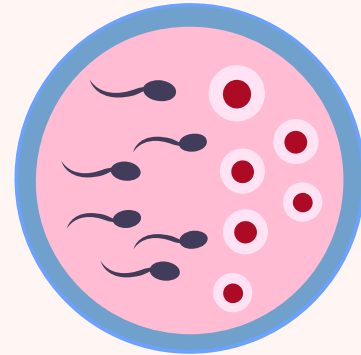


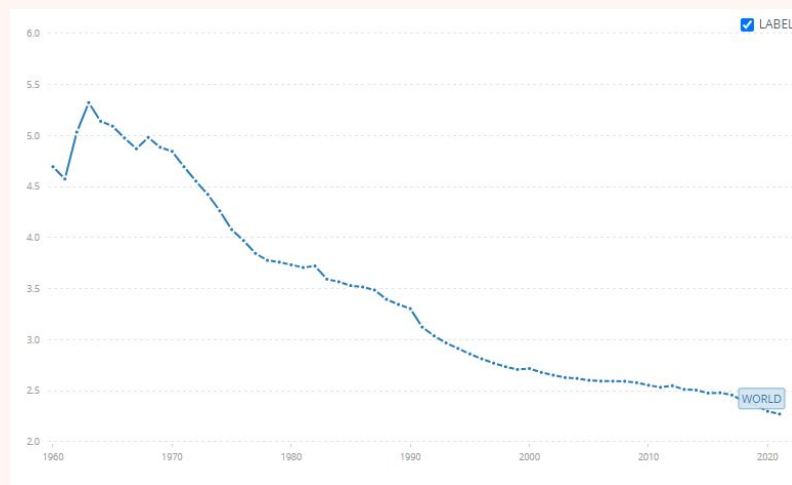
Impactions Of Global Fertility Rates

Xicheng Guo
Jintao Cao



Background

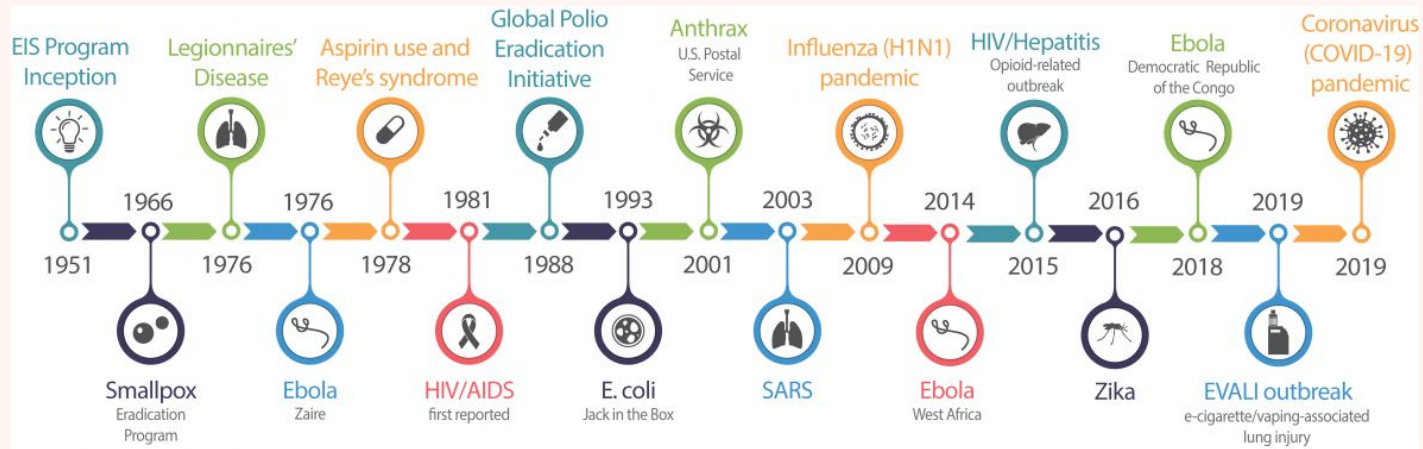
Fertility rate refers to the number of children a woman gives birth to within the age range generally recognized by medicine as suitable for childbearing. In traditional international statistical standards, the age range of women in fertility statistics is 15-49 years old



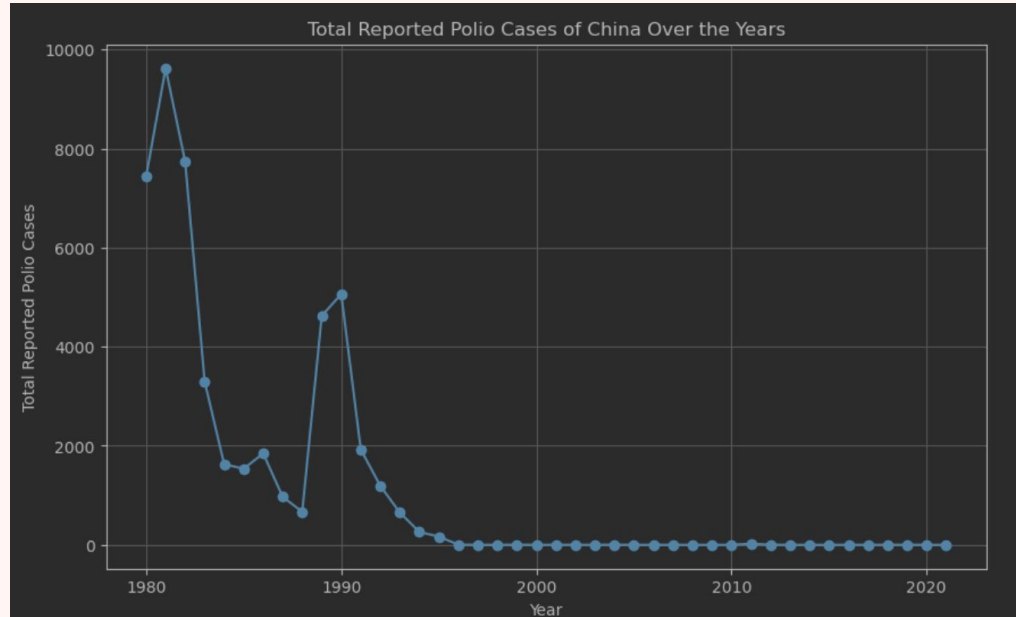
| | | | | |
|-----------------------------|------------------------------|--|----------------|------------------|
| Data Source | World Development Indicators | <null> | <unset> | <unset> |
| <null> | <unset> | <unset> | <unset> | <unset> |
| Last Updated Date | 2023-10-26 | <null> | <unset> | <unset> |
| <null> | <unset> | <unset> | <unset> | <unset> |
| Country Name | Country Code | Indicator Name | Indicator Code | 1960 |
| Aruba | ABW | Fertility rate, total (births per woman) | SP.DYN.TFRT.IN | 4.82 |
| Africa Eastern and Southern | AFE | Fertility rate, total (births per woman) | SP.DYN.TFRT.IN | 6.72412581084242 |
| Afghanistan | AFG | Fertility rate, total (births per woman) | SP.DYN.TFRT.IN | 7.282 |
| Africa Western and Central | AFW | Fertility rate, total (births per woman) | SP.DYN.TFRT.IN | 6.45844789624312 |
| Angola | AGO | Fertility rate, total (births per woman) | SP.DYN.TFRT.IN | 6.708 |
| Albania | ALB | Fertility rate, total (births per woman) | SP.DYN.TFRT.IN | 6.455 |
| Andorra | AND | Fertility rate, total (births per woman) | SP.DYN.TFRT.IN | |
| Arab World | ARB | Fertility rate, total (births per woman) | SP.DYN.TFRT.IN | 6.93433241736243 |
| United Arab Emirates | ARE | Fertility rate, total (births per woman) | SP.DYN.TFRT.IN | 6.718 |
| Argentina | ARG | Fertility rate, total (births per woman) | SP.DYN.TFRT.IN | 3.075 |
| Armenia | ARM | Fertility rate, total (births per woman) | SP.DYN.TFRT.IN | 4.786 |
| American Samoa | ASM | Fertility rate, total (births per woman) | SP.DYN.TFRT.IN | |
| Antigua and Barbuda | ATG | Fertility rate, total (births per woman) | SP.DYN.TFRT.IN | 4.692 |
| Australia | AUS | Fertility rate, total (births per woman) | SP.DYN.TFRT.IN | 3.453 |
| Austria | AUT | Fertility rate, total (births per woman) | SP.DYN.TFRT.IN | 2.49 |
| Azerbaijan | AZE | Fertility rate, total (births per woman) | SP.DYN.TFRT.IN | 5.878 |
| Burundi | BDI | Fertility rate, total (births per woman) | SP.DYN.TFRT.IN | 7.083 |
| Belgium | BEL | Fertility rate, total (births per woman) | SP.DYN.TFRT.IN | 2.54 |
| Benin | BEN | Fertility rate, total (births per woman) | SP.DYN.TFRT.IN | 6.282 |
| Benin | BFA | Fertility rate, total (births per woman) | SP.DYN.TFRT.IN | 6.248 |
| Burkina Faso | BFA | Fertility rate, total (births per woman) | SP.DYN.TFRT.IN | 6.248 |
| Burkina Faso | BFA | Fertility rate, total (births per woman) | SP.DYN.TFRT.IN | 6.248 |

Hypothesis

Epidemic diseases will reduce the total fertility rate and the trend will go back when these epidemics are gradually out of people's lives.



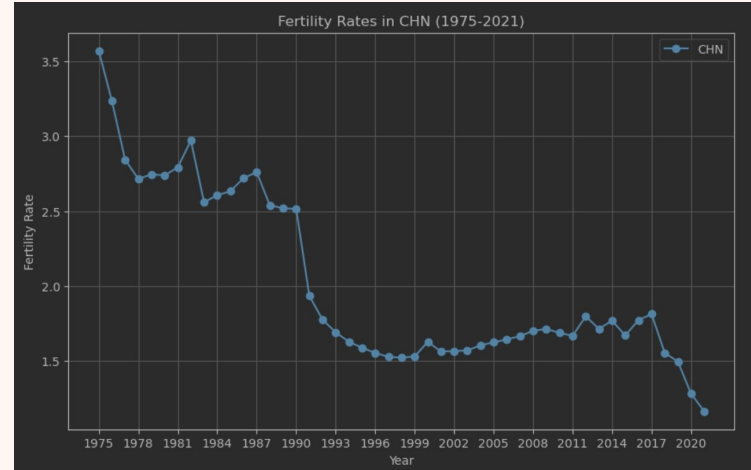
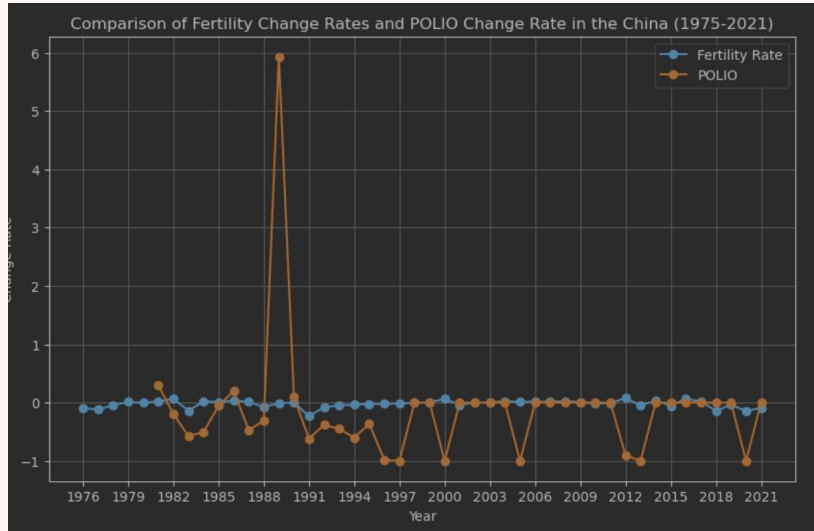
Polio(poliomyelitis)



Poliomyelitis, often just called poliomyelitis, is an infectious disease caused by the poliovirus. It is highly contagious. In China in the 1980s, the number of people infected with this disease was very high. A large proportion of these are newborn babies. However, with the subsequent spread of the vaccine, the number of polio infections gradually dropped to zero.

China's Fertility Rates

Comparison



Change Rate

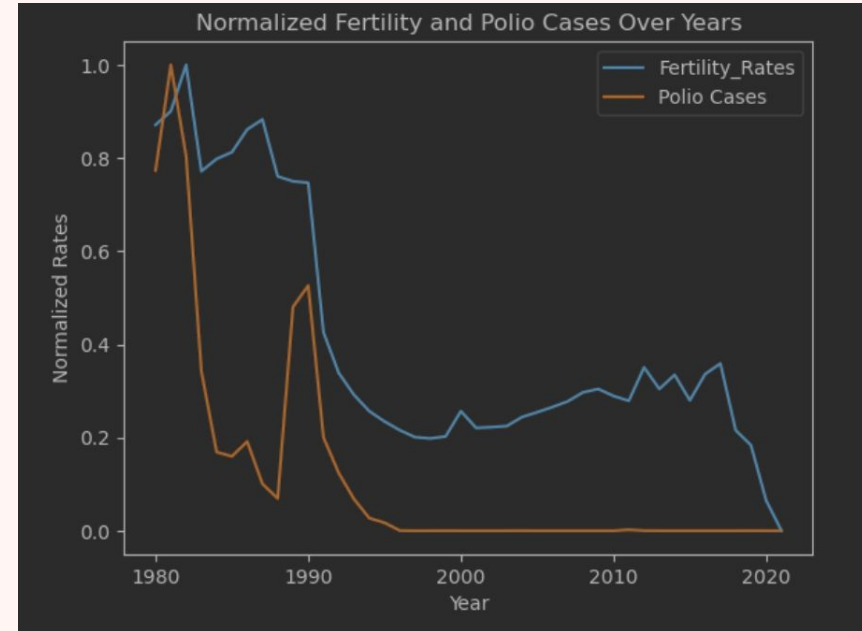
```
change_rate = (value - previous_value) / previous_value
```

Comparison

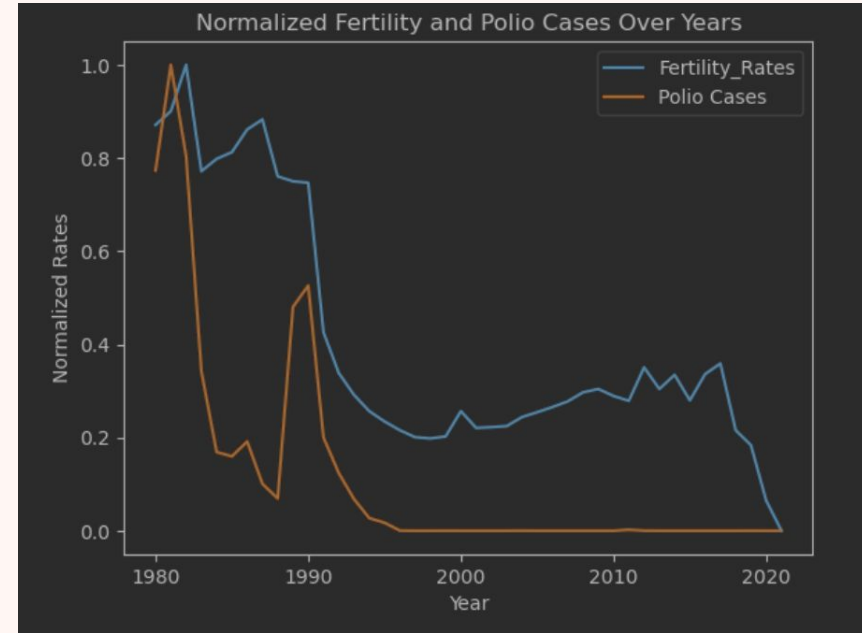
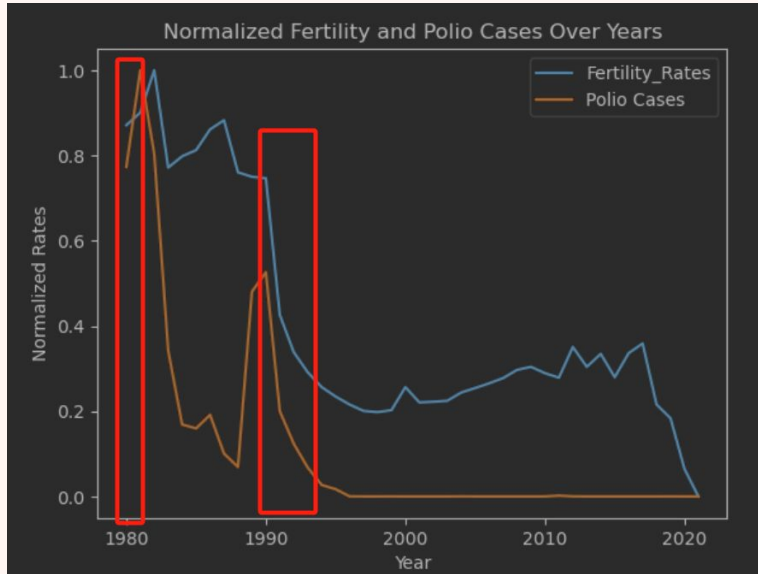
Normalization

Normalization Formula

$$X_{\text{normalized}} = \frac{(X - X_{\text{minimum}})}{(X_{\text{maximum}} - X_{\text{minimum}})}$$



Comparison

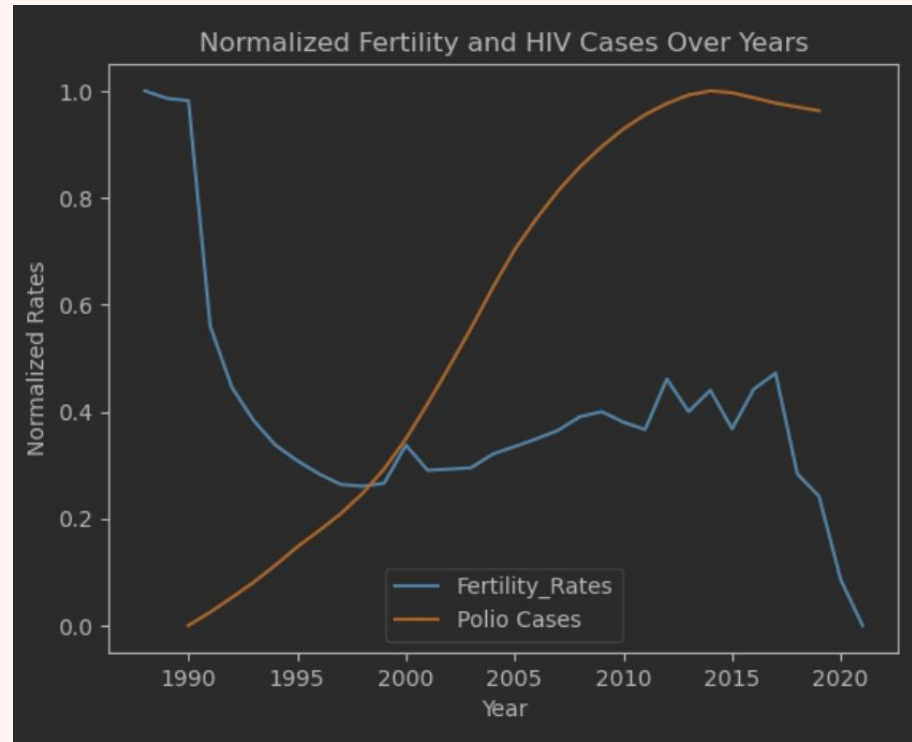


HIV



HIV (Human Immunodeficiency Virus) is a virus that attacks cells that help the body fight infections, making people more susceptible to other infections and diseases. It is spread through contact with certain body fluids of a person with HIV, most commonly during unprotected sex.

Comparison



COVID -19

China

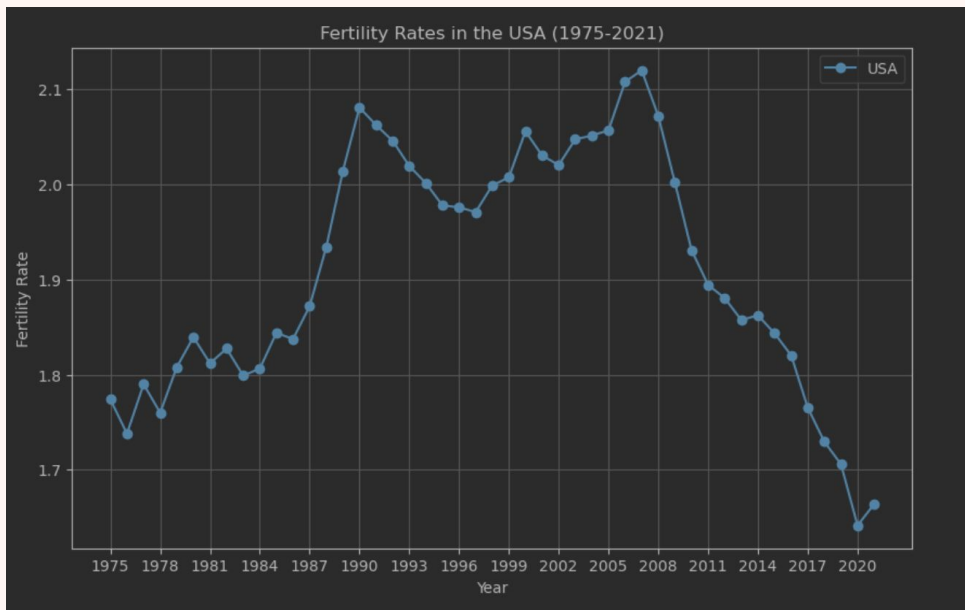
99319858 cases

| | | | | | | |
|-----------|----|-------|------|----|----|---|
| 1/3/2020 | CN | China | WPRO | 0 | 0 | 0 |
| 1/4/2020 | CN | China | WPRO | 1 | 1 | 0 |
| 1/5/2020 | CN | China | WPRO | 0 | 1 | 0 |
| 1/6/2020 | CN | China | WPRO | 3 | 4 | 0 |
| 1/7/2020 | CN | China | WPRO | 0 | 4 | 0 |
| 1/8/2020 | CN | China | WPRO | 0 | 4 | 0 |
| 1/9/2020 | CN | China | WPRO | 0 | 4 | 0 |
| 1/10/2020 | CN | China | WPRO | 0 | 4 | 0 |
| 1/11/2020 | CN | China | WPRO | 0 | 4 | 0 |
| 1/12/2020 | CN | China | WPRO | 41 | 45 | 1 |

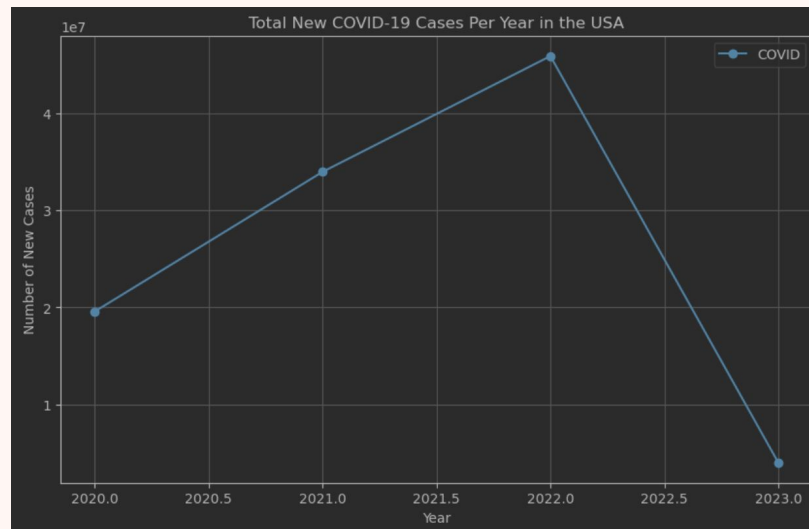
USA

103436829 cases

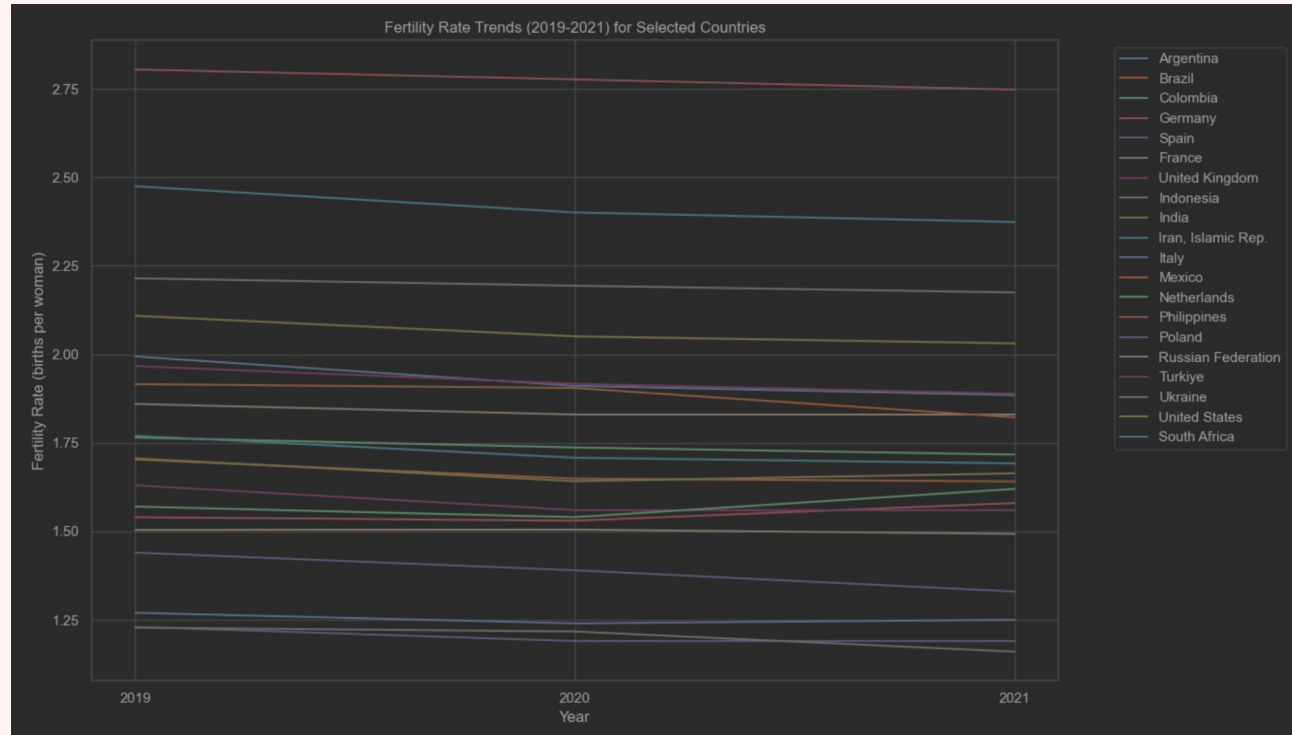
USA's Fertility Rates



USA's COVID Cases



Top 20 countries with the highest number of COVID Cases during 2021–2022



Top 20 countries with the highest number of COVID Cases during 2021–2022

Fertility Rate Increase Or Remain Unchanged

| 4 rows × 3 columns pd.DataFrame | | | |
|---------------------------------|---------------|--------|-------|
| | Country Name | 2020 | 2021 |
| 0 | Germany | 1.5300 | 1.580 |
| 1 | Italy | 1.2400 | 1.250 |
| 2 | Netherlands | 1.5400 | 1.620 |
| 3 | United States | 1.6415 | 1.664 |

| | | | |
|---|----------------|-----------|----------|
| 4 | Spain | -0.032520 | 0.000000 |
| 5 | France | -0.016129 | 0.000000 |
| 6 | United Kingdom | -0.042945 | 0.000000 |

Top 20 countries with the highest number of COVID Cases during 2021–2022

Fertility rate decrease (deceleration)

```
countries_decreased_slower = df_countries[
    (df_countries['Change Rate 2019-2020'] < 0) &
    (df_countries['Change Rate 2020-2021'] < 0) &
    (df_countries['Change Rate 2019-2020'] < df_countries['Change Rate 2020-2021'])
]
countries_decreased_slower[['Country Name', 'Change Rate 2019-2020', 'Change Rate 2020-2021']]
Executed at 2023.12.04 21:40:32 in 80ms
```

< < 8 rows > > 8 rows × 3 columns [pd.DataFrame](#)

| | Country Name | Change Rate 2019-2020 | Change Rate 2020-2021 |
|-----|--------------------|-----------------------|-----------------------|
| 9 | Argentina | -0.041625 | -0.013605 |
| 29 | Brazil | -0.031709 | -0.004851 |
| 45 | Colombia | -0.015864 | -0.011514 |
| 106 | Indonesia | -0.009481 | -0.008660 |
| 109 | India | -0.027501 | -0.009751 |
| 112 | Iran, Islamic Rep. | -0.035028 | -0.009368 |
| 244 | Turkiye | -0.025419 | -0.014606 |
| 263 | South Africa | -0.029899 | -0.011245 |

Top 20 countries with the highest number of COVID Cases during 2021-2022

Fertility rate decrease (acceleration)

```
countries_decreased_faster = df_countries[
    (df_countries['Change Rate 2019-2020'] > df_countries['Change Rate 2020-2021'])
]
countries_decreased_faster[['Country Name', 'Change Rate 2019-2020', 'Change Rate 2020-2021']]
```

Executed at 2023.12.04 21:40:32 in 8ms

5 rows × 3 columns [pd.DataFrame](#)

| | Country Name | Change Rate 2019-2020 | Change Rate 2020-2021 |
|-----|--------------------|-----------------------|-----------------------|
| 154 | Mexico | -0.005741 | -0.043570 |
| 187 | Philippines | -0.009982 | -0.010443 |
| 190 | Poland | -0.034722 | -0.043165 |
| 202 | Russian Federation | 0.000665 | -0.007973 |
| 248 | Ukraine | -0.008958 | -0.046836 |

Result for Hypothesis one

Polio ✕

HIV ✕

COVID ✕

Epidemic will **not** reduce the total fertility rate and the trend will go back when these epidemics are gradually out of people's lives.

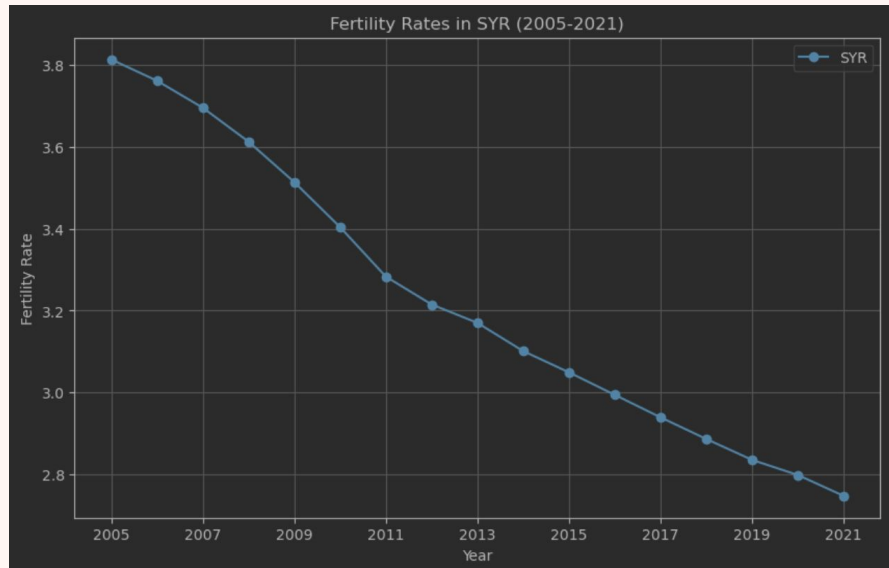
Hypothesis

War or riots will affect the fertility rate to a certain extent. War will increase the death rate in war-torn countries. We believe that the increase in death rate will lead to a decrease in fertility, but this decrease in fertility is phased and will rebound after the war.

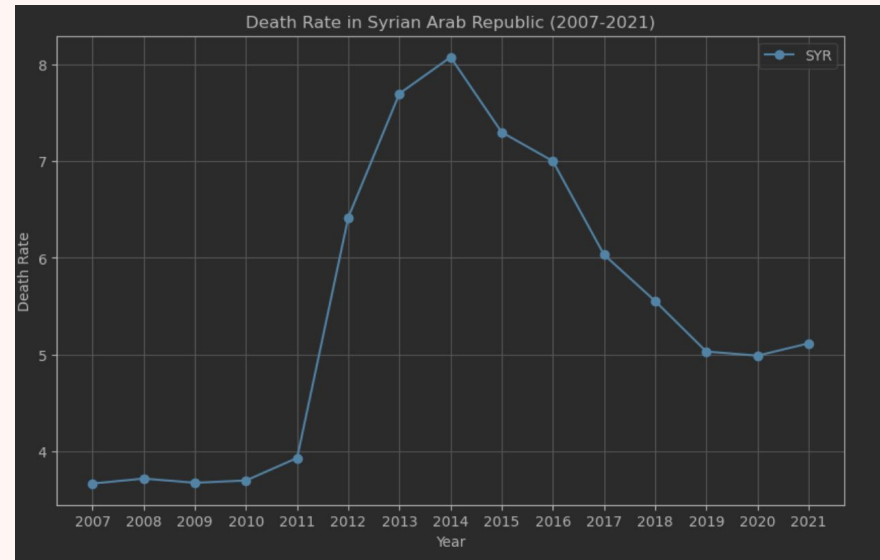


Syrian Civil War(2011-now)

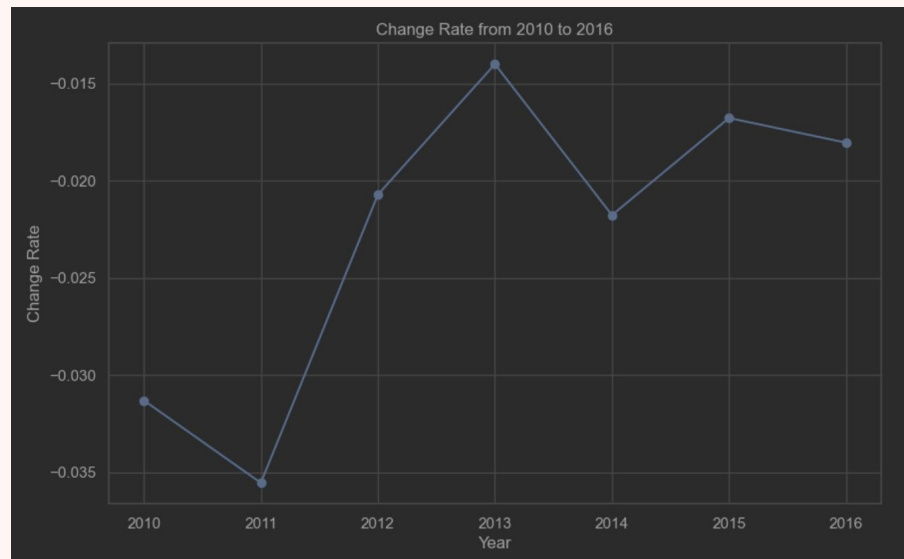
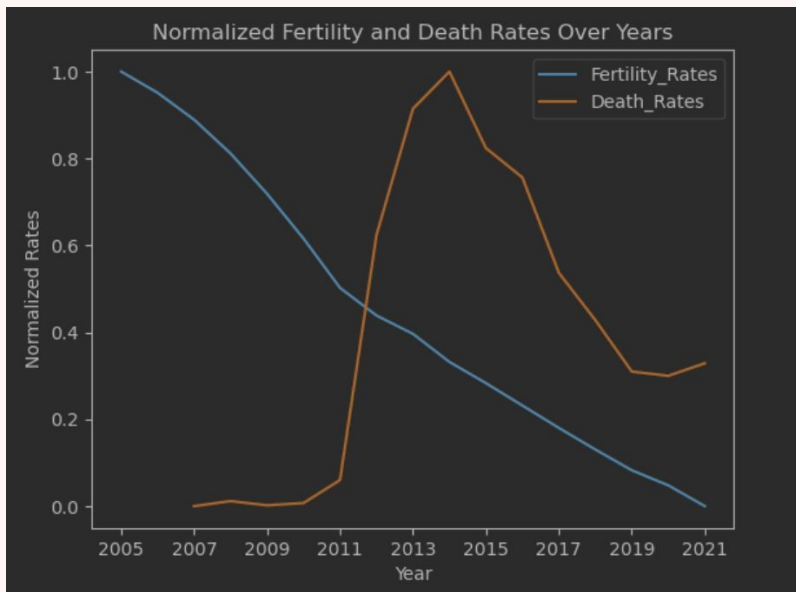
Syrian Fertility Rates



Syrian Death Rates

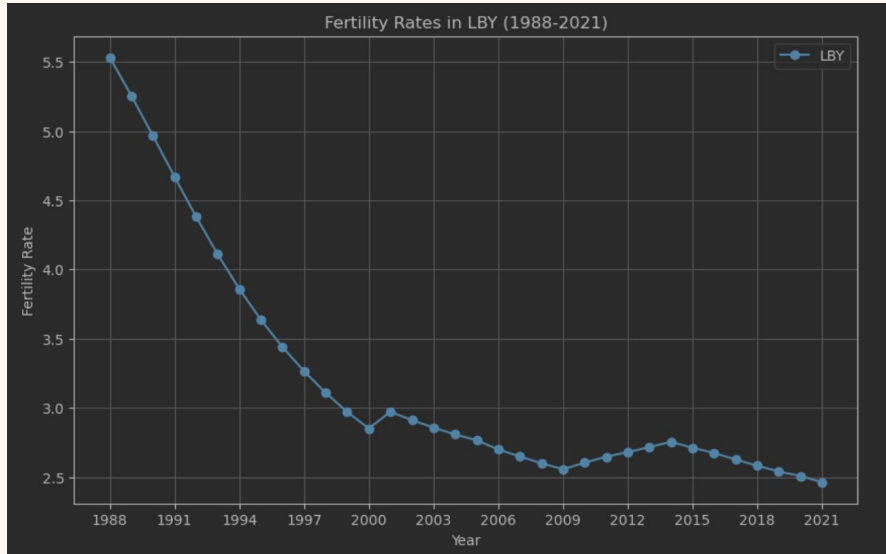


Comparison

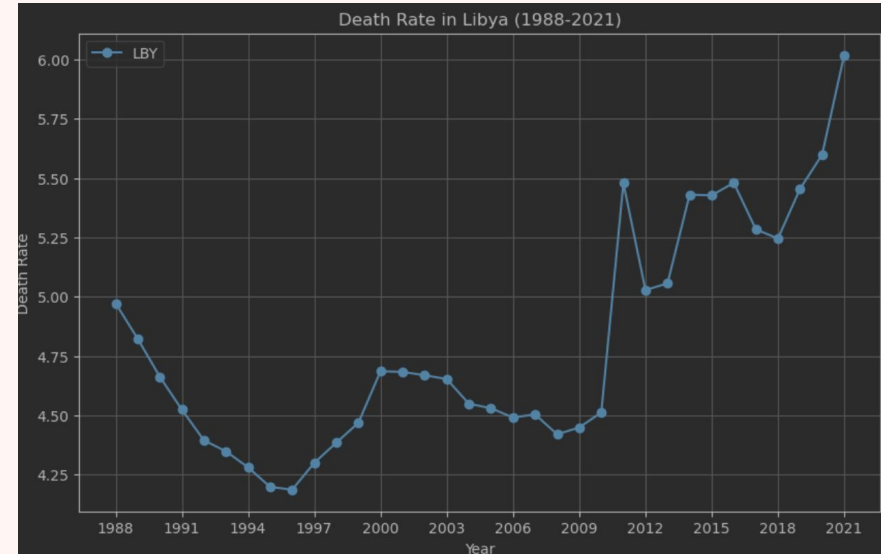


Libyan Civil War

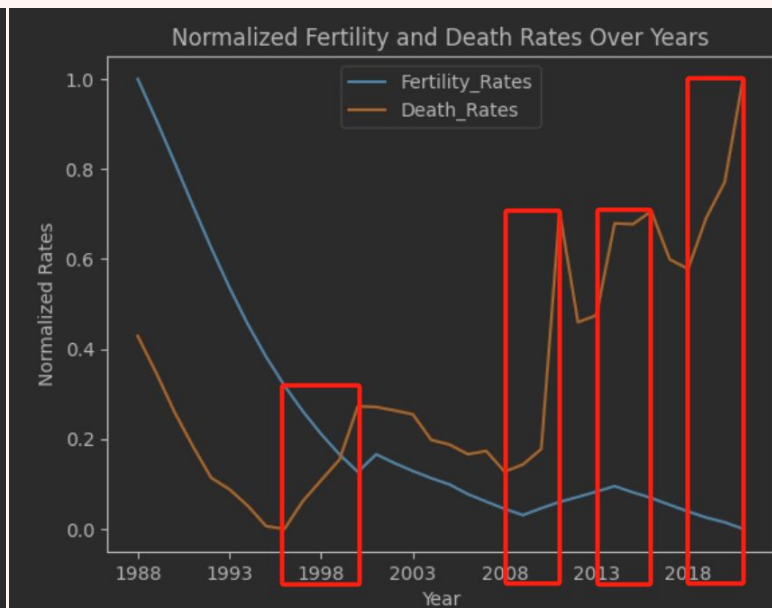
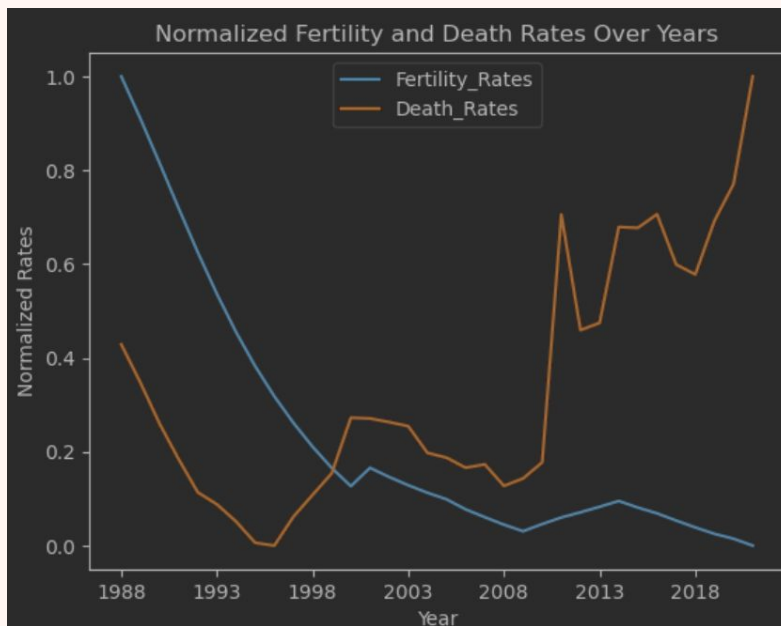
Libyan Fertility Rates



Libyan Death Rates

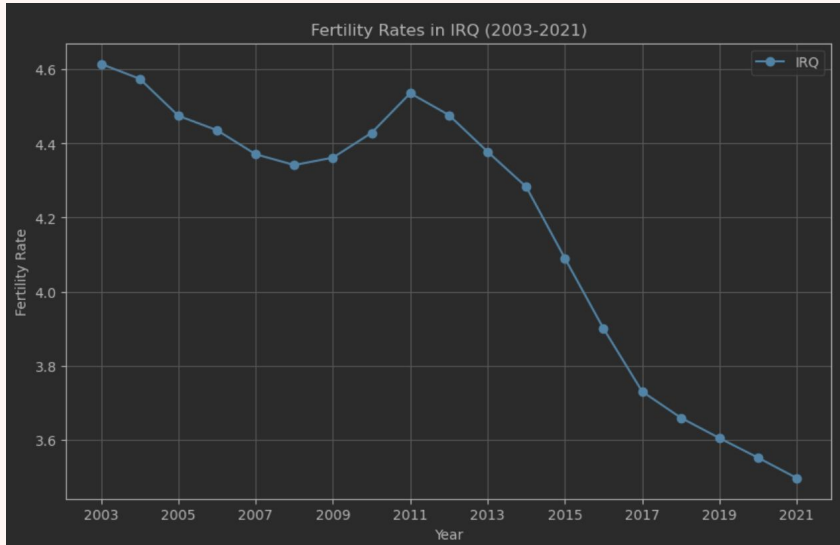


Comparison

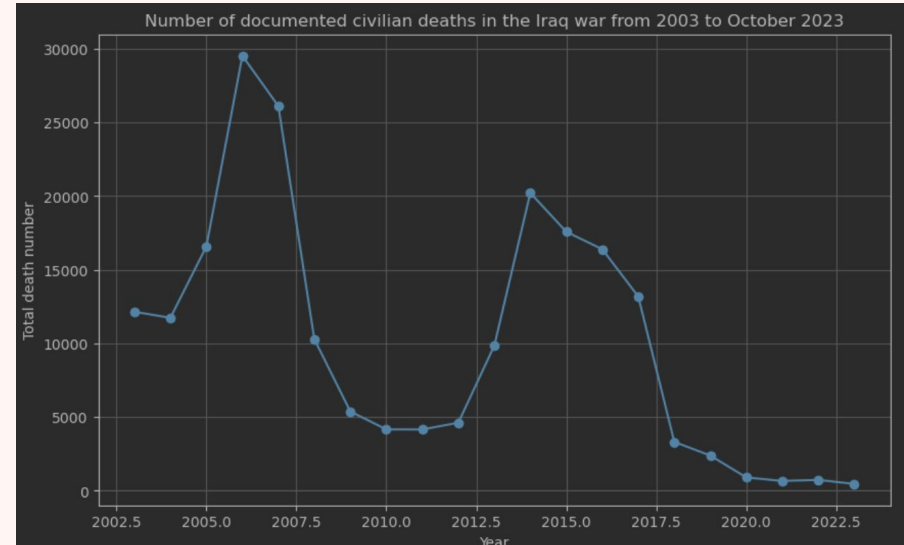


Iraq War(2003-2012)

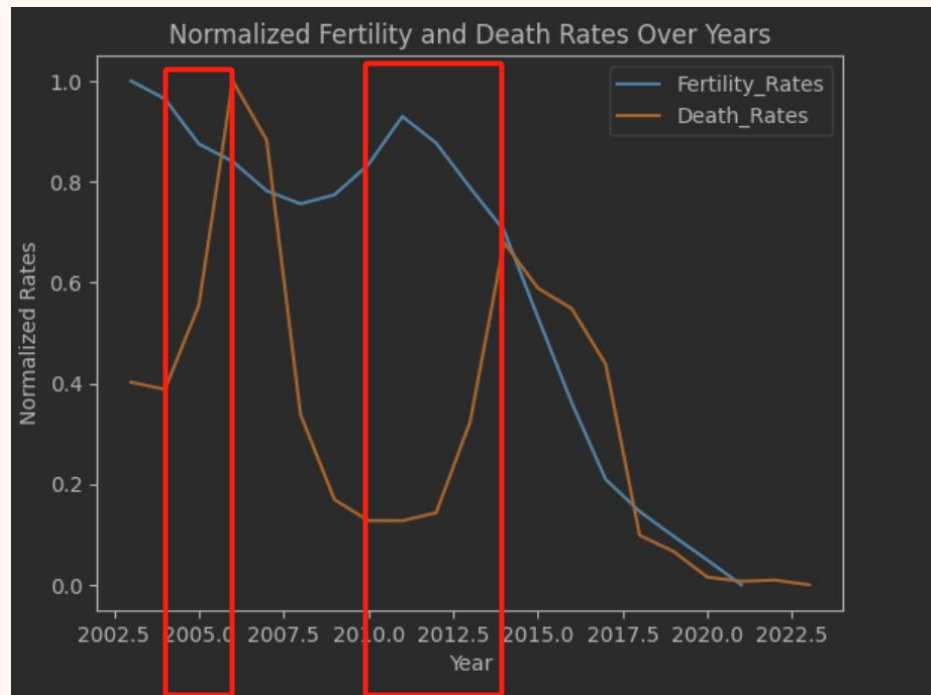
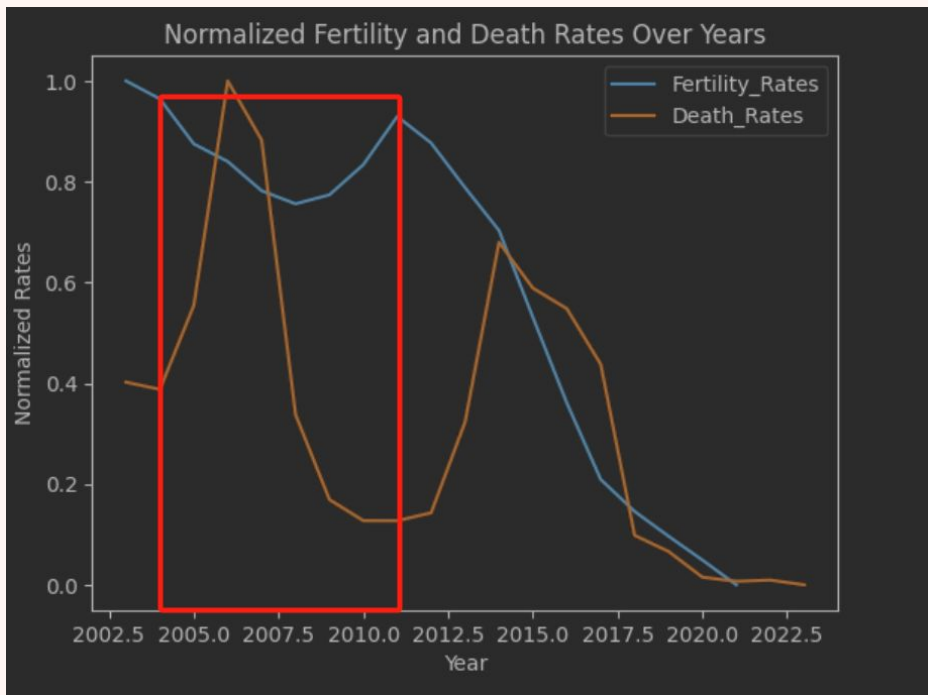
Iraq Fertility Rates



Iraq Death Rates

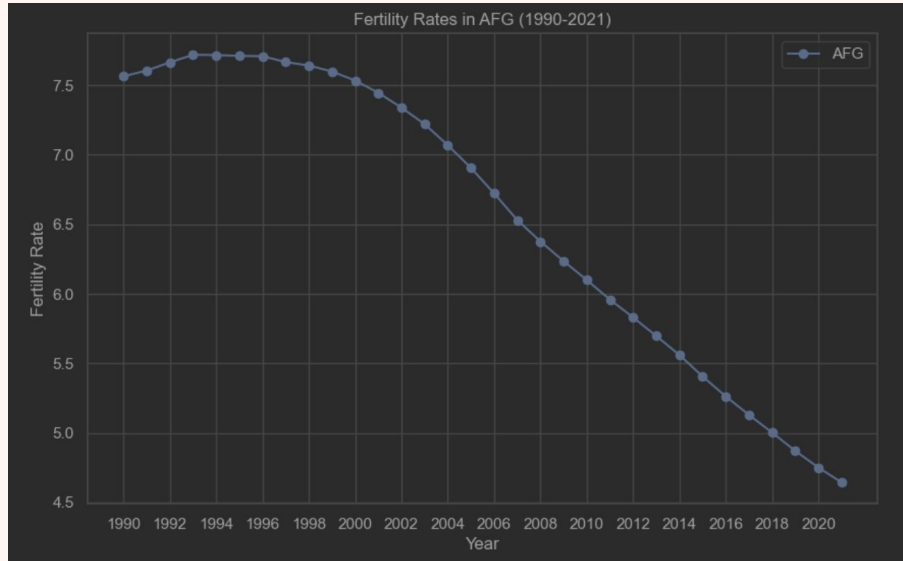


Comparison

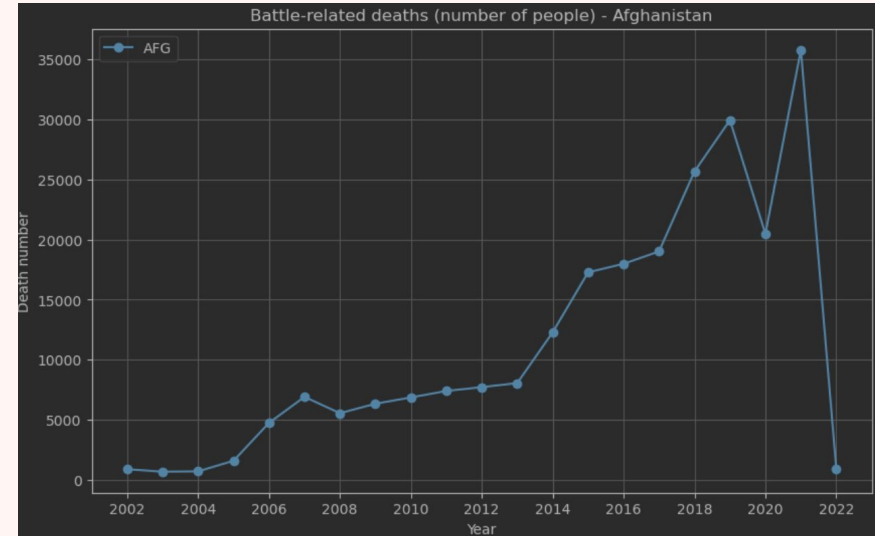


Afghan Civil War(2001-2021)

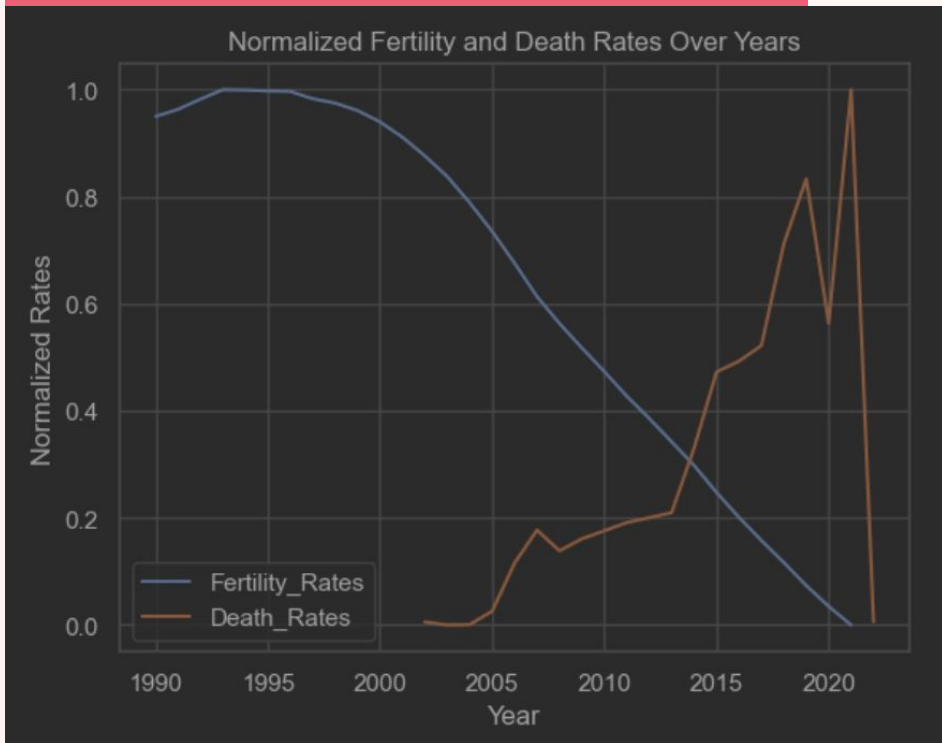
Afghan Fertility Rates



Afghan Death Rates



Comparison



Result for Hypothesis two

| War-torn Country | Death Rate | Fertility Rate |
|------------------|--|--|
| Syrian | Increase at first and then decrease | Continuous decrease |
| Libyan | Overall continued to increase | Continuous decrease |
| Iraq | Increase at first and then decrease ; decrease after the war | Decrease at first and then Increase ; decrease after the war |
| Afghan | Overall continued to increase | Continuous decrease |

War will increase the mortality rate in war-torn countries at a certain stage. During periods of sustained increases in mortality, countries' fertility rates typically fall or remain at historically low levels.

Conclusion

Both Epidemic and war have a certain impact on fertility. However, this effect is not obvious and unstable. We believe that the reason for this phenomenon is that Epidemic and war are one of the factors affecting fertility rate changes, but the weight of these two factors among all factors is very low.

THANKS!

Reference

https://en.wikipedia.org/wiki/Total_fertility_rate

<https://en.wikipedia.org/wiki/Polio>

<https://data.worldbank.org/indicator/SP.DYN.TFRT.IN>

<https://covid19.who.int/data>

<https://ourworldindata.org/grapher/the-number-of-reported-paralytic-polio-cases>

<https://ourworldindata.org/grapher/share-of-population-infected-with-hiv-ihme>

<https://data.worldbank.org/indicator/SP.DYN.CDRT.IN?end=2021&locations=SY&start=1984>

<https://data.worldbank.org/indicator/SP.DYN.CDRT.IN?end=2021&locations=LY&start=1960>

<https://data.worldbank.org/indicator/SP.DYN.CDRT.IN?end=2021&locations=IQ&start=1995>

<https://data.worldbank.org/indicator/SP.DYN.CDRT.IN?locations=AF>