Abstract

Populations is important and key in everything we do. Politics, voting, the economy, environment are a few ways populations can affect. That is why It is important to understand and to deal with the increasing population. Consider that there is not a way to stop growing populations, but there is a way to better understand, and adapt to the growing populations. Analyzing Crude Birth Rates, Life Expectancy, and different periods in understanding these always changing populations at, which can also be compared at a Global Scale.

Introduction

United States and Mexico, both culturally different, but similar in terms of how citizens should be represented This 1,988-mile border is the only separation between the 2 countries (Owens, 2016) and yet share very similar aspects of life. As human populations grow, human also grow (Pimentel et al., 1997). Issues include food, water, housing, energy as well as the shrinking of biodiversity (Pimentel et al., 1997). Note that this is not an attempt to stop population, but to understand population to potentially find ways to adapt to this ever-growing population.

From a political standpoint, specifically in the United States, citizens, who are found in populations, vote for their government officials. In the Primaries and Caucuses people vote for who they think would be the best candidate (*Presidential Election Process,* USAGov). From

there a national convention is held to verify a nominee. On election day, people or citizens cast their vote, which then goes through the electoral college process. This is when the President of United States can get elected (*Presidential Election Process,* USAGov). Though oversimplifying the process, the officials voted from beginning to end of process, then help connect the ideas of the population and express it to the government. In Mexico, there is also a voting system in place. Through oversimplifying the process of voting in Mexico, voters also vote through polls and choose a Candidate for presidency. The winner is then chosen by the plurality of the votes and serve for 6 years (*Political Electoral System,* National Electoral Institute). Similar as the United states, the ideas are created in a population, which then the population votes. Population is key and a foundation to the political processes at a state and federal level.

Though population can have positive effects, there are negative ones as well. Regarding the Environment, imbalance between resources and world population is a concern (The Royal Society of London and the US National Academy of Sciences, 1992). According to the Food and Agriculture Organization of the United Nations, “Between 2015 and 2020, the rate of deforestation was estimated at 10 million hectares per year” (Food and Agriculture Organization of the United Nations, 2020). For visual purposes, a hectare is about 2.47 football fields. 10 million hectares is about 4,048,582 football fields. Does not help visually but does provide a context on how important population is in relation to deforestation. In the air, fine particle pollution has surpassed health standards in small, mid-sized, and large metropolitan areas (Ridlington et al., 2018). There has also been a report of water pollution conducted. According to the article and report done, approximately, 39% of rivers, 46% of lakes, and 51%

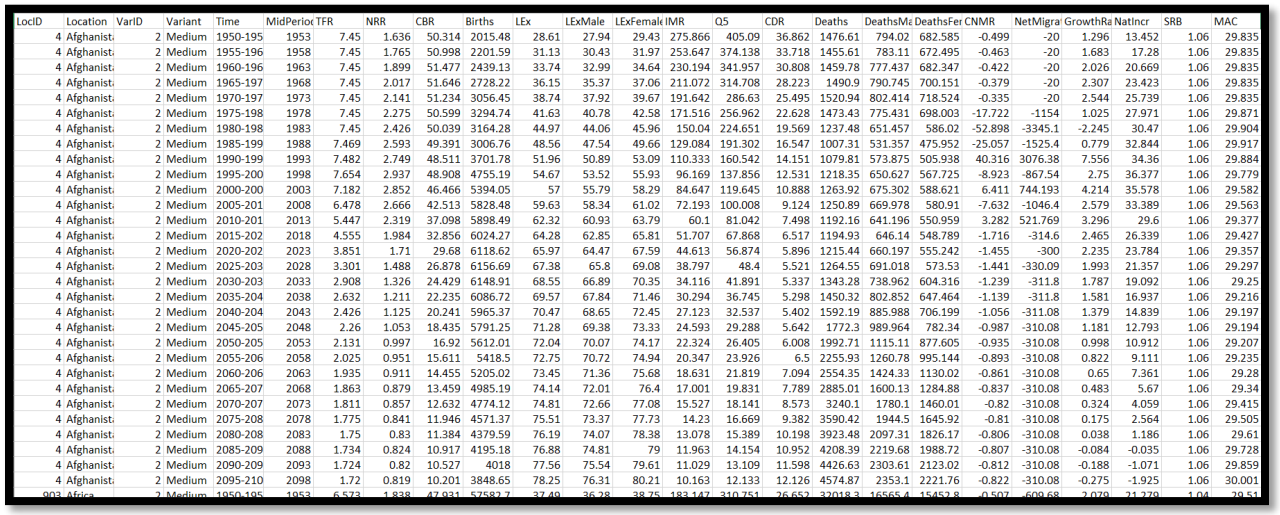
of estuaries are too polluted for safe fishing or swimming (U.S. PIRG, 2007). These are just a few of the impacts from population growth.

The purpose of this study is to analyze the important factors in population and in hopes that a better sense of understanding and adapting is gained to the growing changes. Important factors in population include births, female and male life expectancy, death and death rate of females and males, migration rate and net migration, and growth rate. All comparing between Mexico and the United States. Years analyzed range from 2010 -2040 as these are the dates that contain an end of a recent decade, ranging from 2010 to 2020, current decade ranging from 2020 to 2030 and a future decade 2030 to 2040. Mexico and United States were specifically analyzed. These countries are important and similar in respect to the type of government and the issues that are ongoing today such as migration, human trafficking, innovation, reform, and trade (Bureau of Western Hemisphere Affairs, 2020). Understanding these factors in population will help identify current decisions and future decisions.

Data

Data analyzed is from the potential datasets listed by Dr. Scott Greene, Professor and Chair for the Department of Geography and Environmental Sustainability at the University of Oklahoma.

Listed as Five Year World Data, this filetype is in .csv, specifically formatted for excel, but brought into RStudio for analyzation purposes. Follows is a Five Year World Data Metadata. Variables ranging from births and gender to Deaths and growth rates.



LocID	Location	VarID	Variant	Time	MidPerioc	TFR	NRR	CBR	Births	LEx	LExMale	LExFemal	IMR	Q5	CDR	Deaths	DeathsMa	DeathsFer	CNMR	NetMigra	GrowthRa	NatIncr	SRB	MAC
4	Afghanist	2	Medium	1950-195	1953	7.45	1.636	50.314	2015.48	28.61	27.94	29.43	275.866	405.09	36.862	1476.61	794.02	682.585	-0.499	-20	1.296	13.452	1.06	29.835
4	Afghanist	2	Medium	1955-196	1958	7.45	1.765	50.998	2201.59	31.13	30.43	31.97	253.647	374.138	33.718	1455.61	783.11	672.495	-0.463	-20	1.683	17.28	1.06	29.835
4	Afghanist	2	Medium	1960-196	1963	7.45	1.899	51.477	2439.13	33.74	32.99	34.64	230.194	341.957	30.808	1459.78	777.437	682.347	-0.422	-20	2.026	20.669	1.06	29.835
4	Afghanist	2	Medium	1965-197	1968	7.45	2.017	51.646	2728.22	36.15	35.37	37.06	211.072	314.708	28.223	1490.9	790.745	700.151	-0.379	-20	2.307	23.423	1.06	29.835
4	Afghanist	2	Medium	1970-197	1973	7.45	2.141	51.234	3056.45	38.74	37.92	39.67	191.642	286.63	25.495	1520.94	802.414	718.524	-0.335	-20	2.544	25.739	1.06	29.835
4	Afghanist	2	Medium	1975-198	1978	7.45	2.275	50.599	3294.74	41.63	40.78	42.58	171.516	256.962	22.628	1473.43	775.431	698.003	-17.722	-1154	1.025	27.971	1.06	29.871
4	Afghanist	2	Medium	1980-198	1983	7.45	2.426	50.039	3164.28	44.97	44.06	45.96	150.04	224.651	19.569	1237.48	651.457	586.02	-52.898	-3345.1	-2.245	30.47	1.06	29.904
4	Afghanist	2	Medium	1985-199	1988	7.469	2.593	49.391	3006.76	48.56	47.54	49.66	129.084	191.302	16.547	1007.31	531.357	475.952	-25.057	-1525.4	0.779	32.844	1.06	29.917
4	Afghanist	2	Medium	1990-199	1993	7.482	2.749	48.511	3701.78	51.96	50.89	53.09	110.333	160.542	14.151	1079.81	573.875	505.938	40.316	3076.38	7.556	34.36	1.06	29.884
4	Afghanist	2	Medium	1995-200	1998	7.654	2.937	48.908	4755.19	54.67	53.52	55.93	96.169	137.856	12.531	1218.35	650.627	567.725	-8.923	-867.54	2.75	36.377	1.06	29.779
4	Afghanist	2	Medium	2000-200	2003	7.182	2.852	46.466	5394.05	57	55.79	58.29	84.647	119.645	10.888	1263.92	675.302	588.621	6.411	744.193	4.214	35.578	1.06	29.582
4	Afghanist	2	Medium	2005-201	2008	6.478	2.666	42.513	5828.48	59.63	58.34	61.02	72.193	100.008	9.124	1250.89	669.978	580.91	-7.632	-1046.4	2.579	33.389	1.06	29.563
4	Afghanist	2	Medium	2010-201	2013	5.447	2.319	37.098	5898.49	62.32	60.93	63.79	60.1	81.042	7.498	1192.16	641.196	550.959	3.282	521.769	3.296	29.6	1.06	29.377
4	Afghanist	2	Medium	2015-202	2018	4.555	1.984	32.856	6024.27	64.28	62.85	65.81	51.707	67.868	6.517	1194.93	646.14	548.789	-1.716	-314.6	2.465	26.339	1.06	29.427
4	Afghanist	2	Medium	2020-202	2023	3.851	1.71	29.68	6118.62	65.97	64.47	67.59	44.613	56.874	5.896	1215.44	660.197	555.242	-1.455	-300	2.235	23.784	1.06	29.357
4	Afghanist	2	Medium	2025-203	2028	3.301	1.488	26.878	6156.69	67.38	65.8	69.08	38.797	48.4	5.521	1264.55	691.018	573.53	-1.441	-330.09	1.993	21.357	1.06	29.297
4	Afghanist	2	Medium	2030-203	2033	2.908	1.326	24.429	6148.91	68.55	66.89	70.35	34.116	41.891	5.337	1343.28	738.962	604.316	-1.239	-311.8	1.787	19.092	1.06	29.25
4	Afghanist	2	Medium	2035-204	2038	2.632	1.211	22.235	6086.72	69.57	67.84	71.46	30.294	36.745	5.298	1450.32	802.852	647.464	-1.139	-311.8	1.581	16.937	1.06	29.216
4	Afghanist	2	Medium	2040-204	2043	2.426	1.125	20.241	5965.37	70.47	68.65	72.45	27.123	32.537	5.402	1592.19	885.988	706.199	-1.056	-311.08	1.379	14.839	1.06	29.197
4	Afghanist	2	Medium	2045-205	2048	2.26	1.053	18.435	5791.25	71.28	69.38	73.33	24.593	29.288	5.642	1772.3	989.964	782.34	-0.987	-310.08	1.181	12.793	1.06	29.194
4	Afghanist	2	Medium	2050-205	2053	2.131	0.997	16.92	5612.01	72.04	70.07	74.17	22.324	26.405	6.008	1992.71	1115.11	877.605	-0.935	-310.08	0.998	10.912	1.06	29.207
4	Afghanist	2	Medium	2055-206	2058	2.025	0.951	15.611	5418.5	72.75	70.72	74.94	20.347	23.926	6.5	2255.93	1260.78	995.144	-0.893	-310.08	0.822	9.111	1.06	29.235
4	Afghanist	2	Medium	2060-206	2063	1.935	0.911	14.455	5205.02	73.45	71.36	75.68	18.631	21.819	7.094	2554.35	1424.33	1130.02	-0.861	-310.08	0.65	7.361	1.06	29.28
4	Afghanist	2	Medium	2065-207	2068	1.863	0.879	13.459	4985.19	74.14	72.01	76.4	17.001	19.831	7.789	2885.01	1600.13	1284.88	-0.837	-310.08	0.483	5.67	1.06	29.34
4	Afghanist	2	Medium	2070-207	2073	1.811	0.857	12.632	4774.12	74.81	72.66	77.08	15.527	18.141	8.573	3240.1	1780.1	1460.01	-0.82	-310.08	0.324	4.059	1.06	29.415
4	Afghanist	2	Medium	2075-208	2078	1.775	0.841	11.946	4571.37	75.51	73.37	77.73	14.23	16.669	9.382	3590.42	1944.5	1645.92	-0.81	-310.08	0.175	2.564	1.06	29.505
4	Afghanist	2	Medium	2080-208	2083	1.75	0.83	11.384	4379.59	76.19	74.07	78.38	13.078	15.389	10.198	3923.48	2097.31	1826.17	-0.806	-310.08	0.038	1.186	1.06	29.61
4	Afghanist	2	Medium	2085-209	2088	1.734	0.824	10.917	4195.18	76.88	74.81	79	11.963	14.154	10.952	4208.39	2219.68	1988.72	-0.807	-310.08	-0.084	-0.035	1.06	29.728
4	Afghanist	2	Medium	2090-209	2093	1.724	0.82	10.527	4018	77.56	75.54	79.61	11.029	13.109	11.598	4426.63	2303.61	2123.02	-0.812	-310.08	-0.188	-1.071	1.06	29.859
4	Afghanist	2	Medium	2095-210	2098	1.72	0.819	10.201	3848.65	78.25	76.31	80.21	10.163	12.133	12.126	4574.87	2353.1	2221.76	-0.822	-310.08	-0.275	-1.925	1.06	30.001
903	Africa	2	Medium	1950-195	1953	6.573	1.838	47.931	57582.7	37.49	36.28	38.75	183.147	310.751	26.652	32018.3	16565.4	15452.8	-0.507	-609.68	2.079	21.279	1.04	29.51

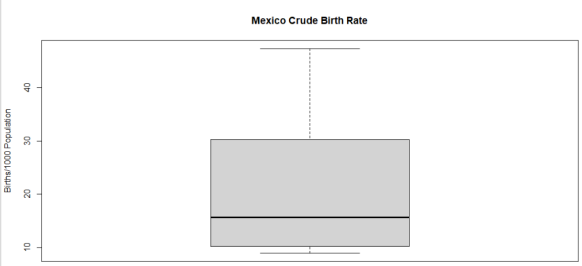
FIVE YEAR WORLD DATA METADATA

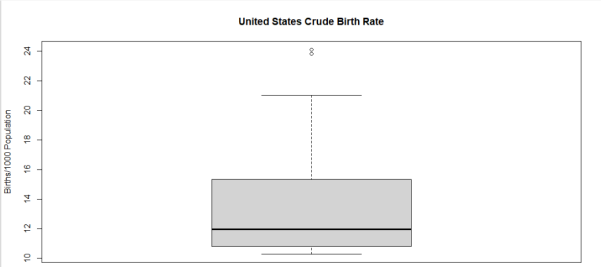
- TFR: Total fertility (live births per woman)
- NRR *: Net reproduction rate (surviving daughters per woman)
- CBR: Crude birth rate (births per 1,000 population)
- Births: Number of births, both sexes combined (thousands)
- LEx: Life expectancy at birth for both sexes combined (years)
- LExMale: Male life expectancy at birth (years)
- LExFemale: Female life expectancy at birth (years)
- IMR: Infant mortality rate, q(1), for both sexes combined (infant deaths per 1,000 live births)
- Q5: Under-five mortality, 5q0, for both sexes combined (deaths under age five per 1,000 live births)
- CDR: Crude death rate (deaths per 1,000 population)
- Deaths: Number of deaths, both sexes combined (thousands)
- DeathsMale *: Number of male deaths (thousands)
- DeathsFemale *: Number of female deaths (thousands)
- CNMR *: Net migration rate (per 1,000 population)
- NetMigrations *: Net number of migrants, both sexes combined (thousands)
- GrowthRate: Average annual rate of population change (percentage)
- NatIncr: Rate of natural increase (per 1,000 population)
- SRB *: Sex ratio at birth (male births per female births)
- MAC: Female mean age of childbearing (years)

Though our primary focus will revolve around 2 countries, United States and Mexico, it is important to know that there are more countries provided in this dataset. Ranging from Afghanistan to Zimbabwe. It is also important to note that the dates we will be focusing on is different than what is listed in the .csv file. While we will be focusing more on the date ranges of 2010 – 2040, dates are available ranging from years 1950 -2100. It is also important to note that certain time periods can have bigger impacts on population or there might be time periods where it is statistically different from one another, however, as mentioned, we will be focusing on 2010 – 2040 as we would like to analyze a recently concluded decade (2010-2020), current decade (2020-2030), and future decade (2030-2040).

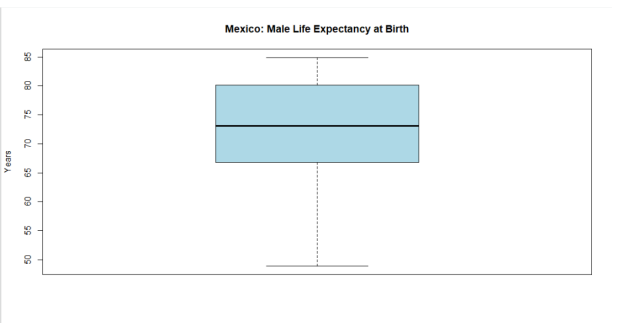
Results and Analysis

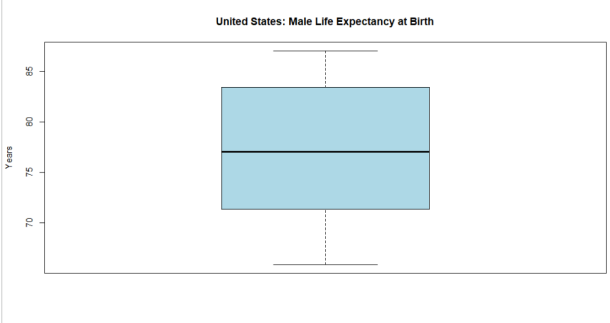
A descriptive analysis was done first in order to gain a better understanding of the differences between Mexico and the United States. Below a Box Plot was conducted for the Country Mexico and the United States from years 1950 – 2100, specifically looking at Crude Birth rate (births per 1,000 population). Just with visuals alone, one can see major differences between the box plots. For Mexico, the Median is set 15.678 and Mean of 21.183. For the United States from years 1950 – 2100, the Median is set at 11.96 and a Mean of 13.49. It appears there are outliers present in the United States model, which can be an indication that data is not normally distributed because of this outlier, it would be best, to conform to using the Median and Standard deviation as using the median is less affected by outliers.

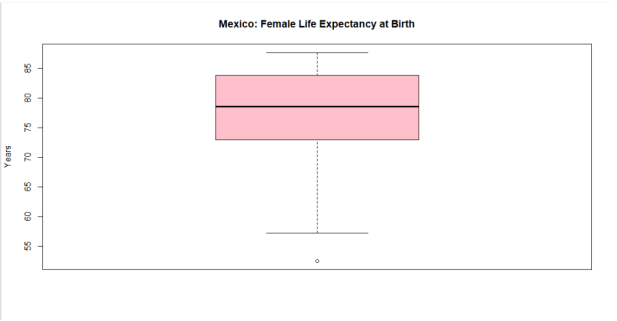


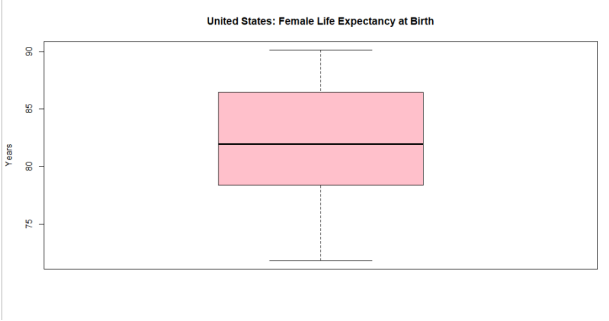


This box plot represents the Male and Female expectancy in United States and Mexico for Years 1950-2100. Visually can see how where the median, mean, max, min all lie. That being said, Median and Mean life expectancy are lower than United States in both Male and Female genders. For Males in Mexico and United States, the mean is 72.28 years and 77.20 years. For Females in Mexico and United States, the median is 78.55 and 81.95. Means were used for Males because there are no outliers present in the box plot as for females, specifically in Mexico, there is an outlier present, so for data not to be affected, it would be best to use the median over mean.



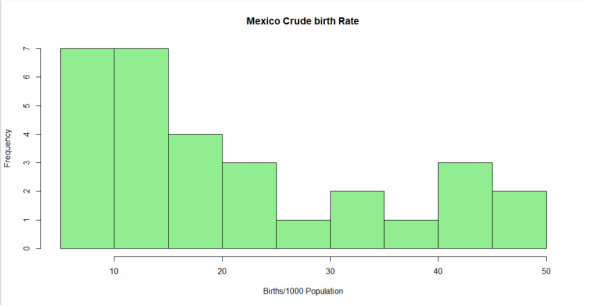


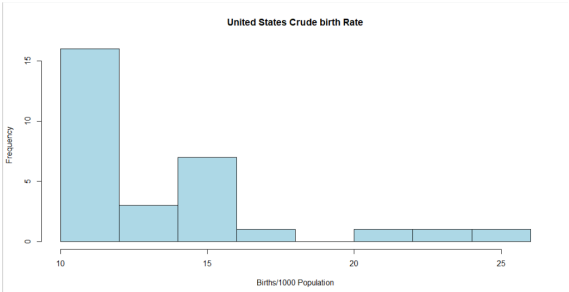


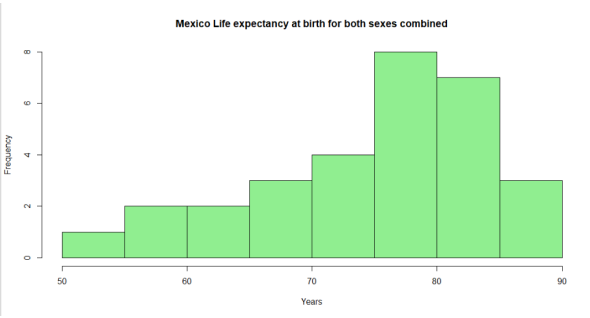


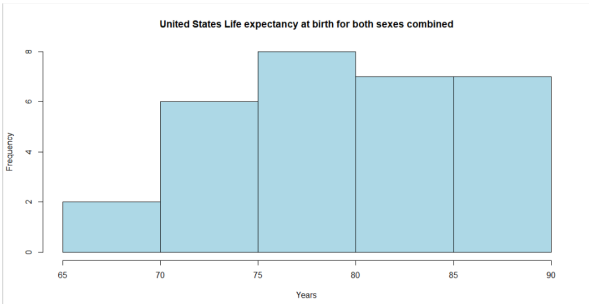
To better visualize Crude Birth Rate and Life Expectancy between United States and Mexico during the years of 1950 - 2100, a histogram was created. When looking at the Mexico and United States Crude Birth Rate, one can see that it is not symmetrical and to the left. Though not symmetrical, it is reasonable to assume it would not be symmetrical because of the births/1000 population. For example, it is more likely if a population of 1000 have 10 births as compared to 40 births. Same goes for the United States. This histogram also makes a determination that Mexico has a higher Crude Birth Rate per 1000 Population as compared to the United States. Looking at the Mexico and United States Life expectancy at birth, one sees the opposite in terms of visualization. It is not symmetrical and appears to be leaning to the

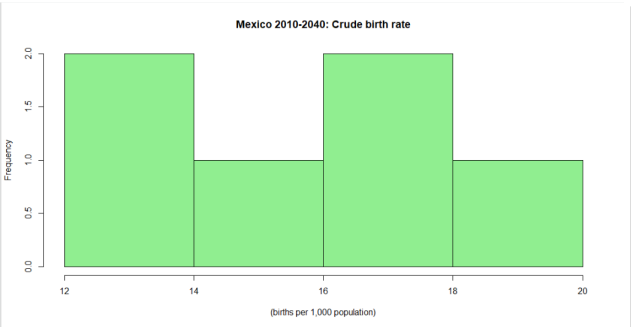
right. It is reasonable to assume it would not be symmetrical because of the likeliness of expectancy to occur around 80 as compared to when younger or older. This histogram makes the determination that the life expectancy at birth in Mexico is high around the 80year mark as compared to the United States, who has a high life expectancy at birth, 70-90 years in.

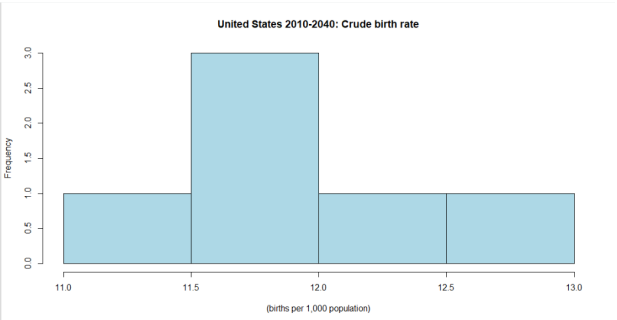










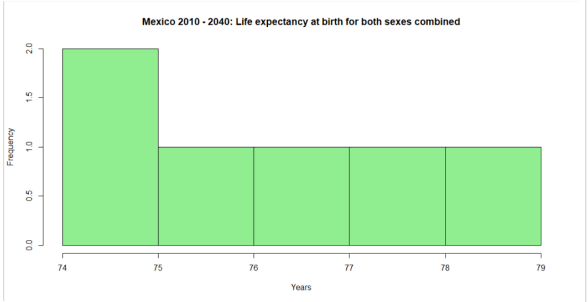


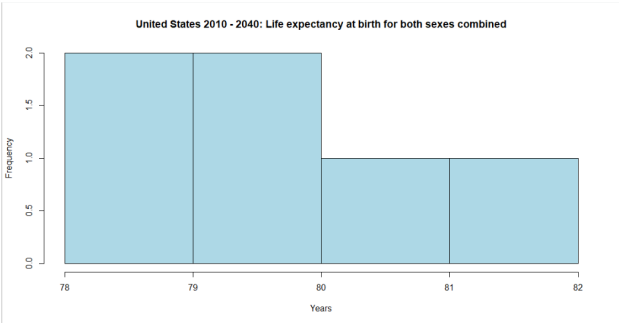
	vars	n	mean	sd	median	trimmed	mad	min	max	range	skew	kurtosis	se
X1	1	6	15.9	2.41	15.68	15.9	2.84	12.99	19.41	6.42	0.19	-1.76	0.98

	vars	n	mean	sd	median	trimmed	mad	min	max	range	skew	kurtosis	se
X1	1	6	11.92	0.39	11.96	11.92	0.26	11.38	12.54	1.17	0.18	-1.25	0.16

A display of histograms shows the differences in Crude Birth Rate in Mexico and the United States. There is a slight difference in the displays provided. When examining Mexico, there

seems to be inconsistencies as the births per 1000 population increases. For example, there is a frequency of 2 for 12-14 births per 1000 population as well as 16-18 births per 1000 population. Examining the United States, it appears to be more consistent. It peaks at 11.5 births per 1000 population. When comparing data models side by side, one can see that in the United States, when births are at 13 per 1000 population the frequency is low, Mexico's births are high at around 13 per 1000 population. Skewness and Kurtosis are also displayed. For Mexico, the skewness is reported at .19 which means it is slightly skewed to the right. It does not make a significant impact to the distribution, thus making Mexico 2010 – 2040 Crude Birth Rate a normal distribution. For the United States, similar to the skewness for Mexico, the skewness is reported at .18, thus not having a significant impact to the distribution and making the Mexico 2010 – 2040 Crude Birth Rate a normal distribution. Examining the kurtoses for both Mexico and United states, a negative appears. -1.76 for Mexico, and 01.25 for United States. This is the peakedness, and since it is at a high negative, it will make the distribution see, push and could have a significant impact to the distribution.



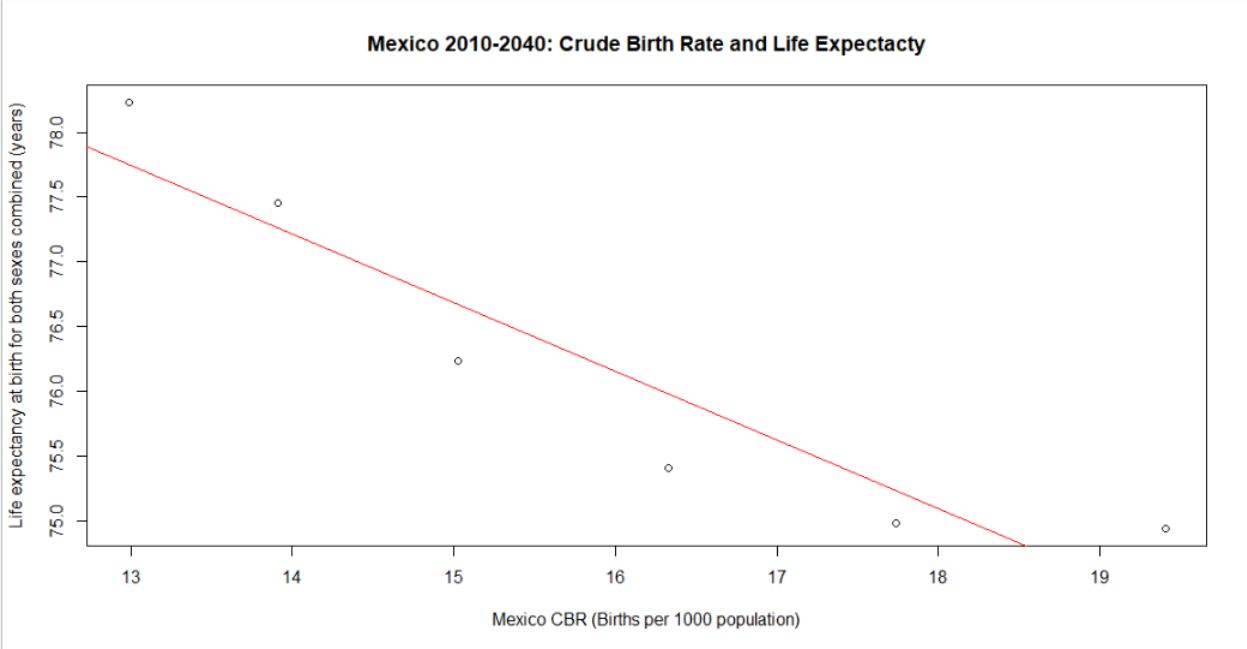


	vars	n	mean	sd	median	trimmed	mad	min	max	range	skew	kurtosis	se
X1	1	6	76.21	1.37	75.82	76.21	1.28	74.94	78.23	3.29	0.38	-1.85	0.56

	vars	n	mean	sd	median	trimmed	mad	min	max	range	skew	kurtosis	se
X1	1	6	79.89	1.19	79.47	79.89	0.88	78.81	81.69	2.88	0.44	-1.8	0.49

Historgram for Life expectancy at birth was developed to give a sense of the occurnace of the number of years from birth. Based off the histogram 78 years is what is different. In Mexico, the number of

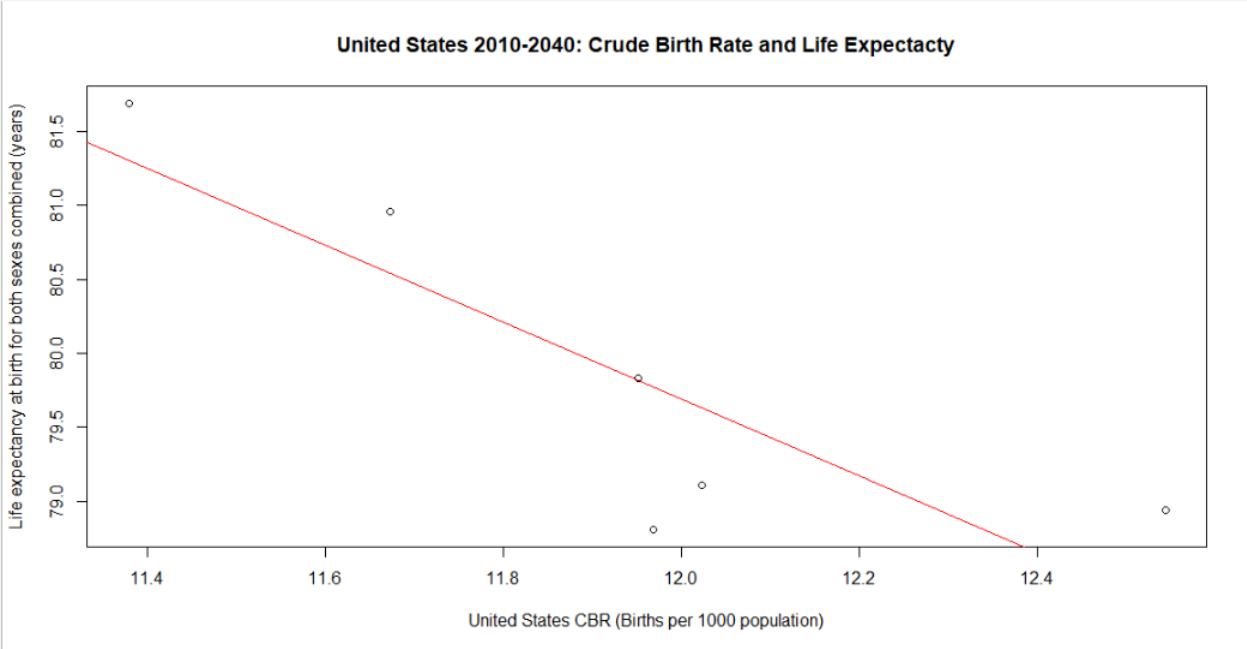
frequency of those with life expectancy of 78 years at birth is 1, while in the United States, the number of frequency of those with life expectany of 78 years is 2. Similar skew and kurtosis, the skew for Mexico is .38, while the skew for United States is .44. this means that the skewness is to the right, which does have an impact to the normal distribution. As for Kurtosis, for both Mexico and United States, Mexico being -1.85 and United States being -1.8, this means the peakedness is pushed, this having an impact on the disribution not looking normal.




```
        Pearson's product-moment correlation

data:  Mexico2010_2040$CBR and Mexico2010_2040$LEx
t = -5.2357, df = 4, p-value = 0.006359
alternative hypothesis: true correlation is not equal to 0
95 percent confidence interval:
 -0.9929436 -0.5068988
sample estimates:
       cor
-0.9341641
```

A scatterplot and best fit line were created to visually see if there is correlation between Mexico Crude Birth Rate and Mexico Life Expectancy at Birth. Based on the scatter plot, one can see it is a strong negative correlation. As the Crude Birth Rate goes down, so does the Life Expectancy at birth in Mexico. A correlation test was calculated to see if there is a difference between the Crude Birth Rate and Life Expectancy at Birth. This is based of a 95% confidence interval or a 0.05 significance level. Null Hypothesis: True Correlation is equal to 0. Alternative Hypothesis: True Correlation is not equal to 0. Looking at the “cor”, one can see there is strong negative correlation between the variables. With 95% confidence, the true value lies between -0.9929436 and -0.5068988. What is important in this analysis is the P value of 0.006359. the P

value not being greater than 0.05, because of the 95% confidence interval, we can Reject the Null hypothesis. In conclusion, there is enough evidence to support the Alternative hypothesis that true correlation is not equal to 0.




```
        Pearson's product-moment correlation

data:  UnitedStates2010_2040$CBR and UnitedStates2010_2040$LEx
t = -3.2227, df = 4, p-value = 0.0322
alternative hypothesis: true correlation is not equal to 0
95 percent confidence interval:
 -0.9832337 -0.1227630
sample estimates:
       cor
-0.8496717
```

This is the scatterplot and best fit line was created for visual purposes and verify the correlation between United States Crude Birth Rate and United States Life Expectancy. Based on the scatter plot, one can see a strong negative correlation. Similar to Mexico's scatterplot, a correlation test was also calculated to see if there is a difference between the Crude Birth Rate and Life Expectancy at Birth. This is based of a 95% confidence level. Null Hypothesis: True

Correlation is equal to 0. Alternative Hypothesis: True Correlation is not equal to 0. Analyzing the “cor”, one can see there is a strong negative correlation between variables with a value of -0.8496717. Note that with 95% confidence, the true value lies between -0.9832337 - -0.1227630. P value is important in this analysis. P value being 0.0322, the values is not greater than 0.5, because of the 95% confidence interval, we can reject the Null Hypothesis. In Conclusion, there is enough evidence to support the Alternative Hypothesis that true correlation is not equal to 0.

```
Call:
lm(formula = Mexico2010_2040$CBR ~ Mexico2010_2040$LEx, data = Mexico2010_2040)

Residuals:
    8473     8474     8475     8476     8477     8478
 1.42405 -0.17920 -0.87937 -0.83248  0.05393  0.41307

Coefficients:
                    Estimate Std. Error t value Pr(>|t|)
(Intercept)          141.166     23.929   5.899  0.00413 **
Mexico2010_2040$LEx   -1.644      0.314  -5.236  0.00636 **
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.9618 on 4 degrees of freedom
Multiple R-squared:  0.8727,    Adjusted R-squared:  0.8408
F-statistic: 27.41 on 1 and 4 DF,  p-value: 0.006359
```

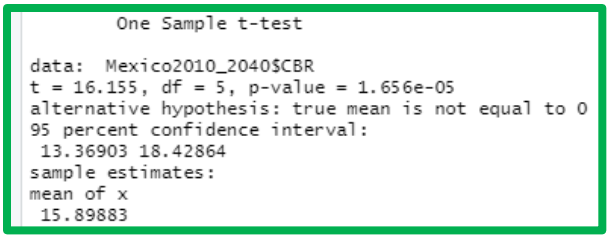
Analyzing the linear model, coefficients are displayed for Mexico Crude Birth Rate and Life Expectancy. With the intercept at 141.166 and Life Expectancy at -1.644, the negative verifies and supports the negative slope. As Crude Birth Rate decreases by 1, the Life Expectancy decreases by -1.644. When analyzing the P values, one can also see that the intercept and Life Expectancy at Birth lie between significance codes 0.001 and 0.01, which further supports the Alternative hypothesis that there is enough evidence to suggest that the True Correlation is not 0.

```
Call:
lm(formula = UnitedStates2010_2040$CBR ~ UnitedStates2010_2040$LEx,
    data = UnitedStates2010_2040)

Residuals:
   13933    13934    13935    13936    13937    13938
 0.35681 -0.25534 -0.11691  0.01131  0.04756 -0.04344

Coefficients:
                           Estimate Std. Error t value Pr(>|t|)
(Intercept)                34.13963    6.89453   4.952  0.00775 **
UnitedStates2010_2040$LEx -0.27809    0.08629  -3.223  0.03220 *
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.2294 on 4 degrees of freedom
Multiple R-squared:  0.7219,    Adjusted R-squared:  0.6524
F-statistic: 10.39 on 1 and 4 DF,  p-value: 0.0322
```

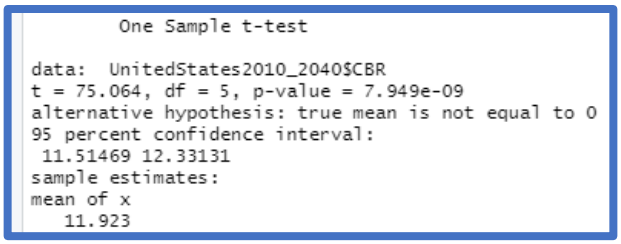
Analyzing the linear model for United States Crude Birth Rate and Life Expectancy, one can see coefficients displayed. With the intercept at 34.13963 and Life Expectancy at -0.27809, the negative verifies and supports the negative slope. As Crude Birth decreases by 1, the Life Expectancy decreases by -0.27809. The important value is the P values. The P values for intercept and Life Expectancy lie between 0.001 and 0.01 for the Intercept, and 0.01 and 0.05 for Life Expectancy, which further supports the Alternative hypothesis that there is enough evidence to suggest that the True Correlation is not 0.

```
> stat.desc(Mexico2010_2040$CBR, basic = F)
      median         mean      SE.mean CI.mean.0.95          var      std.dev     coef.var
  15.6785000   15.8988333    0.9841378    2.5298067    5.8111630    2.4106354    0.1516234
> stat.desc(Mexico2010_2040$LEx, basic = F)
      median         mean      SE.mean CI.mean.0.95          var      std.dev     coef.var
 75.82000000  76.20666667   0.55928923   1.43769874   1.87682667   1.36997324   0.01797708
> stat.desc(UnitedStates2010_2040$CBR, basic = F)
      median         mean      SE.mean CI.mean.0.95          var      std.dev     coef.var
 11.95950000  11.92300000   0.15883807   0.40830626   0.15137720   0.38907223   0.03263207
> stat.desc(UnitedStates2010_2040$LEx, basic = F)
      median         mean      SE.mean CI.mean.0.95          var      std.dev     coef.var
 79.47000000  79.89000000   0.48531090   1.24753138   1.41316000   1.18876406   0.01488001
```

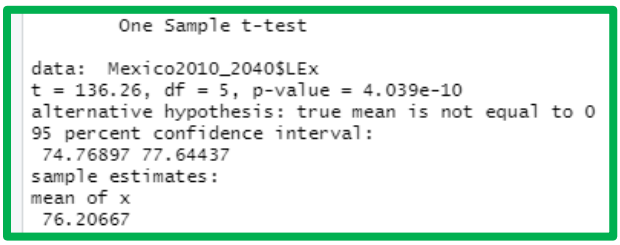
Confidence interval of 95% was determined in this analysis. Looking at the Mexico's Crude Birth Rate, the true value lies +- 2.5298067 of the 15.8988333 mean. For Mexico's Life Expectancy at Birth, the true value lies +-1.43769874 of the 76.20666667 mean. Switching to United States, the Crude Birth Rate true value lies +- 0.40830626 of the 11.92300000 mean. For United States Life Expectancy at birth, true value lies +-1.24753138 of the 79.89000000 mean.



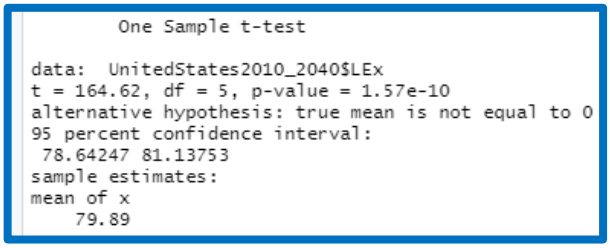
```
        One Sample t-test

data:  Mexico2010_2040$CBR
t = 16.155, df = 5, p-value = 1.656e-05
alternative hypothesis: true mean is not equal to 0
95 percent confidence interval:
 13.36903 18.42864
sample estimates:
mean of x
 15.89883
```



```
        One Sample t-test

data:  UnitedStates2010_2040$CBR
t = 75.064, df = 5, p-value = 7.949e-09
alternative hypothesis: true mean is not equal to 0
95 percent confidence interval:
 11.51469 12.33131
sample estimates:
mean of x
   11.923
```



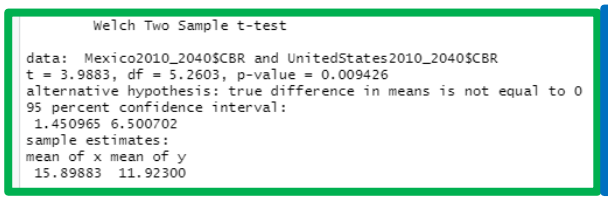
```
        One Sample t-test

data:  Mexico2010_2040$LEx
t = 136.26, df = 5, p-value = 4.039e-10
alternative hypothesis: true mean is not equal to 0
95 percent confidence interval:
 74.76897 77.64437
sample estimates:
mean of x
 76.20667
```



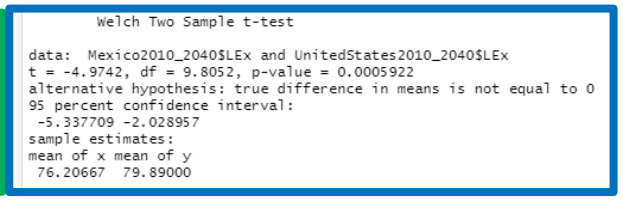
```
        One Sample t-test

data:  UnitedStates2010_2040$LEx
t = 164.62, df = 5, p-value = 1.57e-10
alternative hypothesis: true mean is not equal to 0
95 percent confidence interval:
 78.64247 81.13753
sample estimates:
mean of x
    79.89
```

A One sample T-test was conducted to analyze Mexico and United States Crude Birth Rate and Life Expectancy at Birth. In these T Test, the HO or Null hypothesis is the true difference in means = 0 and the Alternative Hypothesis is the true difference in Means is NOT EQUAL to 0. When analyzing first the Crude Birth Rates for Mexico and United States, the means are different. Mexico's Crude Birth Rates during the years 2010 – 2040 is 15.89883, while in the United States, the mean Crude Birth Rates during the years 2010 – 2040 is 11.923. by looking at the 95% confidence interval values, with 95 % confidence, the true value for Mexico's Crude Birth Rate lies between 13.36903 and 18.42864, while in the United States, the true value lies between 11.51469 and 12.33131. In Conclusion, since the p values are less than the 0.05 significance level, there is enough evidence to support the Alternative Hypothesis that the true difference in means is not equal to 0 and Reject the Null Hypothesis. When analyzing the T test for Mexico and United States Life Expectancy at Birth for years 2010-2040, the means are again different. Mexico's mean Life Expectancy at Birth is 76.20667 as compared to the United States 79.89. in conclusion, since the p values are less than 0.05 significance level, there is enough

evidence to support the Alternative Hypothesis that the true difference in means is not equal to 0.



```
        Welch Two Sample t-test

data:  Mexico2010_2040$CBR and UnitedStates2010_2040$CBR
t = 3.9883, df = 5.2603, p-value = 0.009426
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 1.450965 6.500702
sample estimates:
mean of x mean of y
 15.89883  11.92300
```



```
        Welch Two Sample t-test

data:  Mexico2010_2040$LEx and UnitedStates2010_2040$LEx
t = -4.9742, df = 9.8052, p-value = 0.0005922
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 -5.337709 -2.028957
sample estimates:
mean of x mean of y
 76.20667  79.89000
```

Another 2 T Test were conducted, however focusing on Two samples to analyze the Crude Birth Rate for both Mexico and United in the years 2010 – 2040 and Life Expectancy for both Mexico and United States. In this test, the Null Hypothesis is the true difference in Means = 0 and the Alternative hypothesis is that the true difference in Means is Not Equal to 0. When analyzing the Two sample t test related to United States and Mexico Crude Birth Rate, the mean is set at 15.89883 (Mexico) and 11.92300 (United States). By looking at the 95% percent confidence intervals, with 95%, the true values lies between 1.450965 and 6.500702 with 3.9883 representing the Standard Deviations away. Though means appear different, what is important is the P value of 0.009426. This p-value is less than the 0.05 significance level, thus we can conclude to Reject null hypothesis. Thus, there is enough evidence to support the Alternative Hypothesis that the true difference in means is not equal to 0 and are in fact, statistically different. When analyzing the Two sample t test related to United States and Mexico Life Expectancy between years 2010-2040, the mean is set at 76.20667 (Mexico) and 79.89000 (United States). By looking at the 95% confidence intervals, with 95% confidence, the true value lies between-5.337709 and -2.028957. though the means appear slightly different, what is important, again, is the P value. The p-value is 0.0005922, which is less than the significance

level of 0.05. In conclusion, there is enough evidence to support the Alternative Hypothesis that the true difference in means is not equal to 0 and are in fact, statistically different.

```
        Pearson's Chi-squared test

data:  ttab2
X-squared = 180, df = 174, p-value = 0.3618
```

	1.047	1.048	1.049	1.05	1.051	1.052	1.053
1953	0	0	0	0	0	1	0
1958	0	0	0	1	0	0	0
1963	0	0	0	1	0	0	0
1968	0	0	0	0	0	1	0
1973	0	0	0	0	0	0	1
1978	0	0	0	0	0	1	0
1983	0	0	0	0	1	0	0
1988	0	0	0	1	0	0	0
1993	0	0	1	0	0	0	0
1998	0	1	0	0	0	0	0
2003	0	1	0	0	0	0	0
2008	0	1	0	0	0	0	0
2013	0	1	0	0	0	0	0
2018	1	0	0	0	0	0	0
2023	1	0	0	0	0	0	0
2028	1	0	0	0	0	0	0
2033	1	0	0	0	0	0	0
2038	1	0	0	0	0	0	0
2043	1	0	0	0	0	0	0
2048	1	0	0	0	0	0	0
2053	1	0	0	0	0	0	0
2058	1	0	0	0	0	0	0
2063	1	0	0	0	0	0	0
2068	1	0	0	0	0	0	0
2073	1	0	0	0	0	0	0
2078	1	0	0	0	0	0	0
2083	1	0	0	0	0	0	0
2088	1	0	0	0	0	0	0
2093	1	0	0	0	0	0	0
2098	1	0	0	0	0	0	0

A Chi squared test was calculated for the United States Mid Period and Sex Ratio at birth (male births per female). Reason being is as compared to Mexico who has about same Sex Ratio throughout its years, United States Sex Ratio changes. First observing the Chi-Square Test, one must understand the contingency table. Dates being on the left, one can see that for 2018-2098 there seems to be a consistent 1.047 Sex Ration, but changes before the 2018 date. Starting from 1953, one can see the Sex Ratio slowly decreasing. In this Chi-square test, the Null Hypothesis is that there is no relationship between Mid Periods and Sex Ratio. Alternative

would be that there is a relationship between Mid Periods and Sex Ratio. As one can see in the calculations, the Chi Squared is at 180. Having 174 degrees of freedom, one can see that the critical value is 205.779. 180 being lower than 205.779, we can say that there is not enough sufficient evidence to Reject the Null hypothesis.

```
                  Df    Sum Sq   Mean Sq F value   Pr(>F)
YearsUS$MidPeriod  1 7.262e-05 7.262e-05   56.41 3.51e-08 ***
Residuals         28 3.605e-05 1.290e-06
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

An ANOVA test was calculated to analyze means between the MidPeriods in the United States during years 1950 -2100. The Null hypothesis: is the mean of 1953 = the mean of 1958 = the mean of 1963 = to the mean of 1968 =…. =means of all midperiods between 1950 – 2100. The Alternative Hypothesis is that at least one of the means is different from others. In the calculations, the Mean sq is 7.262e-05, which is the value between Mid Periods. Mean SQ

Residuals is 3.605-05 which is the value within the Mid Periods. The F value represents the Mean SQ/Mean SQ residuals. Which is 56.41. This value is similar to the Z-score, the higher the value, the further out the tail is, the more likely that the pattern is not random. Pr(>F) is 3.51e-08, which is close to 0 and lower than the F value, thus we can reject the null hypothesis and Support the Alternative hypothesis that at least one of the means is different from others. In conclusion, there is sufficient evidence to Reject the Null hypothesis and support the Alternative hypothesis that at least one of the means is different.

Mexico

```
lm(formula = Mexico2010_2040$LEx ~ Mexico2010_2040$LExMale + 
    Mexico2010_2040$LExFemale + Mexico2010_2040$Deaths + Mexico2010_2040$CBR, 
    data = Mexico2010_2040)

Coefficients:
             (Intercept)    Mexico2010_2040$LExMale  Mexico2010_2040$LExFemale     Mexico2010_2040$Deaths  
              -3.327e-01                 5.406e-01                 4.676e-01                 -1.540e-05  
     Mexico2010_2040$CBR  
              -6.134e-05  
```

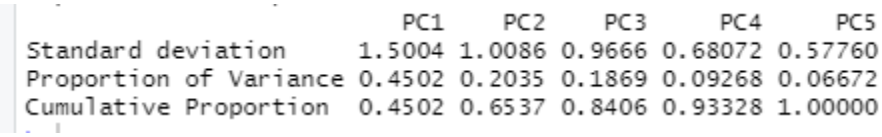
```
Analysis of Variance Table

Response: Mexico2010_2040$LEx
                           Df Sum Sq Mean Sq    F value    Pr(>F)    
Mexico2010_2040$LExMale     1 9.3704  9.3704 8.3490e+05 0.0006967 ***
Mexico2010_2040$LExFemale   1 0.0137  0.0137 1.2249e+03 0.0181851 *  
Mexico2010_2040$Deaths      1 0.0000  0.0000 1.3700e-02 0.9257610    
Mexico2010_2040$CBR         1 0.0000  0.0000 1.0000e-04 0.9940373    
Residuals                   1 0.0000  0.0000                         
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
> 
```

United States

```
lm(formula = UnitedStates2010_2040$LEx ~ UnitedStates2010_2040$LExMale + 
    UnitedStates2010_2040$LExFemale + UnitedStates2010_2040$Deaths + 
    UnitedStates2010_2040$CBR, data = UnitedStates2010_2040)

Coefficients:
                    (Intercept)    UnitedStates2010_2040$LExMale  UnitedStates2010_2040$LExFemale  
                      1.765e-01                      5.358e-01                      4.627e-01  
   UnitedStates2010_2040$Deaths        UnitedStates2010_2040$CBR  
                     -8.033e-06                      1.925e-02  
```

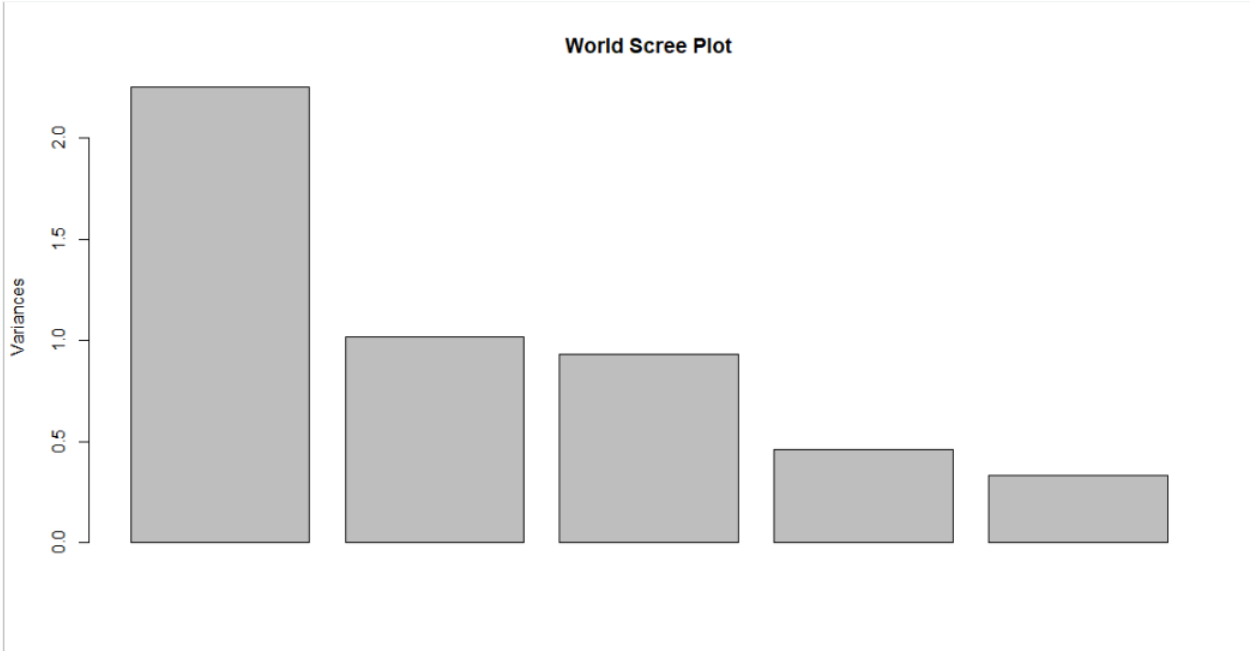
```
Analysis of Variance Table

Response: UnitedStates2010_2040$LEx
                               Df Sum Sq Mean Sq    F value    Pr(>F)
UnitedStates2010_2040$LExMale   1 7.0592  7.0592 1.6890e+07 0.0001549 ***
UnitedStates2010_2040$LExFemale 1 0.0065  0.0065 1.5590e+04 0.0050985 **
UnitedStates2010_2040$Deaths    1 0.0000  0.0000 8.5017e+01 0.0687755 .
UnitedStates2010_2040$CBR       1 0.0000  0.0000 8.4412e+01 0.0690193 .
Residuals                       1 0.0000  0.0000
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

Life Expectancy, Life Expectancy for Male and Female, Deaths, and Crude Birth Rates were all included in this Regression Model. Looking at Regression Model for Mexico, specifically for years 2010-2040, coefficients are -3.327 e-01 (intercept) + 5.406-1 (Life Expectancy Male) + 4.676e-01 (Life Expectancy Female) -1.540e-05 (Deaths) -6.134e05 (Crude Birth rates). When looking at the ANOVA, one can see the F variability and within variability. Looking at the P values, Life Expectancy for Males is statistically different at a range of 0 – 0.001 and Life Expectancy for Female is statistically different at a range of 0.01 – 0.05. Analyzing the Regression model for United States, coefficients are 1.765e-01 (intercept) + 5.358e-01 (Life Expectancy Males) + 4.67e-01 (Life Expectancy Females) – 8.033e-06 (Deaths) + 1.925e-02 (Crude Birth Rates). In the ANOVA functionality, we can note that the P values, 1 is statistically different at a range of 0 – 0.001 significant codes. 1 is statistically different at a range of 0.001 – 0.01. 2 are statistically different at a range of 0.05 – 0.1.



	PC1	PC2	PC3	PC4	PC5
Standard deviation	1.5004	1.0086	0.9666	0.68072	0.57760
Proportion of Variance	0.4502	0.2035	0.1869	0.09268	0.06672
Cumulative Proportion	0.4502	0.6537	0.8406	0.93328	1.00000

A Principle Component Analysis was calculated using the data file “world_data.csv”. This was done to gain a better understand how important population is at a global scale. For this, PC1 = “Population. PC2 = “Density”. PC3 = “Population Increase”. PC4 = “Babymort”. PC5 = “GDP_Cap. The Eigenvalues listed are 1.5004 for Component 1. 1.0086 for Component 2. 0.9666 for Component 3. 0.68072 for Component 3. .68072 for Component 4. .57760 for Component 5. Principle Component 1 and 2 are ones that would want to retain because of the Standard Deviations being greater than 1. PC3 is close to a Standard Deviation of 1, so for that reason PC3 is another component to retain. Analyzing the Cumulative Proportion, one can see that it represents the explain variability. Since PC 1, PC2, and PC3 are going to be retained, this indicates that about 84% of the variability can be explained by the retained Principle Components.



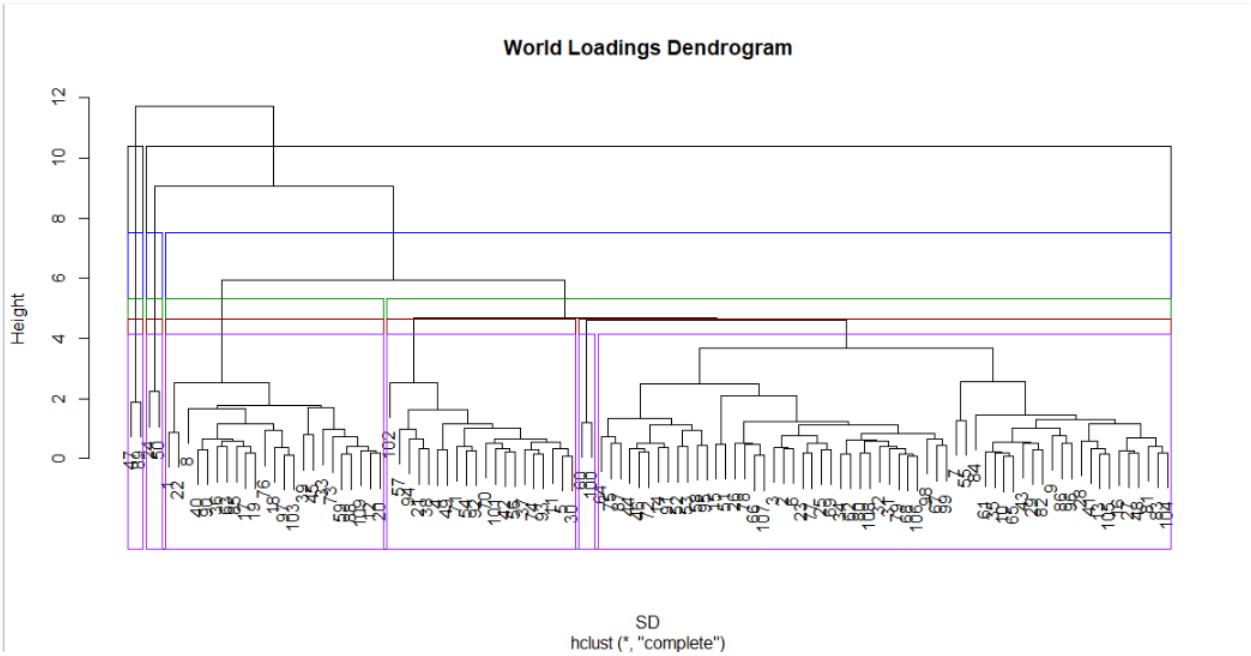
For Visual Purposes, a Scree Plot was also calculated. From Left to Right, this just further verify that we want to keep the 1st, 2nd, and 3rd bar graph as these represent PC1, PC2, and PC3.

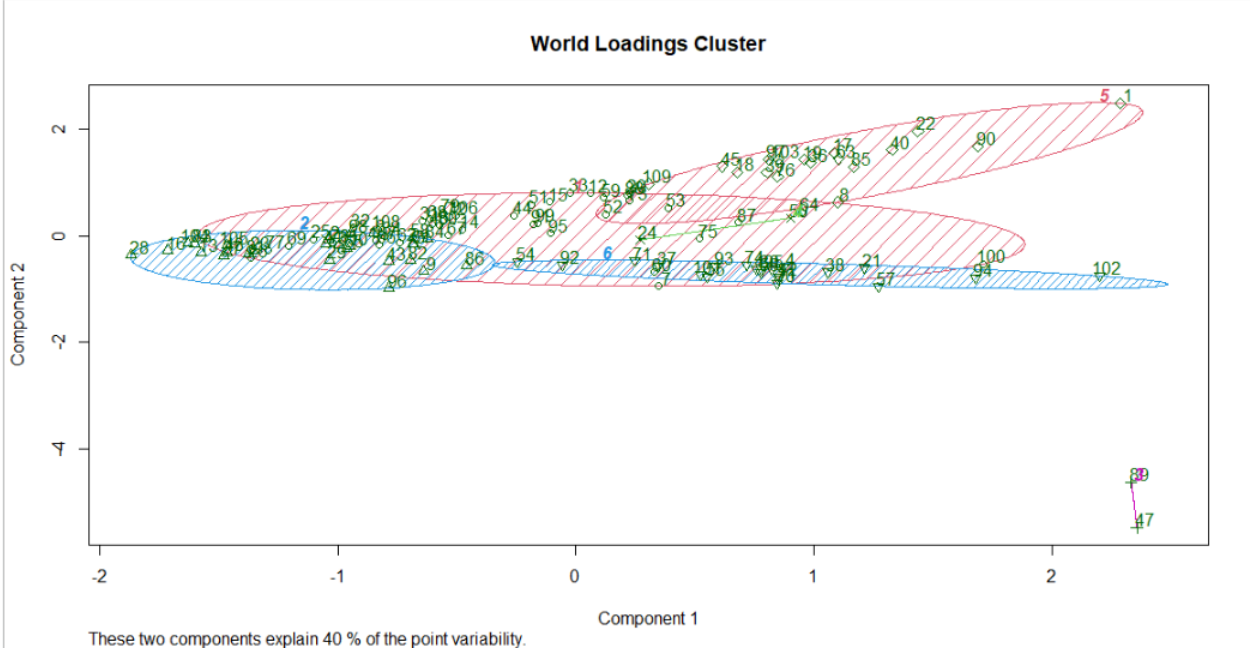
Principle Component Analysis Component Loadings

	PC1	PC2	PC3	PC4	PC5
ï..populatn	0.06129561	-0.9784499186	-0.01518048	0.18501389	0.06646818
density	-0.22911414	-0.0008669515	-0.97024489	-0.03368205	0.07068469
pop_incr	0.54087397	0.1973144737	-0.12788343	0.72895090	0.34756117
babymort	0.57905086	-0.0293322016	-0.19135375	-0.07958076	-0.78796597
gdp_cap	-0.56205428	0.0533069003	0.07364762	0.65340100	-0.49889530

	PC1	PC2	PC3	PC4	PC5
1	2.95580354	0.22263304	-0.55624784	-0.177836964	-1.871965708
2	-0.15575498	0.02186703	0.37340238	-0.453937390	0.396891450
3	-0.27860224	0.25162641	0.21320087	-0.279147340	0.272654742
4	-1.55801866	0.27040208	0.62301842	0.980673923	-0.238451384
5	-2.27927506	0.15086203	0.64127838	0.389717577	-0.688783687
6	0.03163590	0.20438865	0.20732163	-0.490878986	0.258588372
7	-0.34548680	0.46156599	-0.85867754	0.585514488	0.455317355
8	1.61324598	-0.49348011	-1.32558776	-0.199222533	-0.576611711
9	-1.25615517	0.09721011	-0.29009840	-0.828110671	-0.039008201
10	-0.99928615	0.04474042	0.49651250	-0.769491887	-0.001909295
11	-2.30849531	0.13218978	0.29561113	0.330801879	-0.636331577
12	1.45171706	0.36613838	-0.04495730	-0.006473938	-0.024620961
13	-0.63403655	0.12555993	0.39419668	-0.864609593	0.507909316
14	0.73875955	0.45327963	0.16370734	0.256438620	0.560773338
15	0.59923226	-0.83616057	0.13709734	-0.490230395	-0.301734803
16	-1.11075692	-0.04501344	0.51331931	-1.331945179	0.205532041
17	2.17418079	0.33240361	-0.31797195	-0.071804691	-0.852636392
18	1.70060281	0.28514694	-0.45892471	-0.378417338	-0.700440144
19	2.13013619	0.35270059	-0.32689810	-0.009045655	-0.689964252
20	1.54512012	0.36505437	-0.10280280	0.143317222	-0.023677499
21	-2.14270464	0.10508951	0.73322426	0.877461436	-0.661639724
22	2.28125049	0.29731935	-0.32433728	-0.352123729	-1.376015227
23	-0.08161671	0.22230560	0.37006699	-0.294931702	0.795266221
24	0.86949500	-7.86739758	-0.05433060	0.534722101	0.568169801
25	0.35376969	0.10875679	0.23778342	-0.219683844	0.597380049
26	0.16348329	0.39075155	0.25269390	0.006026659	1.087199250
27	-1.26306059	0.01431577	0.52982983	-1.102458974	0.174194872
28	-0.43411648	0.10300313	0.34796794	-0.902925558	0.754078872
29	-1.29011905	0.04161437	0.44741217	-0.732351527	0.115933415
30	-2.32568220	0.15210106	0.61407708	0.312152383	-0.705160756
31	0.60937690	0.23873461	-0.04556973	-0.482947880	0.192580866
32	0.54721864	0.26259319	0.16844725	-0.320147438	0.494194031
33	1.15966263	-0.09776998	-0.05426994	-0.371022932	-0.229552645
34	0.50600336	0.29340526	-0.13840687	-0.341530039	0.472781734
35	-0.86435851	0.13165651	0.49044755	-0.708286234	0.089300588
36	2.22373397	0.08469354	-0.33299035	0.160508239	-0.560195171
37	-2.01940824	0.16712458	0.68826558	0.198670280	-0.443878475
38	-2.17398172	-0.12857793	0.59446157	0.690318714	-0.619994813
39	0.88794074	0.22677670	0.03281597	-0.427474844	-1.043325683
40	2.38087764	0.43745131	-0.45112779	0.084002564	-0.888016816
41	-0.55138499	0.13966318	0.35620230	-0.682381160	0.215671008
42	-2.13205269	-0.31134635	0.41261019	0.511286594	-0.513470297
43	-1.08284501	0.14767560	0.47196503	-0.286246317	0.249947586
44	1.05014606	0.35242064	-0.06647950	0.030442371	0.282182303
45	1.42481247	0.16466885	-0.42377963	-0.795883861	-0.998307709
46	0.95528343	0.40700259	0.05330080	0.081623736	0.576112522
47	-3.93484373	0.07891414	-7.11843066	-0.441834157	0.095656007
48	-1.28155431	-0.06094159	0.49150133	-1.250530223	0.061023554
49	-1.78535070	0.34363019	0.67767253	0.822231839	-0.295525981
50	1.47413317	-5.79937602	-0.47463973	0.577455311	0.133426559
51	0.89995082	-1.08949313	-0.04911967	-0.430105214	-0.098821609
52	1.53183390	0.13119221	-0.09843004	0.661258417	0.488461473
53	1.66847161	0.46728406	-0.15227077	0.756531342	0.346520993
54	-1.67062888	0.14499843	0.61850468	-0.182007234	-0.201348264
55	-0.93352109	0.45265583	0.15080290	1.056794606	0.277348994
56	-2.19881461	-0.19141647	0.48641414	0.355975310	-0.605893458
57	-2.42694827	-0.60268068	0.30775409	0.739493354	-0.646930700
58	1.04900505	0.52644092	0.05177947	0.481239272	0.967152757
59	1.64590995	0.29412549	-0.14987926	0.221866347	0.157246797
60	1.07071844	0.91736705	-0.05774574	2.249550103	1.533106225
61	-0.94867372	0.13390747	0.48793923	-0.571152798	-0.069303317
62	0.41894742	0.31186118	-0.26593654	-0.310585829	0.485956189
63	2.31915957	0.46652633	-0.33493142	0.240024433	-0.611825816
64	1.27254740	0.59898113	-0.02657012	1.147593457	0.113955619
65	-1.05334222	0.09134380	0.49813486	-0.752731502	0.021200232
66	0.31068307	0.27941314	0.19722272	0.093446913	0.717575779
67	0.25418099	-0.27092764	0.20942831	-0.016816275	0.391433705
68	0.76104733	0.15103077	0.06590337	-0.263132623	0.308023736
69	0.24663209	0.15472079	0.02898216	-0.418840387	0.697755553
70	-2.09376669	0.15799553	0.19610658	0.514055850	-0.443843806
71	-1.69107762	0.21208027	0.65859128	0.222448865	-0.319446812
72	1.12368190	0.40644878	0.02780798	0.005918905	0.463763715
73	1.67690280	-0.17318070	-0.23870501	0.301140358	0.176920214
74	-2.11271492	0.20367214	0.73418071	0.447285481	-0.583393800
75	0.64392049	0.62305375	0.13786511	1.232874049	0.479071333
76	1.92447693	-0.44178961	-0.39784773	0.112248004	-0.439938733
77	0.04436089	0.32824202	0.31513453	-0.211740941	0.825515462
78	0.62512902	0.42883319	0.20843826	0.171636353	0.945800428
79	0.78593751	0.16488921	0.12213431	-0.331901045	0.185778480
80	0.66636007	-0.15928523	-0.15108801	-0.362706481	0.279416924
81	-0.91165321	-0.15710452	0.39135629	-0.935410114	0.285599973
82	-1.33951667	0.08794520	0.48017771	-0.438612004	0.043617544
83	-0.75065358	-0.10791751	0.40079112	-1.262854628	0.216232413
84	-0.86647444	-0.90264539	0.51383793	-0.651809386	-0.151756827
85	2.07069859	0.34295599	-0.70839246	-0.091994671	-0.798896554
86	-0.77280139	-0.07271907	-0.16410109	-0.311726799	0.193109896
87	0.81844945	0.44769936	0.08226122	0.956078997	0.145401131
88	1.63469396	0.42609243	-0.14451170	0.235849237	0.073986357
89	-3.02799251	0.31700133	-5.76219891	0.433975535	0.338734797
90	2.33070583	0.42904400	-0.34315860	0.330740683	-1.042367775
91	0.77974562	0.15075598	0.08911792	0.276683526	0.358268291
92	-1.74824604	-0.08483492	0.58996832	-0.048935475	-0.239676934
93	-2.00328687	0.18357950	0.70483297	0.428548079	-0.473214814
94	-2.43286671	0.27311371	0.52663024	1.092587393	-0.832685024
95	1.24953452	0.52303225	-0.06876027	0.847390185	0.806987313
96	-1.16339994	0.08733626	-0.25648450	-0.331887843	0.477821979
97	1.93565939	0.15627189	-0.23875923	-0.222092736	-0.758799166
98	0.17802564	-0.15382487	0.13661149	-0.551938398	0.336183267
99	0.47859055	-0.06690534	0.08539152	-0.012297538	0.111829867
100	0.41704616	0.89814485	0.11433686	2.734071103	0.646123527
101	-2.08902283	-0.20572554	0.40069007	0.200871226	-0.474864884
102	-2.20799878	-1.36217960	0.67790493	1.708577848	-0.768833421
103	1.89535763	0.20536882	-0.30386510	-0.295920928	-0.833631447
104	-0.69825560	-0.30057850	0.40465150	-1.263933756	0.247750341
105	-0.50347717	0.14844121	0.46149318	-0.807646285	0.437597294
106	0.78358728	0.19111704	0.07338873	-0.247279105	0.219693811
107	0.32902061	0.25241204	0.24554668	0.013925968	0.648366419
108	0.60275359	-0.19917400	-0.11854356	-0.473127052	0.404045907
109	1.66173341	0.36563396	-0.11369683	0.019052894	-0.189428517

Displayed are the weights for variables listed using the Component Loadings. When examining Principle Component 1, .06129561 is the weight for the 1 variable, which is population. -.22911414 is the weight for the 2nd variable, which is density. 0.54087397 is the weight for the 3rd variable, which is population increase. 0.057905086 is the weight for the 4th variable, which is "babymort". -0.56205428 is the weight for variable "gdp_cap". When examining PC 1 -3, which are the retained Principle Components, there are weights that stand out. For Example, for PC1, Population Increase and "baby_mort" stands out. PC2, Population increase stands out and PC3, "gdp_cap" is what stands out. A full list of loadings is also displayed which is the weight for every observation. Notice that the 1st component is weighted more because they are considered more significant than components towards the end.


World Loadings Dendrogram
Height
0
2
4
6
8
10
12
SD
hclust (*, "complete")


World Loadings Cluster
Component 2
-4
-2
0
2
-2
-1
0
1
2
Component 1
These two components explain 40 % of the point variability.

A Dendrogram was created and displays individual observations with groups forming as one goes up. To determine the number of clusters, retain, it was observed the variance and created containers. With this, the number if clusters were retained. While a Dendrogram helps analyze the hierarchical and separate observations, the k means cluster helps split between a set number of clusters. When examining the clusters, one can see the 6 components or cluster groups and visualization of the between variability and within variability.

Conclusion

Analyzing the Crude Birth Rate for Mexico and United States, the mean tended to be higher during the years of 1950 – 2100. However, when analyzing Male and Female Life Expectancy, it was obvious that the Life Expectancy was higher in terms of means in the United States. During the years 2010 – 2040, there was a negative strong correlation in Mexico and United States in terms of the Crude Birth Rate. As Crude Birth Rate goes up, life expectancy goes down. Though both had a strong negative correlation, United States had a slower rate. Also, During the years of 2010-2040, when analyzing the T test, Mexico and the United States had true means not equal to 0, specifically for Crude Birth Rate and Life Expectancy. Chi Squared and ANOVA displays relationships between Mid Periods and Sex Ratio in Mexico vs United States. Linear Regression Models identified that Mexico's important variables for Life Expectancy is the Life Expectancy for Males and Females, while in the United States, the important variables in Life Expectancy were Life Expectancy in genders, Deaths, and Crude Birth Rates. Principle Component Analysis and Clusters were observed using the world population data as it hoped to gain a better understanding of the important factors in population. Principle Component 1-3 (Population, Density, Population increase) were considered important and retained. Though the Dendrogram and Kmeans were used for visualizations on Clusters, it still displayed what the variability might be and the importance of population. During this analyzation, it is important to note that there are several analyzations one can do with so many variables. Going over this data at first, gave an idea of the details and important these variables have, and once calculating data, it further supported the idea that any calculations can be done, but not all can be solved.

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