Impact of the Age Dependency on the Gross National Income in the Arab World

Dataset

Dataset used to perform analysis:

- World Development Indicators Dataset
- Data Source URL:
  https://www.kaggle.com/worldbank/world-development-indicators

Motivation / Background Information I

- Arab World consist of 22 states of the Middle East and Norther Africa.
- The population of the Arab World comprises of 422 Mio inhabitants, i.e. of 17.7% of the total Earth population
- The economy of the Arab World belongs to the strongest and most quickly developing economies of the World despite the Arab Spring in 2010 – 2011 and the resulting military conflicts in Syria, Libya and Somalia being a failed state.
- The GDP of Arab World is 6.601 Billion $US as for 2016

Source: www.wikipedia.org

Motivation / Background Information II

- ***Gross national income GNI*** - way to measure economic development alternatively to GDP

- ***GNI = GDP + Money flowing from foreign countries – Money flowing to foreign countries***

- GNI denotes the total domestic and foreign output claimed by residents of a country

Motivation / Background Information III

- ***Age dependency ratio*** denotes the ratio between all people who do NOT participate in the labour force (aged 0 – 14 and 65+) and people who are a part of the labour force (aged 15 – 64)

$$Age\ dependecy\ ratio = \frac{\#\ of\ people\ aged\ 0\ -14\ and\ 65+}{\#\ of\ people\ aged\ 15\ -\ 64} \cdot 100\%$$

Source: www.wikipedia.org

Motivation / Background Information IV

- In this study, we consider the development of GNI in the Arab World to prove the following hypothesis

- ***Hypothesis:*** *lower age dependency ratio has a positive impact on the level of GNI in the Arab World. This is because more people participate in the labour force and thus in the generation of GNI.*

- Vice versa, this means that higher dependency ratio has a negative impact on GNI because less people participate in the labour farce

Research Question + Method

- ***Research Quesiton:*** Is the hypothesis stating that a lower age dependency ratio has a positive impact on the level of GNI in the Arab World right?

- ***Method:*** The GNI as well as the age dependecy of the Arab world is investigated over the period from 1960 to 2015 to answer the research question

Findings I

As Fig. 1 shows, the hypothesis that lower age dependency has a positive impact on the development of GNI turns out to be right.

Indeed, the decrease of the age dependency between 1980 and 2010 coincides with a (steep) increase of the gross national income GNI.

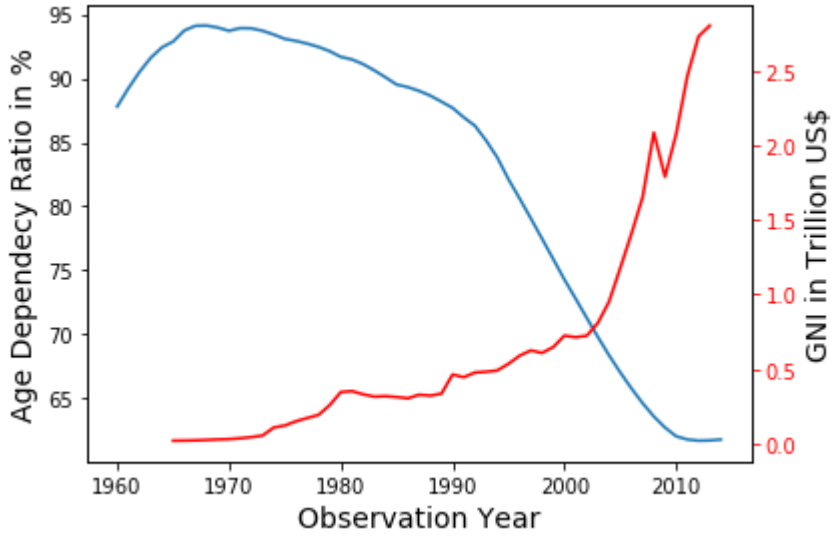


Fig. 1: Age dependency ratio (blue curve) in the Arab World in comparison with the GNI development (red curve) over the period of time of 1960 – 2015

Findings II

However: The steep decrease of the age dependency between 1980 and 2010 is surprising and requires further investigations since it might have either a positive or negative impact on the GNI development in (near) future.

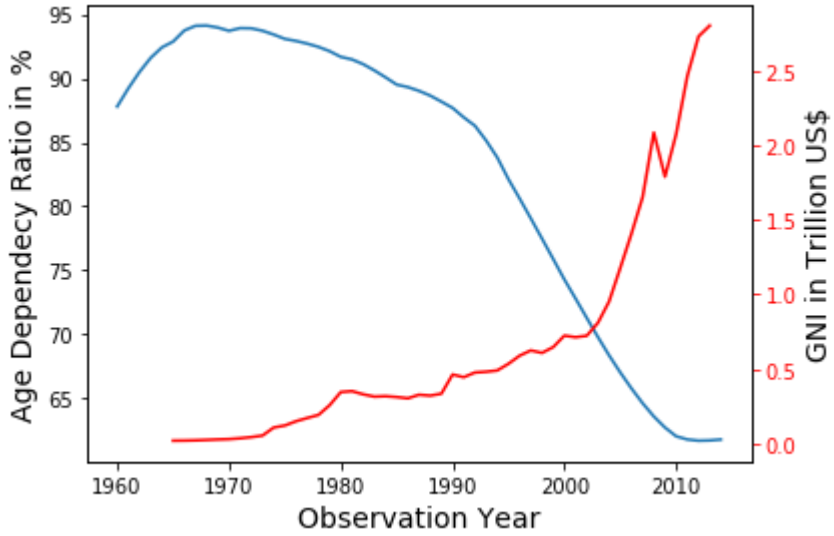


Fig. 1: Age dependency ratio (blue curve) in the Arab World in comparison with the GNI development (red curve) over the period of time of 1960 – 2015

Additional Studies and Findings I

Three ways why the age dependency might decrease:

- Less people aged 65+ => positive impact on the GNI development in near future because there are less people to take expensive health care of
- Less people aged 0 – 14 => negative impact on the GNI development in near future because less people will be available as labour force in 5 – 15 years
- Less people aged both, 65+ and 0 – 14, => the impact on the GNI development depends on the proportion of elderly and young people

Additional Studies and Findings II

Fig. 2 shows that the age dependency ratio of elderly people remains approximately constant over the considered period of time. Accordingly, the impact of the age dependency ratio of elderly people on the GNI remains also constant and can be excluded from consideration.

However: the drop of the age dependency ratio of young people specifically between 1980 and 2010 is worrying and requires further studies!!!

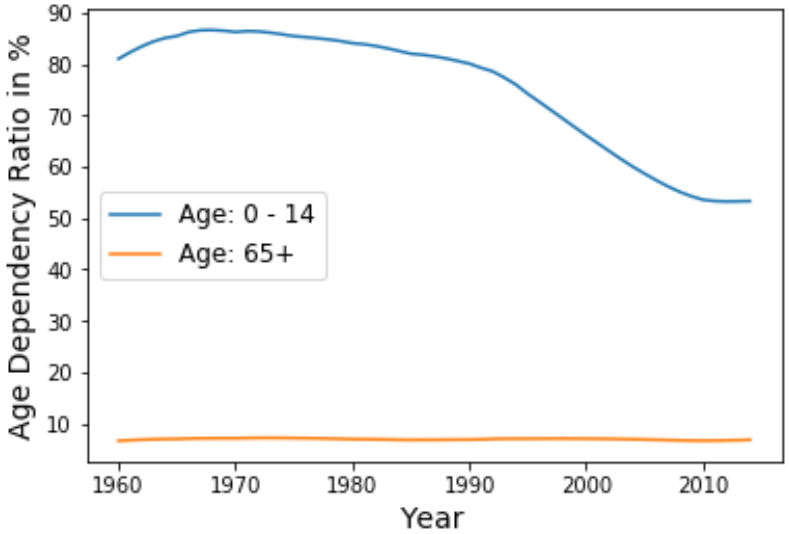


Fig. 2: Age dependency ratio of young people (blue curve) in comparison with age dependency of old people (orange curve) over the period of time of 1960 – 2015

Additional Studies and Findings III

Fig. 3 shows the percentage of young, middle-age, and elderly people.
The decrease of the young part of the population between 1980 – 2010 coincides with the increase of the middle-age people.

This *suggests* that the birth rate has drastically declined in this period of time. It is noticeable that people born between 1980 and 1990 entered the productive age after 1990 which cause the increase of the middle-age and decrease the young part of the population.

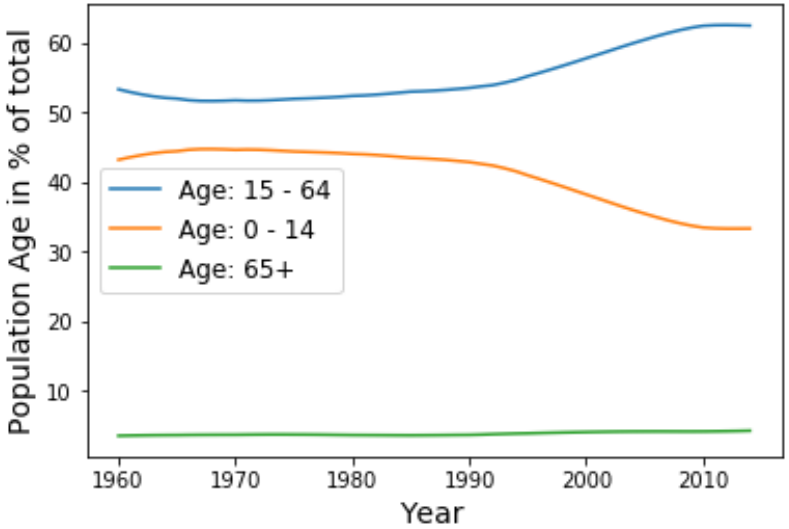


Fig. 3: Percentage of elder people (green curve), labour force participants (blue curve), and young people (orange curve) in the Arab World over the period of 1960 and 2015

Additional Studies and Findings IV

⇒ *Negative* Impact on GNI in the Arab World in near future!!!

⇒ This is because there will be less people participating in the labour force and contributing to GNI in 5 – 15

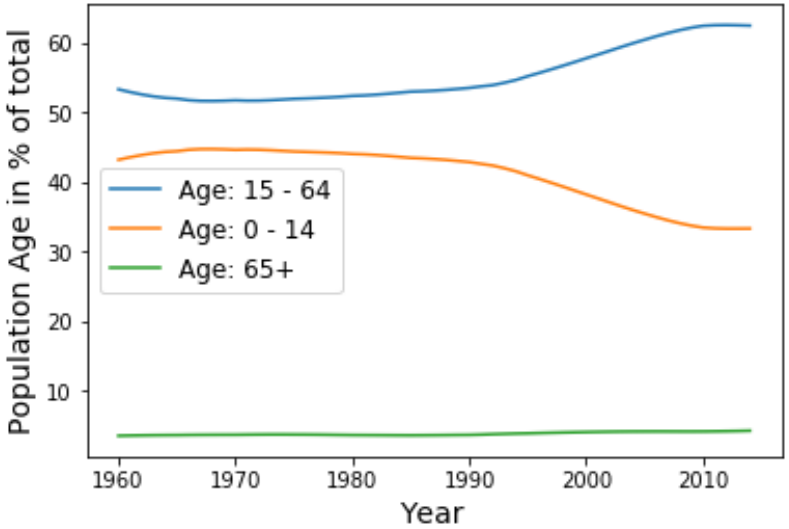


Fig. 3: Percentage of elder people (green curve), labour force participants (blue curve), and young people (orange curve) in the Arab World over the period of 1960 and 2015

Summary

- The hypothesis that lower age dependency ratio has a positive impact on the level of GNI in the Arab World is proven

- However: this does NOT necessary imply a positive impact in near future: if the contribution of young people (aged 0 – 14) to the age dependency ratio is low, less people will participate in the labour force in 5 – 15 years which will have a negative impact on the GNI development

- Our studies show that there has been a decline of young people in the population and age dependency ratio in the Arab World between 1980 – 2010 suggesting a decline of the birth rate in this period of time. This might result in a slowdown or even stagnation of the GNI development in near future UNLESS the governments of the Arab World countries undertake some action to increase the birth rate and, thus, the young people population.

- Examples of such action might be the resolution of military conflicts in Syria, Libya, establishment of a functioning government in Somalia, and democratisation processes in all countries of the Arab World.

Thanks a lot for your attention!!! ☺

Data Exploration with Pandas and Matplotlib

Introduction

Hypothesis to prove: lower age dependency ratio has a positive impact on the level of GNI in the Arab World. This is because more people participate in the labour force and thus in the generation of GNI

In [131]:
```
import pandas as pd
import numpy as np
import random
import matplotlib.pyplot as plt
```

Loading data and filtering data

In [5]:
```
data_tot = pd.read_csv('./Notebooks/Week5-Visualization/Indicators.csv')
data_tot.shape
```

Out[5]: (5656458, 6)

In [6]:
```
data_tot.head()
```

Out[6]:

	CountryName	CountryCode	IndicatorName	IndicatorCode	Year	Value
0	Arab World	ARB	Adolescent fertility rate (births per 1,000 wo...	SP.ADO.TFRT	1960	1.335609e+02
1	Arab World	ARB	Age dependency ratio (% of working-age populat...	SP.POP.DPND	1960	8.779760e+01
2	Arab World	ARB	Age dependency ratio, old (% of working-age po...	SP.POP.DPND.OL	1960	6.634579e+00
3	Arab World	ARB	Age dependency ratio, young (% of working-age ...	SP.POP.DPND.YG	1960	8.102333e+01
4	Arab World	ARB	Arms exports (SIPRI trend indicator values)	MS.MIL.XPRT.KD	1960	3.000000e+06

In [13]:
```
# Data filtered for Arab World

arab = data_tot[data_tot['CountryCode'] == 'ARB']
arab.shape
arab.head()
```

Out[13]:

	CountryName	CountryCode	IndicatorName	IndicatorCode	Year	Value
0	Arab World	ARB	Adolescent fertility rate (births per 1,000 wo...	SP.ADO.TFRT	1960	1.335609e+02
1	Arab World	ARB	Age dependency ratio (% of working-age populat...	SP.POP.DPND	1960	8.779760e+01
2	Arab World	ARB	Age dependency ratio, old (% of working-age po...	SP.POP.DPND.OL	1960	6.634579e+00
3	Arab World	ARB	Age dependency ratio, young (% of working-age ...	SP.POP.DPND.YG	1960	8.102333e+01
4	Arab World	ARB	Arms exports (SIPRI trend indicator values)	MS.MIL.XPRT.KD	1960	3.000000e+06

In [28]:
```
# Observation time range
start = arab['Year'].min()
end = arab['Year'].max()
unique_years = arab['Year'].unique()

print('Observation begins: ' + str(start))
print('Observation ends: ' + str(end))
print('Total number of unique observation sets: ' + str(len(unique_years)))

type(arab[arab['IndicatorCode'] == 'SP.POP.DPND'].values)
```

```
Observation begins: 1960
Observation ends: 2015
Total number of unique observation sets: 56
```

Out[28]:
```
numpy.ndarray
```

Age Dependency in the Arabic World

Claim: Dependent part of the population ages between 0 and 14 and 65+ and does not actively participate in the labor force and accordingly does not contribute to the GDP development.

In [33]:
```
# Age Dependency
depend = arab[arab['IndicatorCode'] == 'SP.POP.DPND']
depend.shape                                                    # Problem: Nicht jedes Jah
r hat eine Beobachtung
depend.head()
```

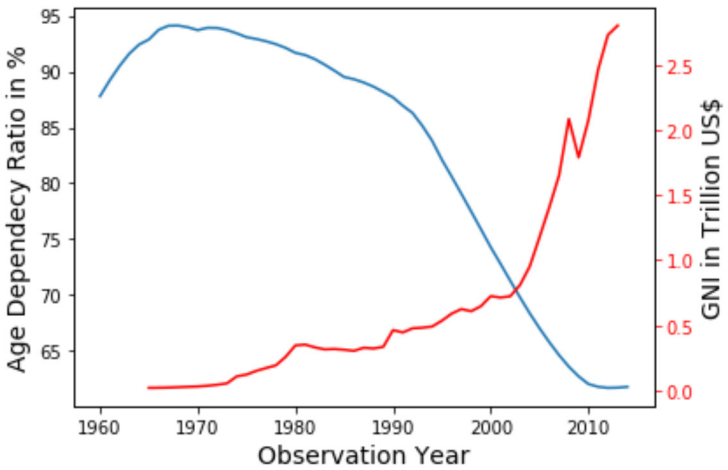
Out[33]:

	CountryName	CountryCode	IndicatorName	IndicatorCode	Year	Value
1	Arab World	ARB	Age dependency ratio (% of working-age populat...	SP.POP.DPND	1960	87.797601
23189	Arab World	ARB	Age dependency ratio (% of working-age populat...	SP.POP.DPND	1961	89.220621
49806	Arab World	ARB	Age dependency ratio (% of working-age populat...	SP.POP.DPND	1962	90.501966
78245	Arab World	ARB	Age dependency ratio (% of working-age populat...	SP.POP.DPND	1963	91.602998
106870	Arab World	ARB	Age dependency ratio (% of working-age populat...	SP.POP.DPND	1964	92.415058

In [68]:
```
# Gross national income (GNI)
filter1 = arab['IndicatorName'] == 'GNI (current US$)'
GNI = arab[filter1]
GNI.shape
```

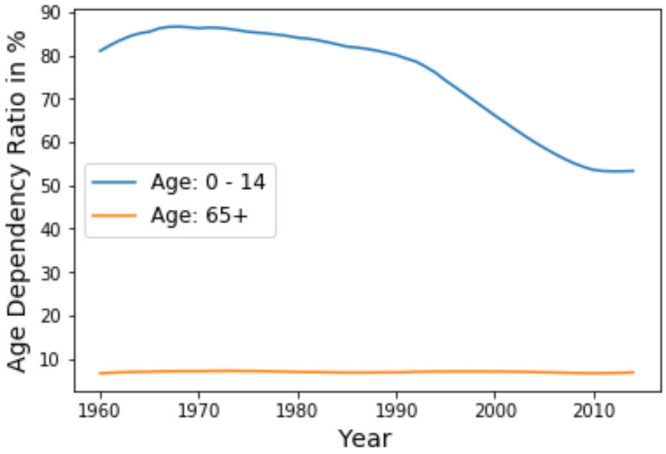
Out[68]: (49, 6)

In [92]:
```
# Plot age dependecy and GNI over time in years

%matplotlib inline

fig, ax1 = plt.subplots()
ax1.plot(depend['Year'] , depend['Value'].values)
ax1.set_xlabel('Observation Year', fontsize=14)
ax1.set_ylabel('Age Dependecy Ratio in %', fontsize=14)

ax2 = ax1.twinx()
ax2.plot(GNI['Year'] , GNI['Value'].values / 1e12, color = 'r' )
ax2.set_ylabel('GNI in Trillion US$', fontsize = 14)
ax2.tick_params('y', colors='r')

fig.tight_layout()
plt.show()

# Hypothesis proved
```



This figure proves the hypothesis stated at the beginning.

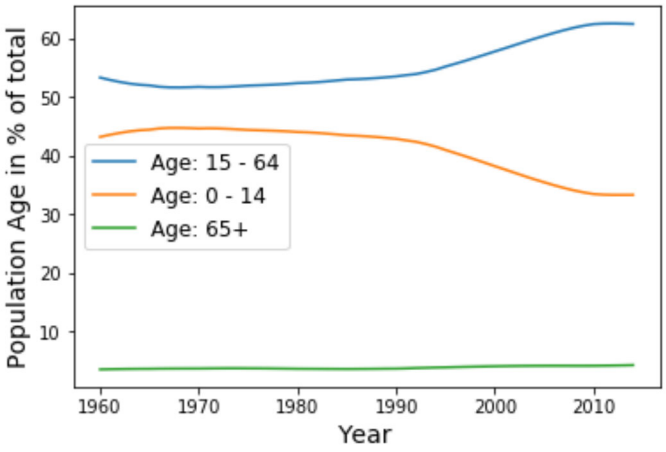
In [132]:
```
# Plot age dependency of young and old people in the Arab World

%matplotlib inline

plus65_rat = arab[arab['IndicatorName'] == 'Age dependency ratio, old (% of wor
king-age population)']
children_rat = arab[arab['IndicatorName'] == 'Age dependency ratio, young (% of
working-age population)']

plt.plot(children_rat['Year'], children_rat['Value'])
plt.plot(plus65_rat['Year'], plus65_rat['Value'])

plt.xlabel('Year', fontsize = 14)
plt.ylabel('Age Dependency Ratio in %', fontsize = 14)


plt.legend(['Age: 0 - 14', 'Age: 65+'], fontsize = 12, loc = 0)

plt.show()
```



Results:

- Age dependency of old people remains constant over the period of observation => neutral impact on the GNI development
- Age dependency of young people drops steeply between 1980 and 2010 => negative impact on the GNI development in near future because there will be no people to participate in the labour force

In [128]:
```
%matplotlib inline

plus65 = arab[arab['IndicatorName'] == 'Population ages 65 and above (% of tota
l)']
working_age = arab[arab['IndicatorName'] == 'Population, ages 15-64 (% of total
)']
children = arab[arab['IndicatorName'] == 'Population, ages 0-14 (% of total)']

plt.plot(working_age['Year'], working_age['Value'])
plt.plot(children['Year'], children['Value'])
plt.plot(plus65['Year'], plus65['Value'])

plt.xlabel('Year', fontsize = 14)
plt.ylabel('Population Age in % of total', fontsize = 14)


plt.legend(['Age: 15 - 64', 'Age: 0 - 14', 'Age: 65+'], fontsize = 12, loc = 0)

plt.show()
```



Results:

- Population part 65+ remains constant
- Decline of the population of young people in 1980 - 2010 (presumably!) due to the reduction of the birth rate
- Children born at the beginning of 80's - middle of 80-s become adults in 90's - early 2000's (increase of the middle-age population) and actively contribute to GNI