

# MILITARY EXPENDITURE DATA ANALYSIS

GWU Data science

*DATS 6103 Project 1*

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# OUTLINE

- Data Source
- Total military spending of the 10 countries
- Total military spending compare to the country's GDP
- Fastest growing country in military spending
- Prediction of future military spending
- Conclusion
- References

# DATA SOURCE

- Stockholm International Peace Research Institute (SIPRI) link: <https://www.sipri.org/>
  - SIPRI is an independent international institute dedicated to research into conflict, armaments, arms control and disarmament. Established in 1966, SIPRI provides data, analysis and recommendations, based on open sources.
- The database includes data for 172 countries for the period 1949-2017
- Three sheets
  - Annual Military Expenditure (Current USD)
  - Annual Military Expenditure per capita (Current USD)
  - Annual share Military Expenditure to GDP (%)
- GDP and GDP per capita data are calculated from the three sheets

# DATA CLEANING

1. Replaced special punctuations and “NaN” by “Na”. (Will use mean value to replace “Na” in subset)

```
ms.replace(("xxx", ". ."), "Na", inplace=True)
ms.fillna("Na", inplace=True)
pms.replace(("xxx", ". ."), "Na", inplace=True)
pms.fillna("Na", inplace=True)
ms_pc.replace(("xxx", ". ."), "Na", inplace=True)
ms_pc.fillna("Na", inplace=True)
```

2. Unify the countries name in different data sets.

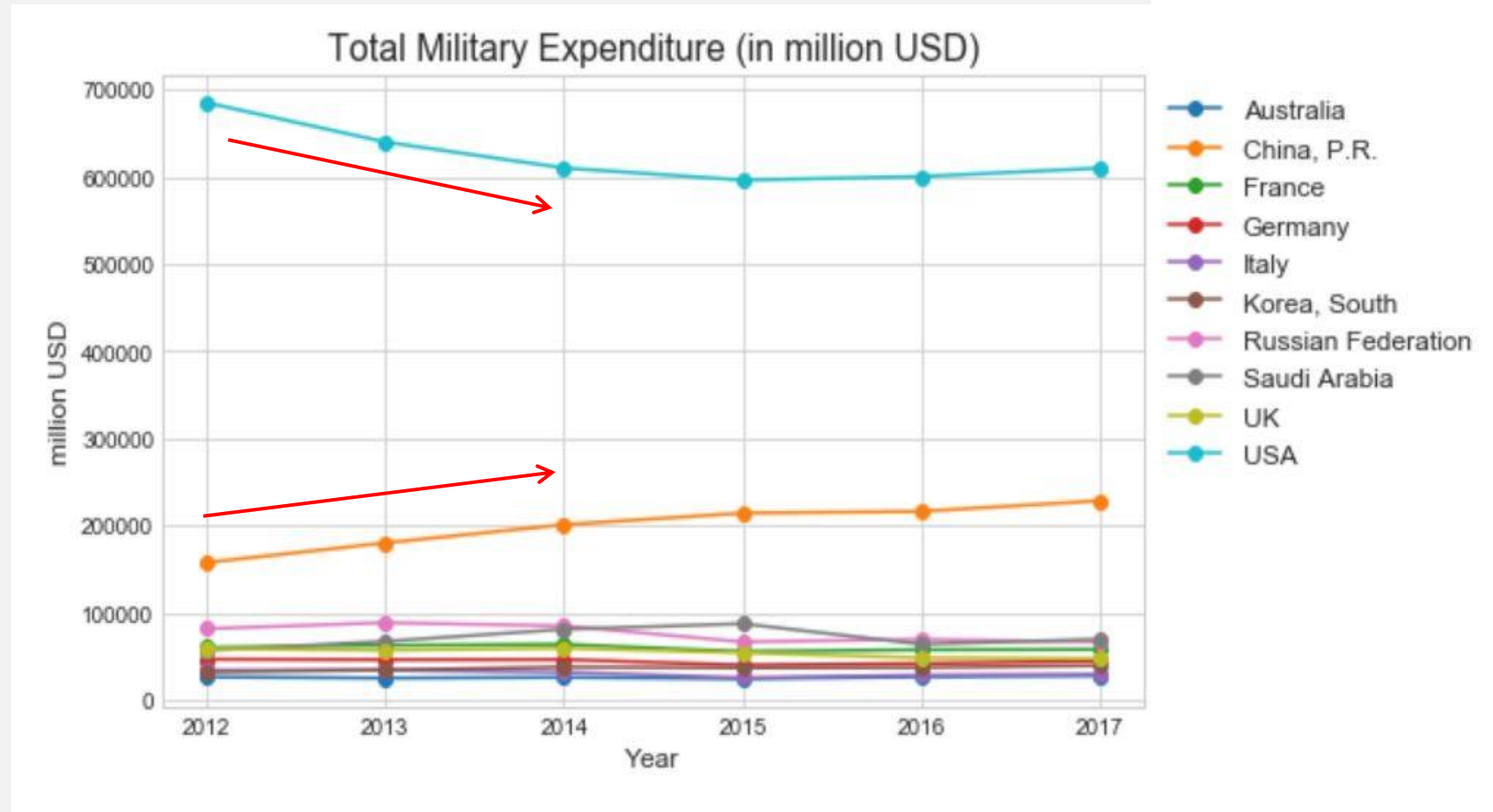
```
ms_pc.rename(index = {"USSR/Russia": "Russian Federation"}, inplace = True)
```

3. Remove irrelevant data for analyzing. (Subset the original data set by Countries and years. Double check missing value in the subset)

```
# define function to select relevant dataframe
def display_relevant(df):
    rowname = ["USA", "China, P.R.", "Russian Federation", "Germany",
               "UK", "France", "Italy", "Saudi Arabia", "Korea, South", "Australia"]
    colname = [2012, 2013, 2014, 2015, 2016, 2017]
    df = df.loc[rowname, colname]
    # change the data type to float
    df = df.iloc[0:11, 0:7].astype(dtype="float64")
    return df
```

## *Total military spending of the 10 countries*

- The US is unquestionably the leading country of military spending. But experience a steady decrease from 2012 to 2015, one of the reason should be the withdrew troops from Afghanistan and Iraq in 2010.
- China is the second in military spending. And experience a steady increase since 2012.



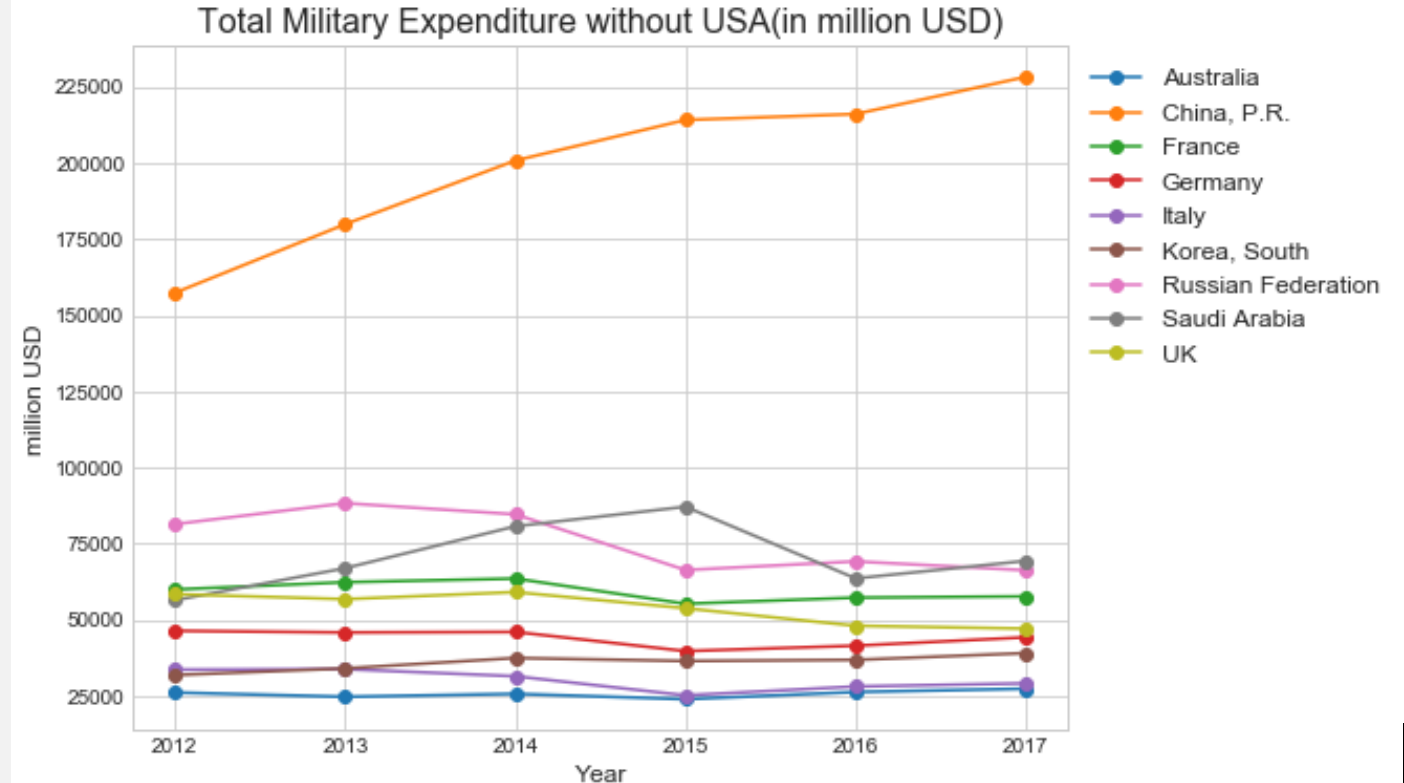
# Total military spending of the 10 countries

- Except for the US and China, all the other countries military spending fluctuated up and down very slightly, and all are less than 100 billion, which means less than half of China's, less than a quarter of America's.
- Unexpectedly, since 2015 Saudi Arabia's military spending is at same level of Russia.
- Australia is the last one in the 10 countries.

```
# plot figure of military spending for 10 countries in absolute value exclude country "USA"
plt.figure(figsize=(8,6))

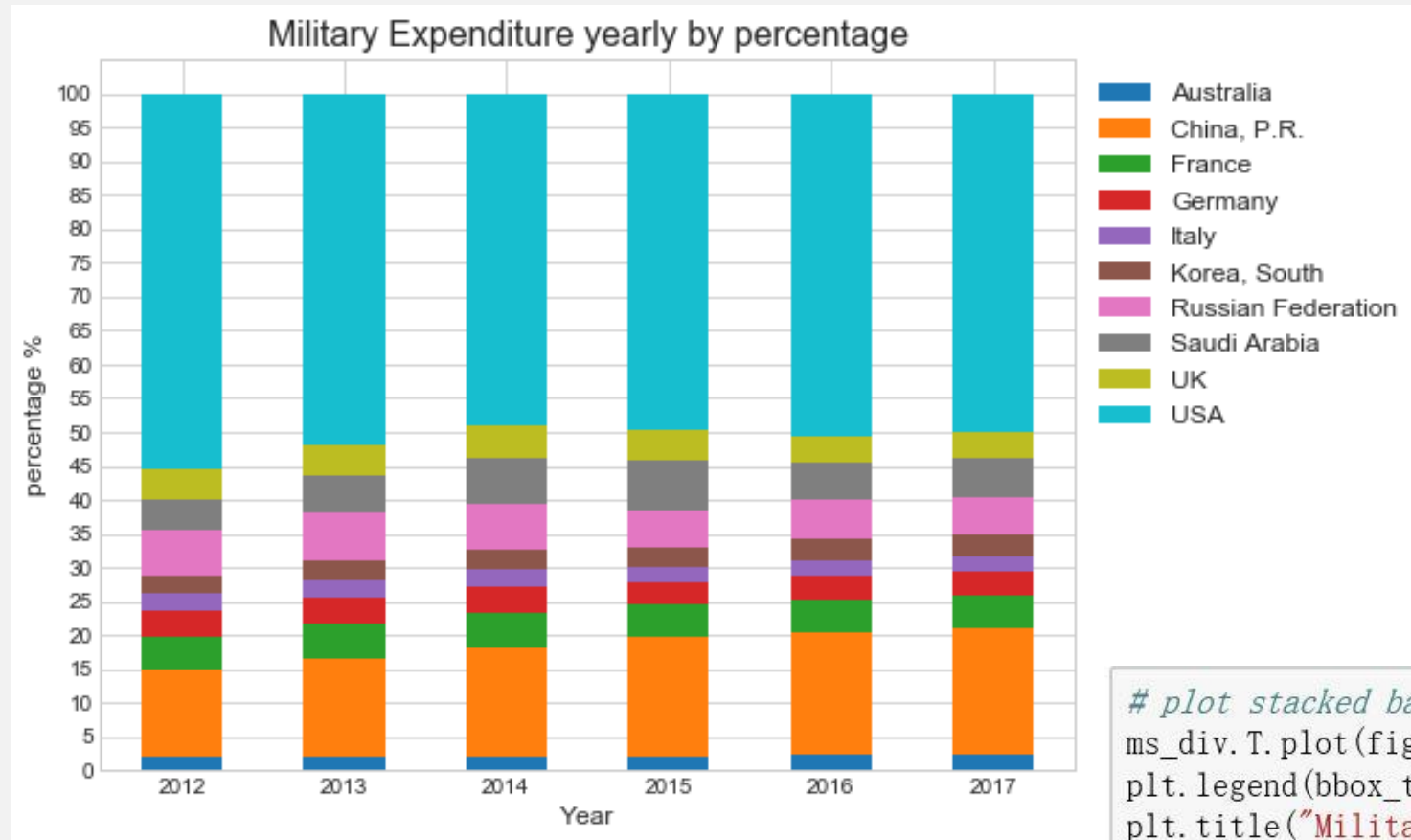
for i in country:
    if i == "USA":
        pass
    else:
        plt.plot(ms.loc[i, :], marker="o")

plt.legend(bbox_to_anchor=(1, 1), fontsize=12)
plt.title("Total Military Expenditure without USA(in million USD)", fontsize=16)
plt.xlabel("Year", fontsize=12)
plt.ylabel("million USD", fontsize=12)
#plt.savefig("ms_no_us.png", bbox_inches='tight') #save the plots to folder
plt.show()
```





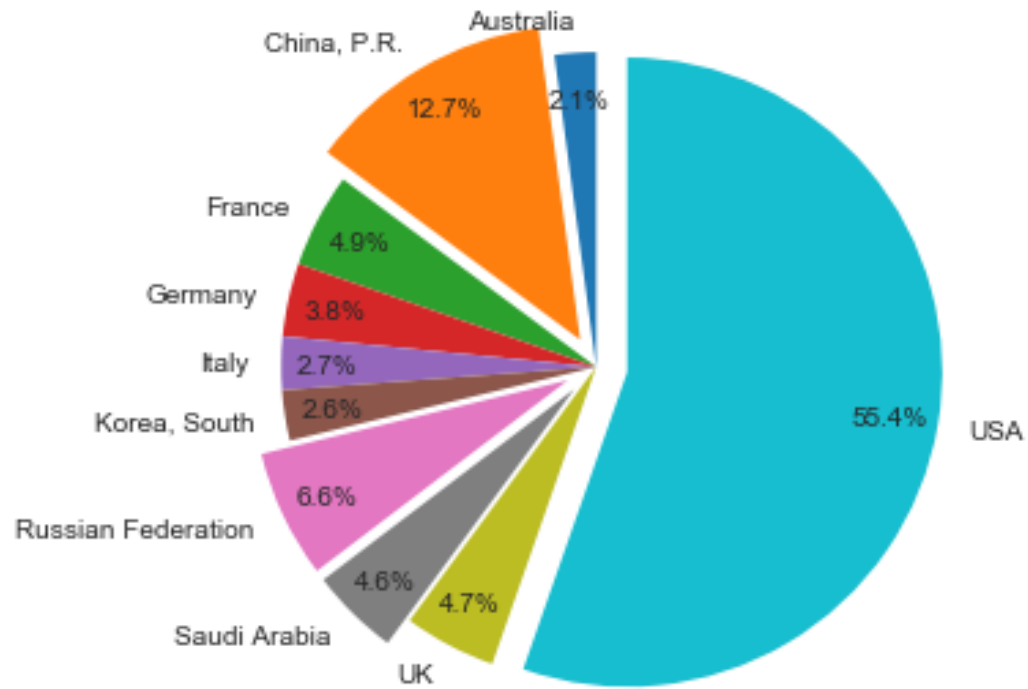
# Total military spending of the 10 countries



- For most countries, military spending didn't vary much. And all count for around 5% of the 10 country's total yearly military spending.

```
# plot stacked bar chart for the percentage of military spending
ms_div.T.plot(figsize=(8, 6), kind="bar", stacked=True)
plt.legend(bbox_to_anchor=(1, 1), fontsize=12)
plt.title("Military Expenditure yearly by percentage", fontsize=16)
plt.xlabel("Year", fontsize=12)
plt.ylabel("percentage %", fontsize=12)
# turn the x axis scale to 0 degree
plt.xticks(rotation=0, fontsize=10)
# set y axis scale from 0 to 105 with 5 added each time
plt.yticks(np.arange(0, 105, 5))
#plt.savefig("ms.png", bbox_inches='tight') #save the plots to folder
plt.show()
```

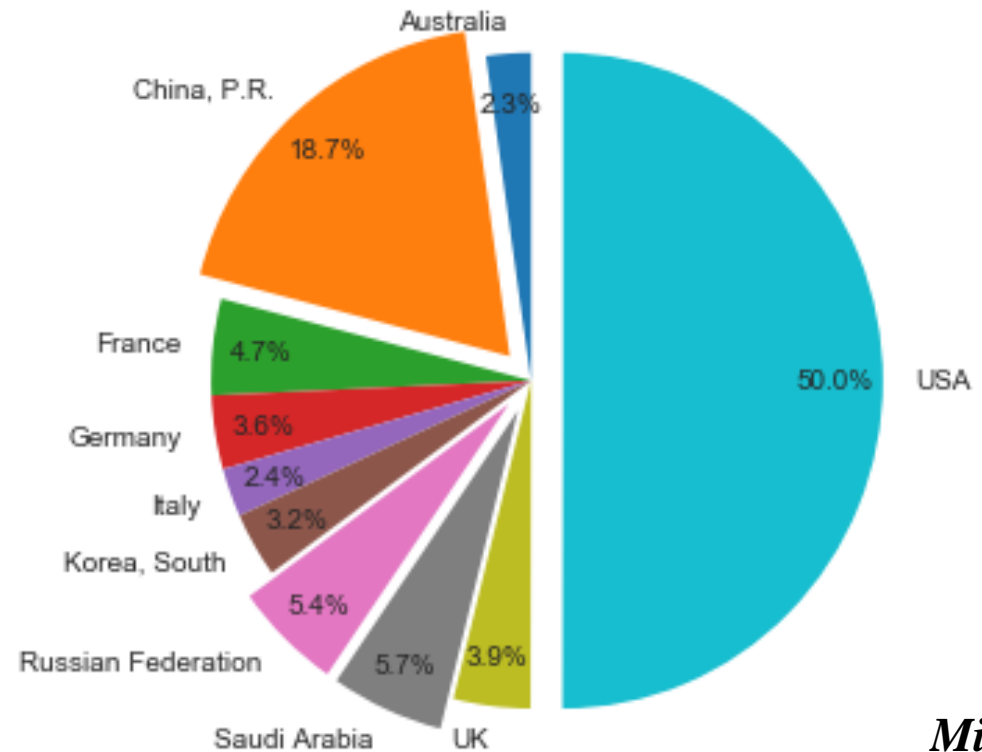
Overall military spending year 2012 in %



- Russia and Saudi Arabia become more even.

- From 2012 to 2017, the US count drop from 55% to 50% , and China count increase from 13% to 18%.

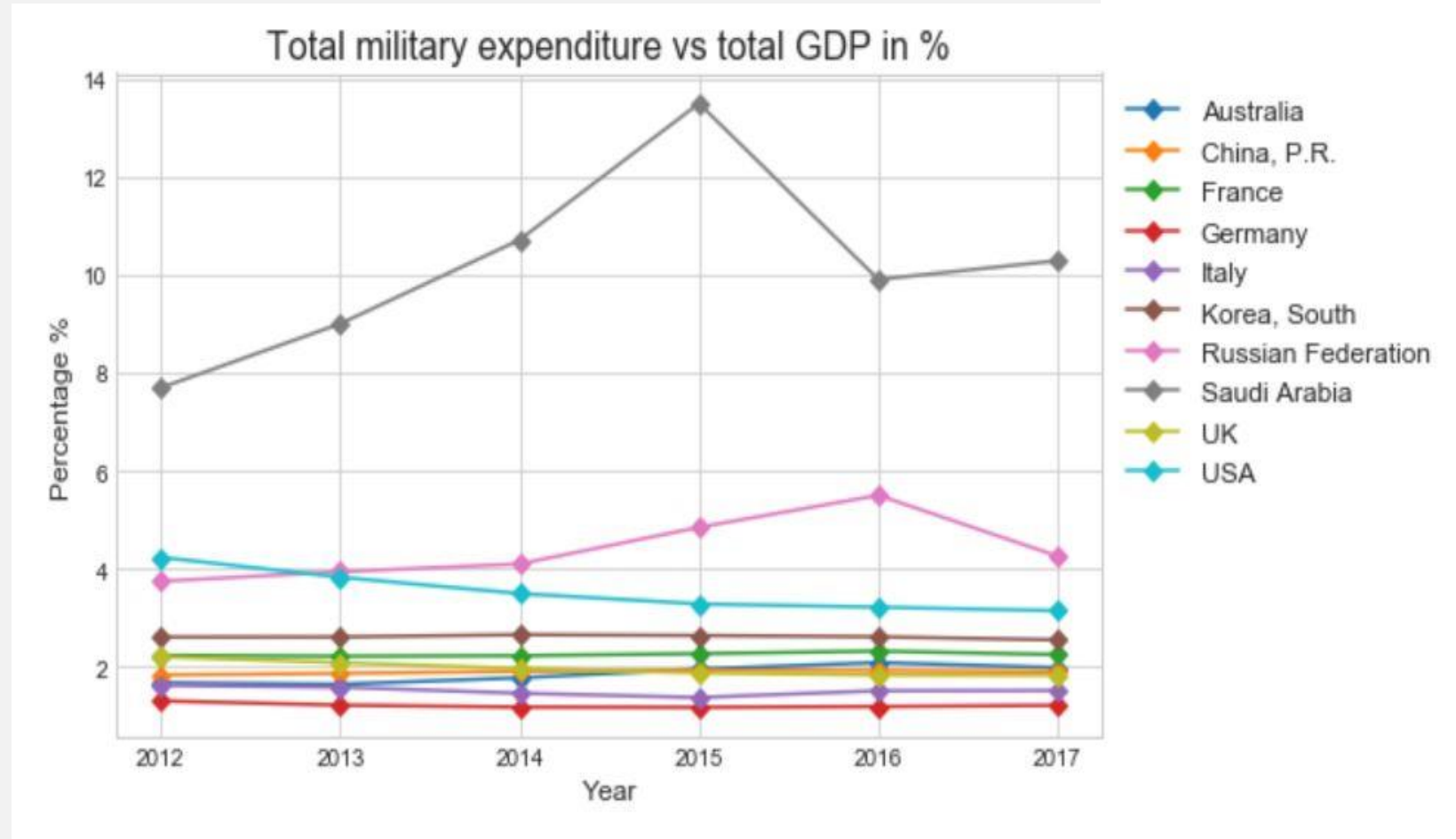
Overall military spending year 2017 in %





## *Total military spending compare to country's GDP*

- The share of military spending to GDP for Saudi Arabia is the highest.
- Since 2014, Saudi Arabia spends over 10% of the GDP on military spending. The domestic and border instability such as Iran nuclear weapons, sectarian tension are all the reasons increase the country's military spending.



# Military spending per capita compare to GDP per capita

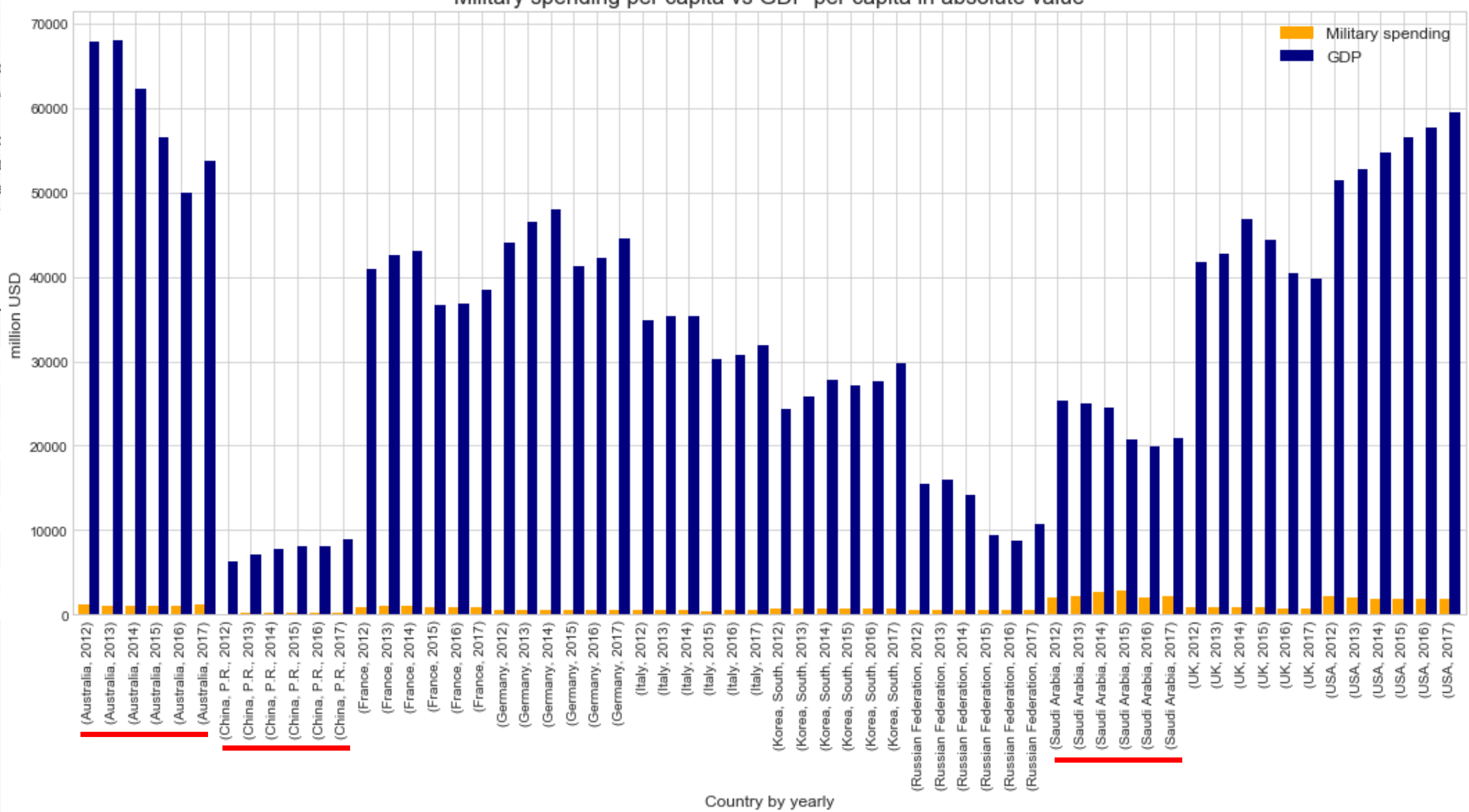
Military spending per capita vs GDP per capita in absolute value

```
# pivot the
stack_ms_pc
stack_gdp_pc
# combine t
ms_gdp_pc =
ms_gdp_pc.co
ms_gdp_pc.in
ms_gdp_pc.h
```

Country

Australia

China, P.R.



➤ Per capita =  $\frac{MS}{population}$

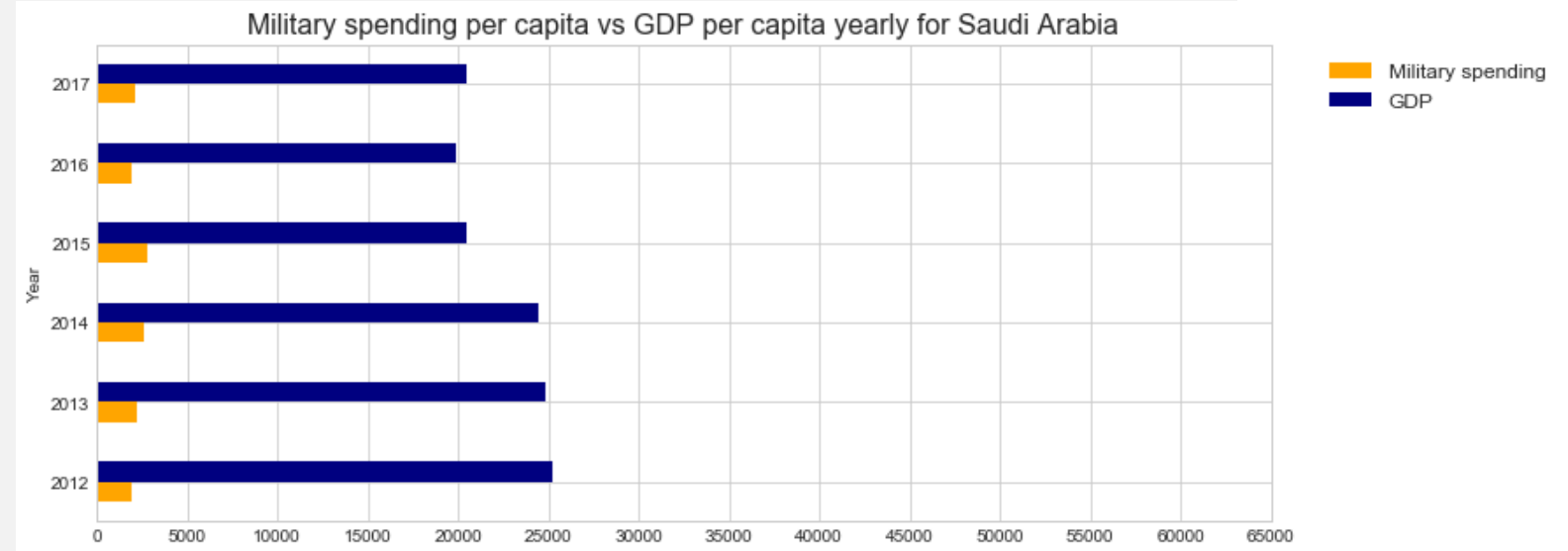
➤ Australia with the highest per person GDP, the lowest population, but not very high per person military spending is because it's very low percent of military spending in GDP.

➤ China's per capita value in military spending and GDP are all the lowest because of the large population.

➤ Saudi Arabia per person GDP is rank 7th, but per person military spending is the highest. This is because it's large percent of military spending in GDP, and low population.

```
population = ms/ms_pc
population
```

	2012	2013	2014	2015	2016	2017
Country						
Australia	22.8218	23.1507	23.4747	23.7996	24.1258	24.4506
China, P.R.	1375.1986	1382.7932	1390.1104	1397.0286	1403.5004	1409.5174
France	63.6399	63.9199	64.1906	64.4572	64.7207	64.9795
Germany	81.0662	81.2651	81.4897	81.7078	81.9147	82.1142
Italy	59.7338	59.6680	59.5857	59.5042	59.4299	59.3599
Korea, South	49.9522	50.1692	50.3856	50.5937	50.7919	50.9822
Russian Federation	143.4206	143.5972	143.7614	143.8880	143.9645	143.9898
Saudi Arabia	29.0864	29.9445	30.7767	31.5571	32.2757	32.9382
UK	64.2503	64.6411	65.0157	65.3971	65.7886	66.1816
USA	313.3354	315.5367	317.7188	319.9292	322.1796	324.4595



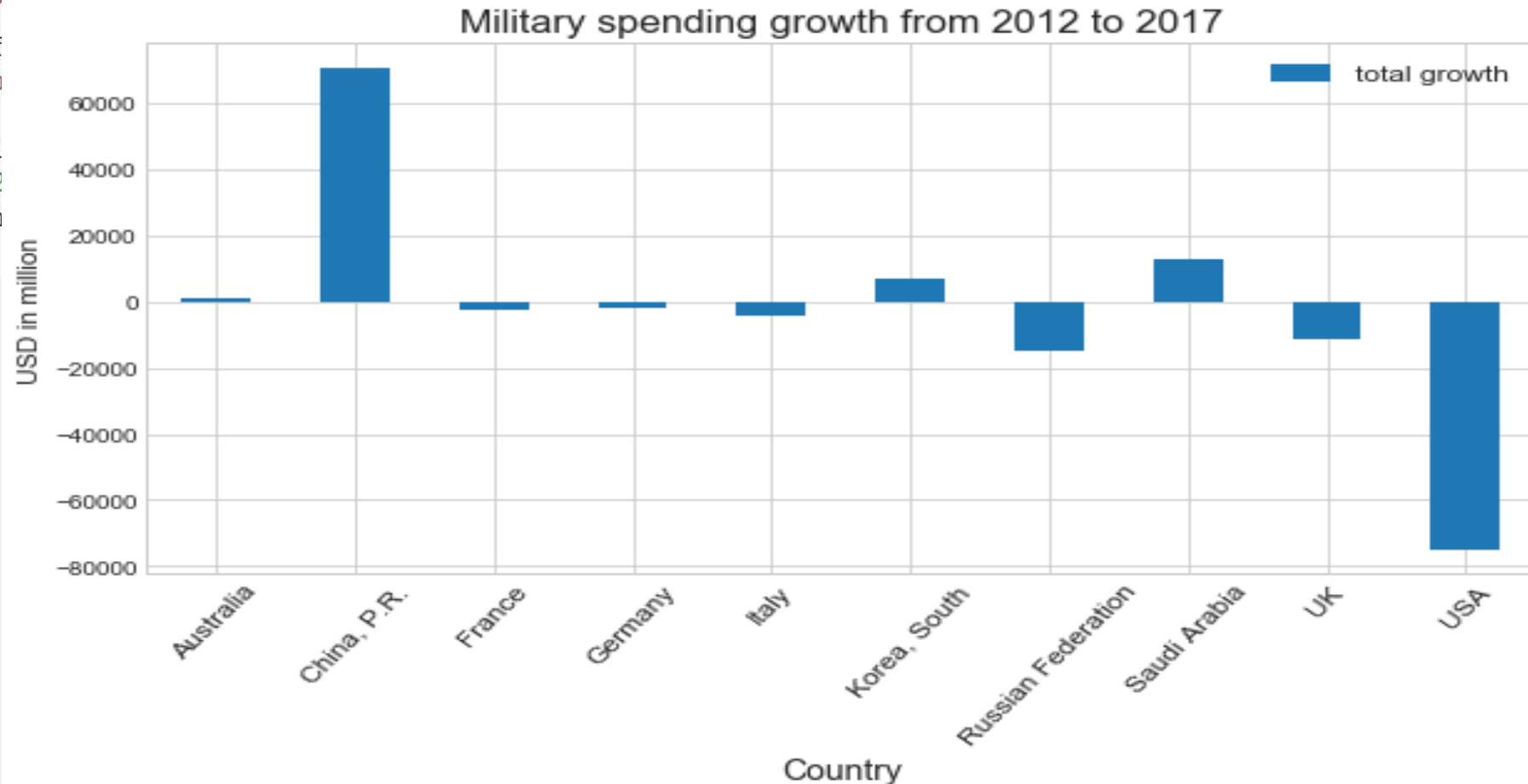
# The fastest growing countries in military spending

```
# define function to calculate the yearly military spending growth
def growth_ms(df):
    for year in range(2012, 2017, 1):
        # add growth columns
        df["growth"+str(year+1)] = df[year+1] - df[year]
    df = df.iloc[:, 6:]

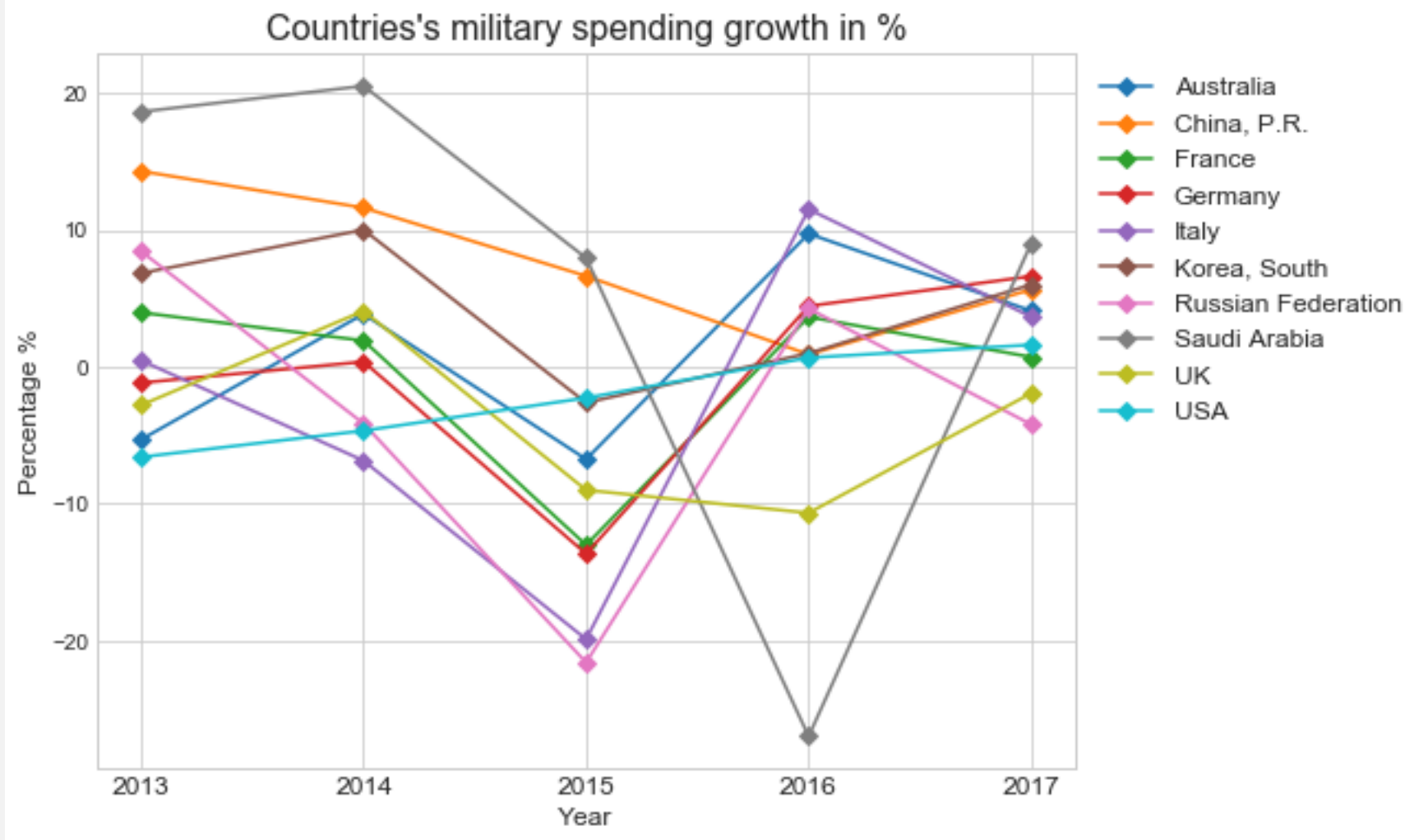
    # plot bar chart by country show yearly growth
    df.plot(figsize=(14, 6), kind="bar")
    plt.legend(bbox_to_anchor=(1, 1), f
    plt.title("Military spending growth
    plt.xlabel("Country", fontsize=14)
    plt.ylabel("USD in million", fontsi
    plt.xticks(rotation=50, fontsize=12
    plt.savefig("growth.png", bbox_inch
    plt.show()
```

- Only China has positive growth in each year.
- All the Europe countries have negative growth in year 2015. The drop of Euro is one of the main reason.

- Fastest growing country top 3 is China, Saudi Arabia, South Korea.



## *The fastest growing countries in military spending*

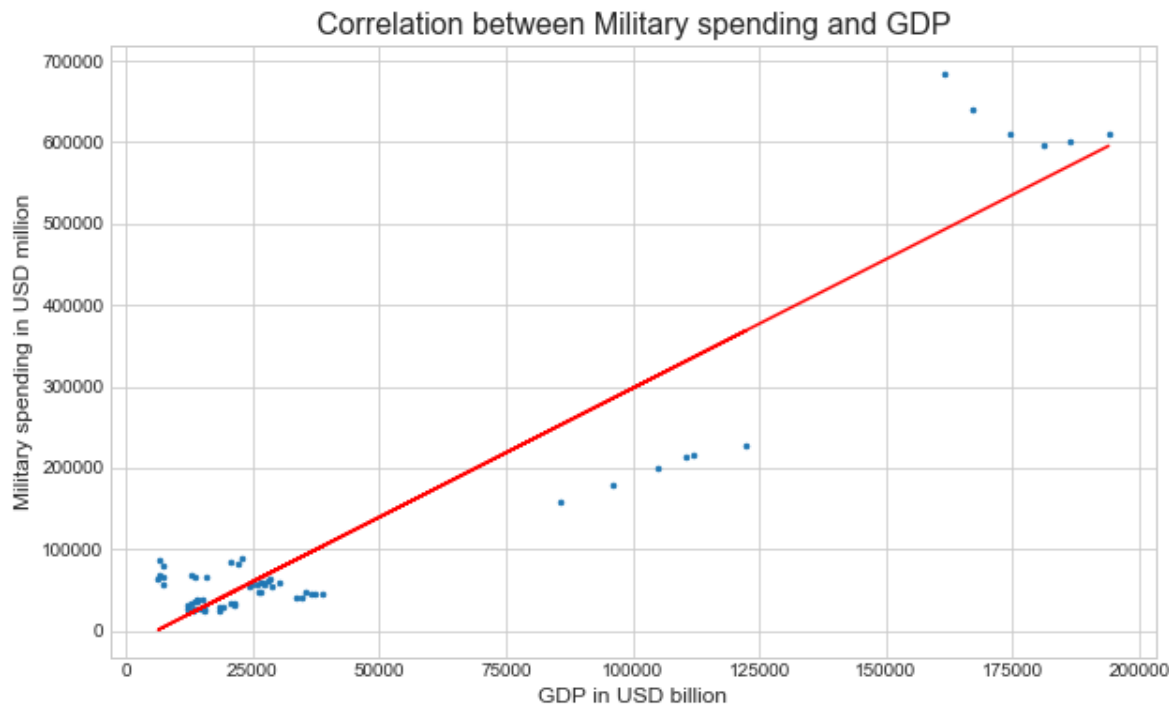


- Saudi Arabia has a significant drop of more than 25% in 2016. This is caused by the oil crunch during that period.

# Correlation and prediction

- *There is correlation between military spending and GDP.*
- $y = 3x - 19198$

```
# plot scatter to show the correlation between military spending and GDP
plt.figure(figsize = (10,6))
x1 = ms_gdp["GDP"]
y1 = ms_gdp["MS"]
plt.scatter(x1, y1, s = 6)
# polynomial of degree 1, b and m cannot exchange
b1, m1 = polyfit(x1, y1, 1)
# m is slope and b is intersect with y axis
plt.plot(x1, m1 * x1 + b1, "-", color="red")
plt.title("Correlation between Military spending and GDP", fontsize=16)
plt.xlabel("GDP in USD billion", fontsize=12)
plt.ylabel("Military spending in USD million", fontsize=12)
#plt.savefig("corr.png") #save the plots to folder
plt.show()
```





# Conclusion

- ▲ United States has the highest overall military expenditure compare with the rest of countries.
- ▼ It has experienced decreasing since 2012
- ▲ China is the fastest growing country in military total expenditure since year 2012.
- ▼ Per capita military spending is the lowest due to large population size.
- ▲ Saudi Arabia spend the most percentage of Gross Domestic Product (GDP) in Military Spending.
- ▼ Economy highly rely on petroleum exporting and insufficient civil budget may cause problems if continue burden such amount on military spending.

**THANK YOU**

# REFERENCE

Cawis, J. (2016), Total World Military Spending Hits \$1.7 Trillion In 2015: Here's A List Of The Top 15 Spenders, Tech Times. Access at <  
<https://www.techtimes.com/articles/147652/20160408/total-world-military-spending-hits-1-7-trillion-in-2015-heres-a-list-of-the-top-15-spenders.htm>>

Cordesman, A. (2018), Military Spending: The Other Side of Saudi Security, CSIS. Access at <  
<https://www.csis.org/analysis/military-spending-other-side-saudi-security>>