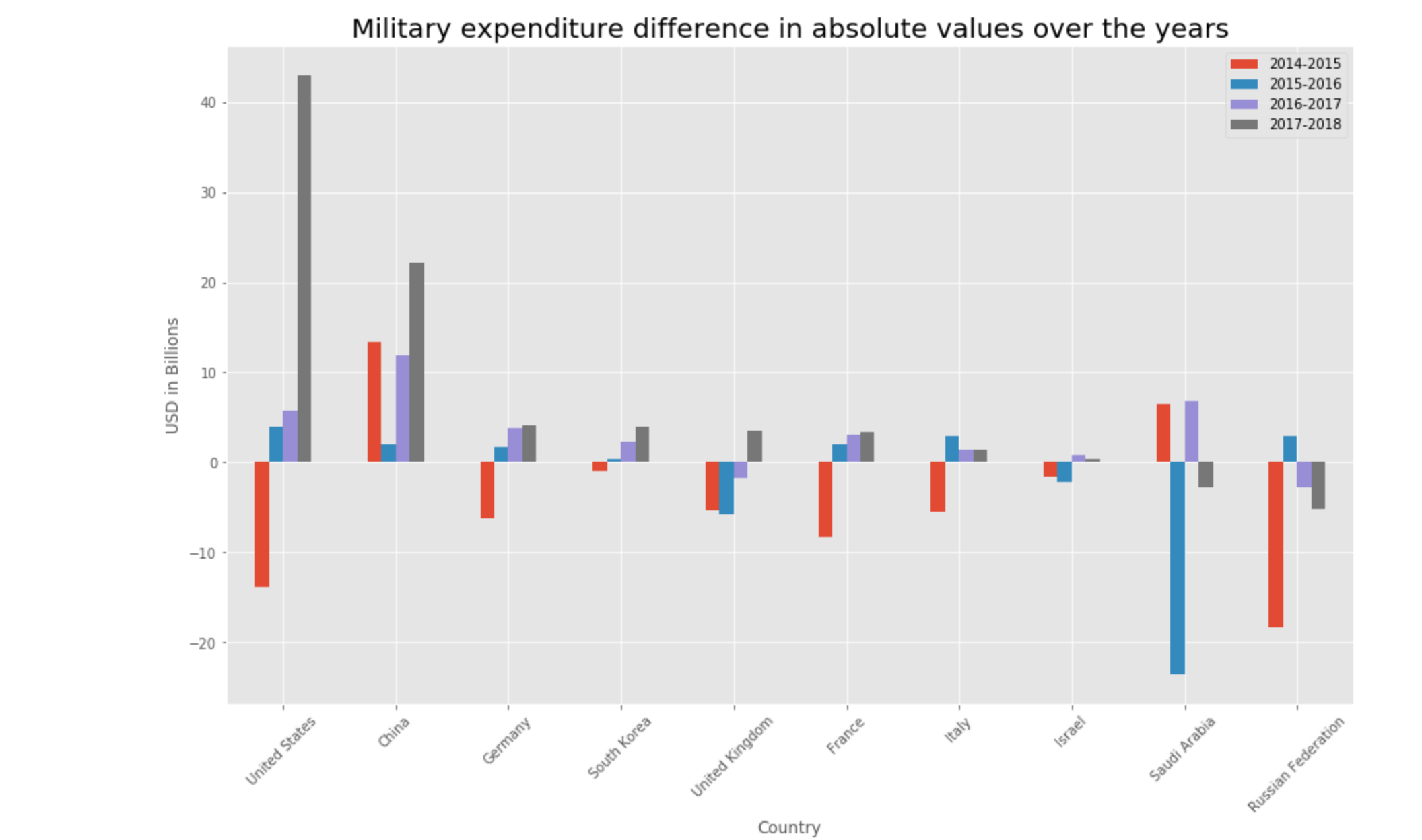
Country Name	2014	2015	2016	2017	2018
China	2.007722e+11	2.140931e+11	2.160313e+11	2.278294e+11	2.499969e+11
France	6.361357e+10	5.534213e+10	5.735841e+10	6.041750e+10	6.379968e+10
Germany	4.610267e+10	3.981258e+10	4.157949e+10	4.538172e+10	4.947063e+10
Israel	1.848583e+10	1.696943e+10	1.478381e+10	1.558161e+10	1.594679e+10
Italy	2.770103e+10	2.218085e+10	2.503303e+10	2.644789e+10	2.780751e+10
Russian Federation	8.469650e+10	6.641871e+10	6.924531e+10	6.652730e+10	6.138755e+10
Saudi Arabia	8.076240e+10	8.718587e+10	6.367280e+10	7.040000e+10	6.755467e+10
South Korea	3.755233e+10	3.657077e+10	3.688528e+10	3.917068e+10	4.306997e+10
United Kingdom	5.918286e+10	5.386219e+10	4.811894e+10	4.643330e+10	4.999719e+10
United States	6.099140e+11	5.961046e+11	6.001064e+11	6.058029e+11	6.487983e+11

In [14]:
```
# Single out the fastest growing countries in military spending in absolute values

# Take difference in military spendings for consecutive years
worldData["Military Expenditure Absolute Difference","2014-2015"] =\
                                    worldData["Military Expenditure","2015"]-worldData["Military Expenditure","2014"]

worldData["Military Expenditure Absolute Difference","2015-2016"] =\
                                    worldData["Military Expenditure","2016"]-worldData["Military Expenditure","2015"]

worldData["Military Expenditure Absolute Difference","2016-2017"] =\
                                    worldData["Military Expenditure","2017"]-worldData["Military Expenditure","2016"]

worldData["Military Expenditure Absolute Difference","2017-2018"] =\
                                    worldData["Military Expenditure","2018"]-worldData["Military Expenditure","2017"]

worldData["Military Expenditure Absolute Difference"]
```

Out[14]:

Country Name	2014-2015	2015-2016	2016-2017	2017-2018
China	1.332087e+10	1.938210e+09	1.179814e+10	2.216748e+10
France	-8.271438e+09	2.016283e+09	3.059084e+09	3.382178e+09
Germany	-6.290097e+09	1.766919e+09	3.802227e+09	4.088906e+09
Israel	-1.516398e+09	-2.185617e+09	7.977937e+08	3.651802e+08
Italy	-5.520189e+09	2.852183e+09	1.414865e+09	1.359621e+09
Russian Federation	-1.827780e+10	2.826601e+09	-2.718005e+09	-5.139757e+09
Saudi Arabia	6.423467e+09	-2.351307e+10	6.727200e+09	-2.845333e+09
South Korea	-9.815594e+08	3.145141e+08	2.285399e+09	3.899291e+09
United Kingdom	-5.320673e+09	-5.743242e+09	-1.685640e+09	3.563889e+09
United States	-1.380936e+10	4.001804e+09	5.696484e+09	4.299535e+10

In [15]:
```
# sort the military spending difference in descending order, sorting is done giving priority to the recent years
sortedChanges = worldData["Military Expenditure Absolute Difference"].sort_values(by=["2017-2018","2016-2017",
                                                                                      "2015-2016","2014-2015"],
                                                                                     ascending=False)

# plot the sortedChanges
# divide by 10**9 to get data in billions
(sortedChanges[["2014-2015","2015-2016","2016-2017","2017-2018"]]/10**9).plot(kind="bar",figsize=(15,9))
plt.title("Military expenditure difference in absolute values over the years",fontsize=20)
plt.xlabel("Country")
plt.ylabel("USD in Billions")
plt.xticks(rotation=45)
plt.legend(loc="best")
plt.show()
```

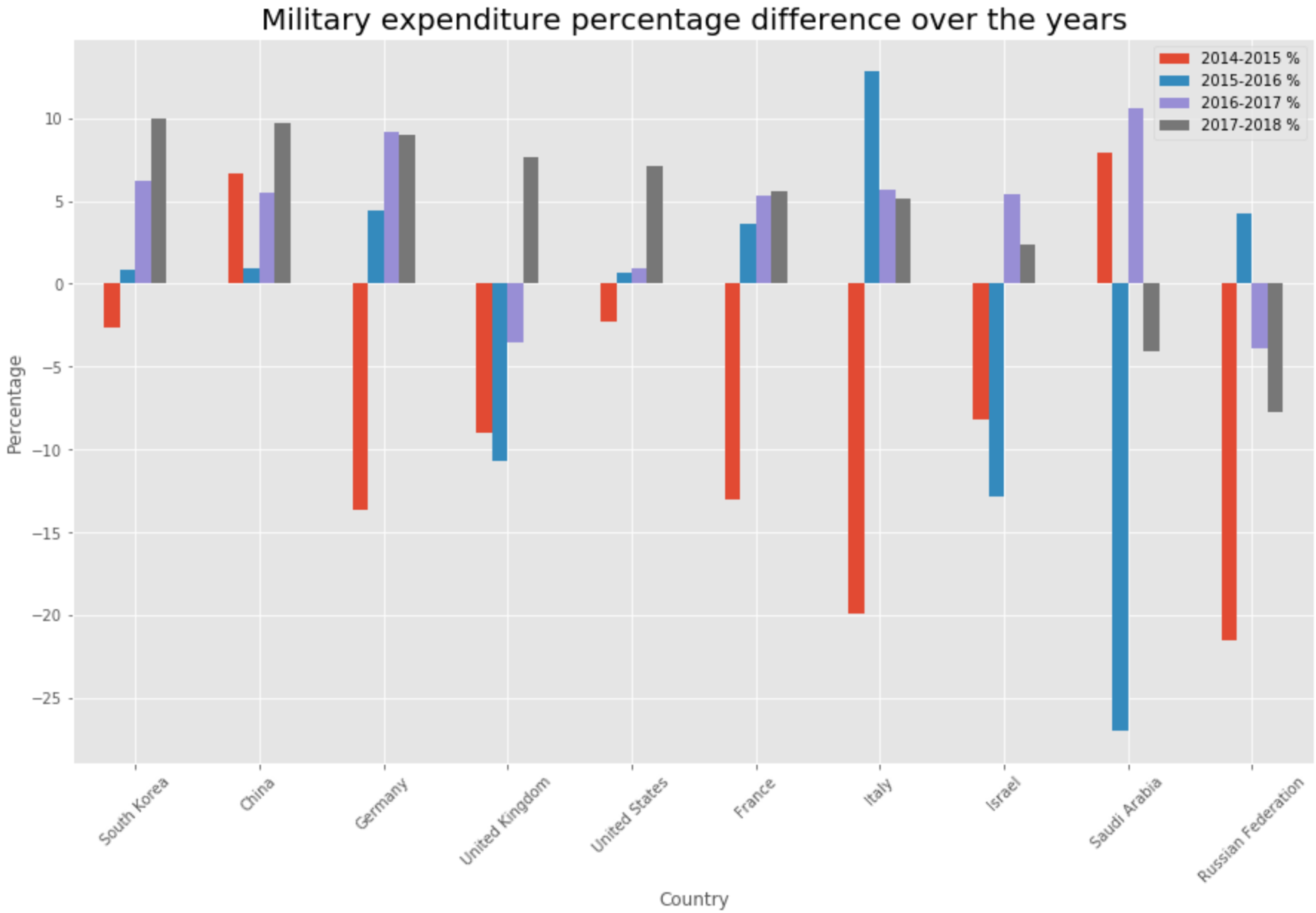

Military expenditure difference in absolute values over the years
2014-2015
2015-2016
2016-2017
2017-2018
USD in Billions
40
30
20
10
0
−10
−20
United States
China
Germany
South Korea
United Kingdom
France
Italy
Israel
Saudi Arabia
Russian Federation
Country

In [16]:
```
# Single out the fastest growing countries in military spending in percentage

# Take difference in military spendings in percentages for consecutive years
# percentageChange = ((new value - old value) / old value)
worldData["Military Expenditure Percentage Difference","2014-2015 %"]= \
                ((worldData["Military Expenditure","2015"]-worldData["Military Expenditure","2014"])
                     /
                 worldData["Military Expenditure","2014"])*100

worldData["Military Expenditure Percentage Difference","2015-2016 %"]= \
                ((worldData["Military Expenditure","2016"]-worldData["Military Expenditure","2015"])
                     /
                 worldData["Military Expenditure","2015"])*100

worldData["Military Expenditure Percentage Difference","2016-2017 %"]= \
                ((worldData["Military Expenditure","2017"]-worldData["Military Expenditure","2016"])
                     /
                 worldData["Military Expenditure","2016"])*100

worldData["Military Expenditure Percentage Difference","2017-2018 %"]= \
                ((worldData["Military Expenditure","2018"]-worldData["Military Expenditure","2017"])
                     /
                 worldData["Military Expenditure","2017"])*100


worldData["Military Expenditure Percentage Difference"]
```

Out[16]:

Country Name	2014-2015 %	2015-2016 %	2016-2017 %	2017-2018 %
China	6.634816	0.905312	5.461310	9.729860
France	-13.002631	3.643305	5.333279	5.598010
Germany	-13.643670	4.438092	9.144477	9.010028
Israel	-8.203027	-12.879732	5.396399	2.343662
Italy	-19.927737	12.858765	5.651993	5.140754
Russian Federation	-21.580343	4.255731	-3.925184	-7.725786
Saudi Arabia	7.953536	-26.968897	10.565265	-4.041667
South Korea	-2.613844	0.860015	6.195964	9.954617
United Kingdom	-8.990227	-10.662846	-3.503070	7.675287
United States	-2.264149	0.671326	0.949246	7.097250

In [17]:
```
# sort the military spending difference percentage in descending order, sorting is done giving priority to the recent y
ears
sortedChangesPct = worldData["Military Expenditure Percentage Difference"].sort_values(by=["2017-2018 %",
                                                                                          "2016-2017 %",
                                                                                          "2015-2016 %",
                                                                                          "2014-2015 %"],
                                                                                        ascending=False)

# plot the sortedChangesPct
(sortedChangesPct[["2014-2015 %","2015-2016 %","2016-2017 %","2017-2018 %"]]).plot(kind="bar",figsize=(15,9))
plt.title("Military expenditure percentage difference over the years",fontsize=20)
plt.xlabel("Country")
plt.ylabel("Percentage")
plt.xticks(rotation=45)
plt.legend(loc="best")
plt.show()
```


Military expenditure percentage difference over the years
2014-2015 %
2015-2016 %
2016-2017 %
2017-2018 %
Percentage
10
5
0
−5
−10
−15
−20
−25
South Korea
China
Germany
United Kingdom
United States
France
Italy
Israel
Saudi Arabia
Russian Federation
Country