Looking at public health care: Comparing life expectancy and GDP per capita.

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Introduction

Many developed countries have a public health option or at least their governments invest more money into public health rather than letting private insurance companies fund health care for most citizens. I have set out to gain (through statistical means) more understanding of governments investing in public health care. I will compare two groups of countries, those that spend 59% or more on public health of the total health care spending and those who spend less than that average (refer to Appendix 1) to life expectancy at birth and standard of living (GDP per capita). The groups of countries were decided and based on the sample mean percentage governments pay of the total health expenditures which is 59.31%; this percentage is calculated from World Bank's data (2011a).

My data was collected from the World Bank and is available to the public. Each dataset collected had a list of countries and yearly statistics; I used the year 2009 for all calculations. My population is the world including every country/state/territory. Every statistic available from these World Bank datasets was used in my analysis. My samples will underrepresent third-world countries and may over represent corrupted or oppressive states that wish to give more positive figures than realistic ones. Developed countries are also over represented in the data.

My hypothesis:

H0: Countries, whose governments invest more than 59% of the total health care expenditure, show no difference in life expectancy or standards of living to those that spend less than 59%.

HA: Countries, whose governments spend more than 59% of the total health care expenditure have a longer life expectancy and higher stand of living.

Life expectancy

According the World Bank data (2011b), the mean life expectancy for countries that spend more than 59% of the total health expenditure is 72 years (with 95% confidence of mean being

between 70 and 74); with a sample standard deviation is 9.06 (refer to Appendix 2a). Countries that spend less than 59% have a mean life expectancy of 65 years (with 95% confidence of mean being between 63 and 67); sample standard deviation of 9.8 (refer to Appendix 2c).

The histograms for life expectancy at birth for both samples, less than 59% of total public health expenditure and 59% or more of total public health expenditure, where both skewed to left. This is not surprising because everyone is living longer except for a small group of third world countries. Here I will test the first variable in the hypothesis.

H0: Countries, whose governments spend more than 59% show no difference in life expectancy than countries that spend less than 59%., have an average to shorter life expectancy.

Ha: Countries, whose governments spend more than 59%, have longer life expectancy.

We will do a two sample test; we have a sample (n) of 94 countries whose governments spend 59.31% or more in the total health care expenditure and the sample of the second group is 86. After calculating the t-test and t-distribution (figures can be found in Appendix 4) p-value is incredibly close to zero at a value of 1.77187E-06; therefore we can reject H0 at any reasonable level of significance. There is significant evidence to claim that government spending on health care can have a positive effect on life expectancy to some degree.

Standard of living

We will measure standard of living by GDP per capita in U.S. dollars and the data represents 2009 statistics (World Bank, 2011c). The GDP mean for countries that spend 59% or more of the total health expenditure is $18,388 (with 95% confidence of mean being between $13326.92 and $23449.58); with sample standard deviation at $25245.14 (refer to Appendix 3a). The mean of GDP in countries that spend less than 59% of the total health expenditure is $4,772.08 (with 95% confidence of mean being between $3,062.09 and $6,482.03); with sample standard deviation at $7927.72 (refer to

Appendix 3c). Histograms for GDP per capita were a little more interesting. The histogram for those countries that spend 59% or more on total health expenditure shows distribution in the middle percent, but not symmetric. Then the histogram for countries that spend less than 59% is skewed to the right but irregular. Now to test the hypothesis:

> H0: Countries, whose governments spend 59% or more on total health care expenditures, show no difference in standard of living than those countries that spend less than 59% of the total health care expenditure.
>
> Ha: Countries, whose governments spend 59% or more on total health care expenditures, have a higher standard of living.

In our test of the above hypothesis, we have a sample (n) of 98 who spend 59% or more in total health care and in the second group a sample size of 85. After doing a one sample test for t-distribution (figures can be found in Appendix 5) we find that p-value is also very low at 1.5459E-06. We can reject H0 at a level of significance of 0.05. There is statistically significant evidence to suggest that countries that spend 59% or more in total health care expenditures also have a higher standard of living when looking at GDP per capita.

Regression

To further illustrate how closely these variables correlate to one another, I have run regression using all the data available for all the countries. I have chosen to use two independent variables: percentage of public health care expenditure and GDP per capita. This is because I believe that greater public spending on health care and GDP per capita go hand in hand; logical reasoning states that those with higher GDP per capita most likely spend more on public health in absolute terms, excluding the United States, of course. My dependent variable is life expectancy, thus we are measuring the relationship between public health care spending and GDP per capita with longevity of life at birth.

The p-value given for life expectancy was 0.006 (Refer to Appendix 6). We can conclude on this level that public health care spending can influence life expectancy of those citizens. Next, looking at the p-value of life expectancy and GDP per capita, which is 2.02E-12 (refer to Appendix 6), we can positively say that there is significant evidence to claim that higher GDP per capita results in a longer life span. In this case we can use GDP per capita as a control variable; meaning, when we compare two countries with the same standard of living we can expect the one country who spends more of the health care expenditure to have a longer life expectancy than the country that spends less. This results are so significant that by increasing the percentage of *public* health care spending by 10% will also increase life expectancy by one year on average

Conclusion

While life expectancy and GDP per capita have many variables that give causes to them, healthy people are essential for both. A higher proportion of public spending on health care out of total spending in a country seems to be more effective in achieving higher GDP per capita and longer life expectancy through a healthier and more productive work force. Looking at our hypothesis testing and regression, these states have longer live expectancy from birth and higher standards of living than countries that do not contribute more than half of the total health care expenditure. However, we are careful to claim that public spending on health care is the sole reason why countries have longer life expectancy and higher GDP per capita, there are just too many other variables to consider that were omitted from our analysis. Whichever the fact may be, it would not be wrong to suggest that public health care spending controlling for GDP per capita play a large role in longer life spans.

Appendices

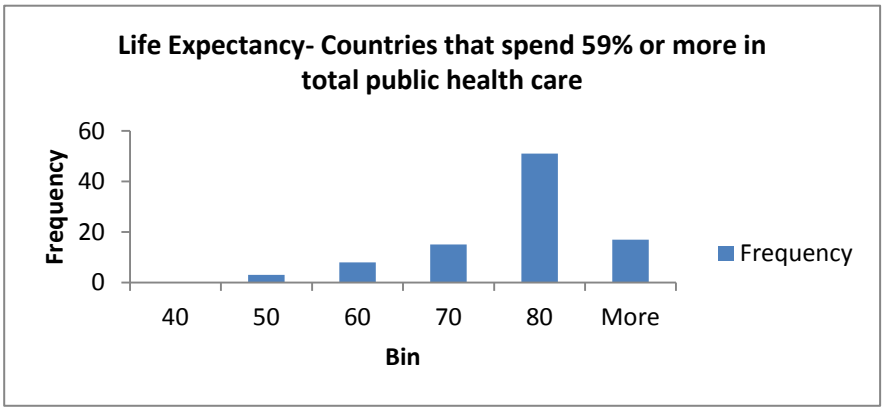
Appendix 1: Global Health Expenditure, public (%) – Descriptive Statistics

Column1	
Mean	59.31605
Standard Error	1.431876
Median	62.13509
Mode	#N/A
Standard Deviation	19.52818
Sample Variance	381.35
Kurtosis	-0.52654
Skewness	-0.36384
Range	92.55827
Minimum	7.170732
Maximum	99.729
Sum	11032.79
Count	186

Appendix 2a: Life expectancy in years of countries, whose governments spend 59% or more in total health care expenditures- Descriptive statistics

Life expectancy: 59% or more	
Mean	72.06508
Standard Error	0.934596
Median	74.19407
Mode	#N/A
Standard Deviation	9.061241
Sample Variance	82.10609
Kurtosis	1.008356
Skewness	-1.29548
Range	36.32618
Minimum	46.66937
Maximum	82.99554
Sum	6774.118
Count	94
Confidence Level(95.0%)	1.855922

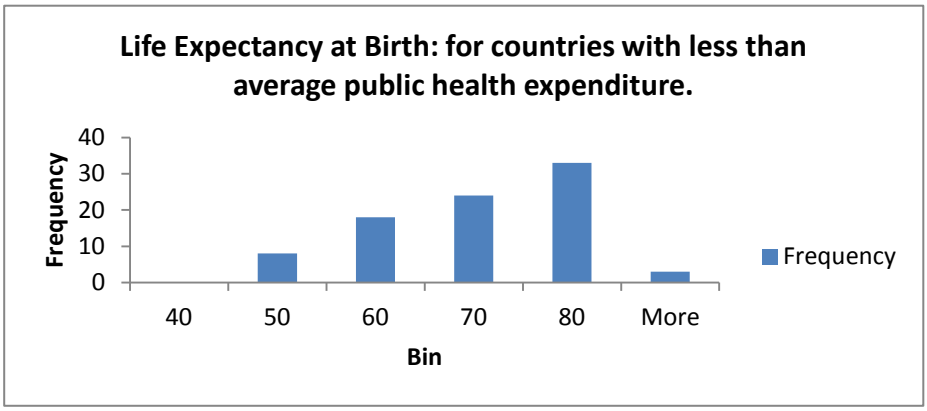
Appendix 2b: Life expectancy in years of countries, whose governments spend 59% or more in total health care expenditures- Histogram



Appendix 2c: Life expectancy in years of countries, whose governments spend less than 59% of total health care expenditures- Descriptive Statistics

Life expectancy	
Mean	65.30580062
Standard Error	1.056629327
Median	68.27536585
Mode	#N/A
Standard Deviation	9.798777272
Sample Variance	96.01603603
Kurtosis	-1.02462624
Skewness	-0.4314778
Range	34.66995122
Minimum	46.88370732
Maximum	81.55365854
Sum	5616.298854
Count	86
Confidence Level(95.0%)	2.100862181

Appendix 2d: Life expectancy in years of countries, whose governments spend less than 59% of total health care expenditures- Histogram

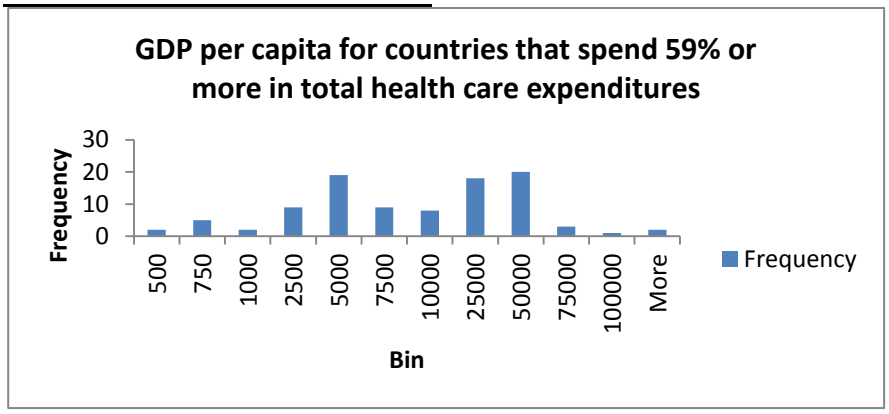


Appendix 3a: GDP per capita(in US $) of countries, whose governments spend 59% or more in total health care expenditures- Descriptive statistics

GPD per capita: 59% or more	
Mean	18388.24838
Standard Error	2550.144428
Median	8324.152325
Mode	#N/A
Standard Deviation	25245.14185
Sample Variance	637317187
Kurtosis	14.64976307
Skewness	3.157940042
Range	172254.5605
Minimum	421.7802278
Maximum	172676.3407
Sum	1802048.341
Count	98
Confidence Level(95.0%)	5061.330773

Appendix 3b: GDP per capita(in US $) of countries, whose governments spend 59% or more in total health care expenditures- Histogram

Bin	*Frequency*
500	2
750	5
1000	2
2500	9
5000	19
7500	9
10000	8
25000	18
50000	20
75000	3
100000	1
More	2



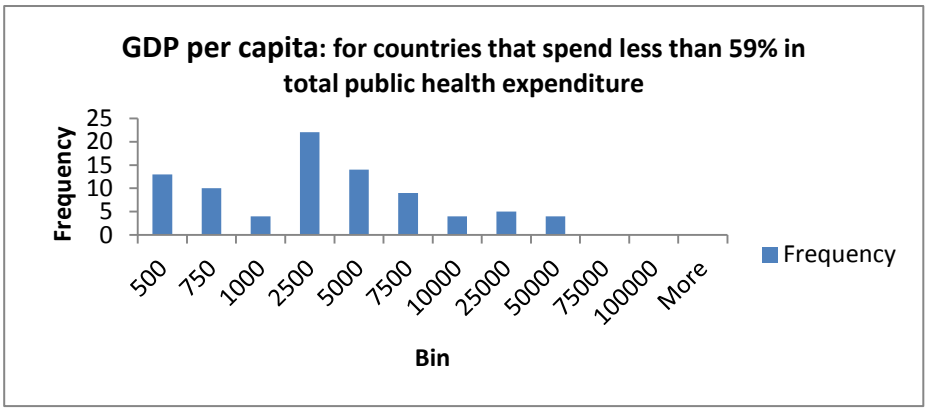
Appendix 3c: GDP per capita(in US $) of countries, whose governments spend less than 59% of the total health care expenditures- Descriptive statistics

GDP per capira: less than 59%	
Mean	4772.058891
Standard Error	859.8823665
Median	1921.879465
Mode	#N/A
Standard Deviation	7927.723706
Sample Variance	62848803.16
Kurtosis	12.05010662
Skewness	3.297546111
Range	45581.68916
Minimum	162.8704077

Maximum	45744.55957
Sum	405625.0057
Count	85
Confidence Level(95.0%)	1709.970387

Appendix 3d: GDP per capita(in US $) of countries, whose governments spend less than 59% of the total health care expenditures- Histogram

Bin	*Frequency*
500	13
750	10
1000	4
2500	22
5000	14
7500	9
10000	4
25000	5
50000	4
75000	0
100000	0
More	0



Appendix 4: T-test for Life Expectancy: Two-Sample Assuming Unequal Variances

	Life expectancy: 59% or more	*Life expectancy: less than 59%*
Mean	72.06508025	65.30580062
Variance	82.10608766	96.01603603
Observations	94	86
Hypothesized Mean Difference	0	
df	173	
t Stat	4.791605078	
P(T<=t) one-tail	1.77187E-06	
t Critical one-tail	1.653709184	
P(T<=t) two-tail	3.54373E-06	
t Critical two-tail	1.973771337	

Appendix 5: T-test for GDP per capita: Two-Sample Assuming Unequal Variances

	59% or more	*less than 59%*
Mean	18388.24838	4772.058891
Variance	637317187	62848803.16
Observations	98	85
Hypothesized Mean Difference	0	
df	119	
t Stat	5.0594966	
P(T<=t) one-tail	7.72952E-07	
t Critical one-tail	1.657759285	
P(T<=t) two-tail	1.5459E-06	
t Critical two-tail	1.980099876	

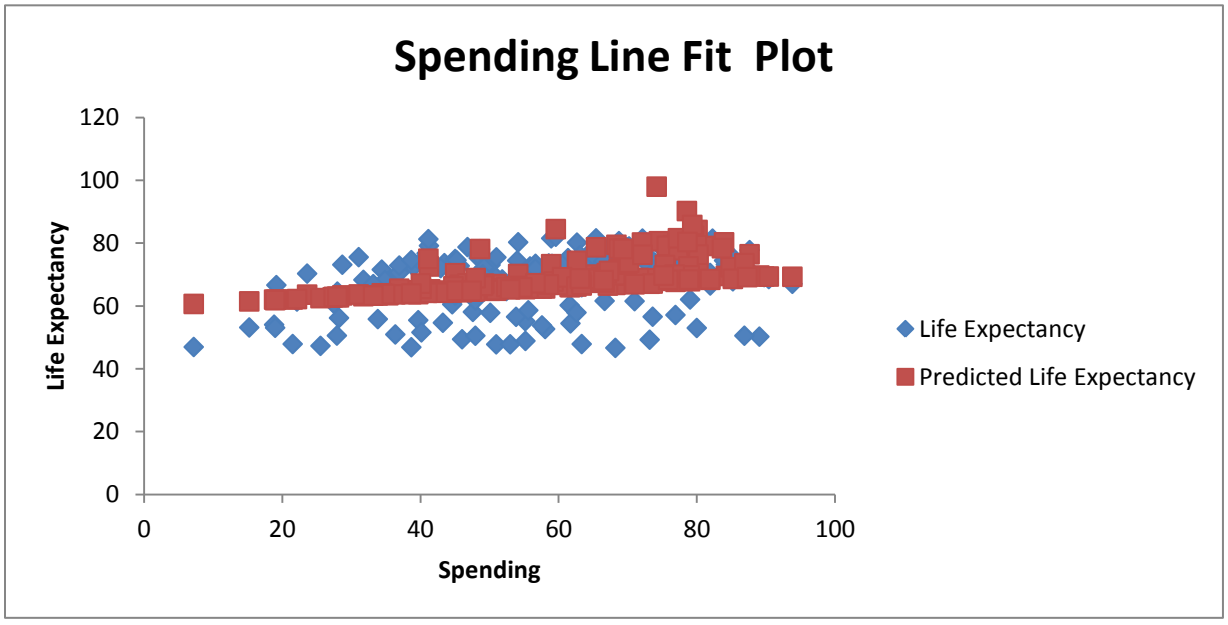
Appendix 6: Regression Statistics: Life Expectancy in relation to percentage of public health care expenditure and GDP per capita.

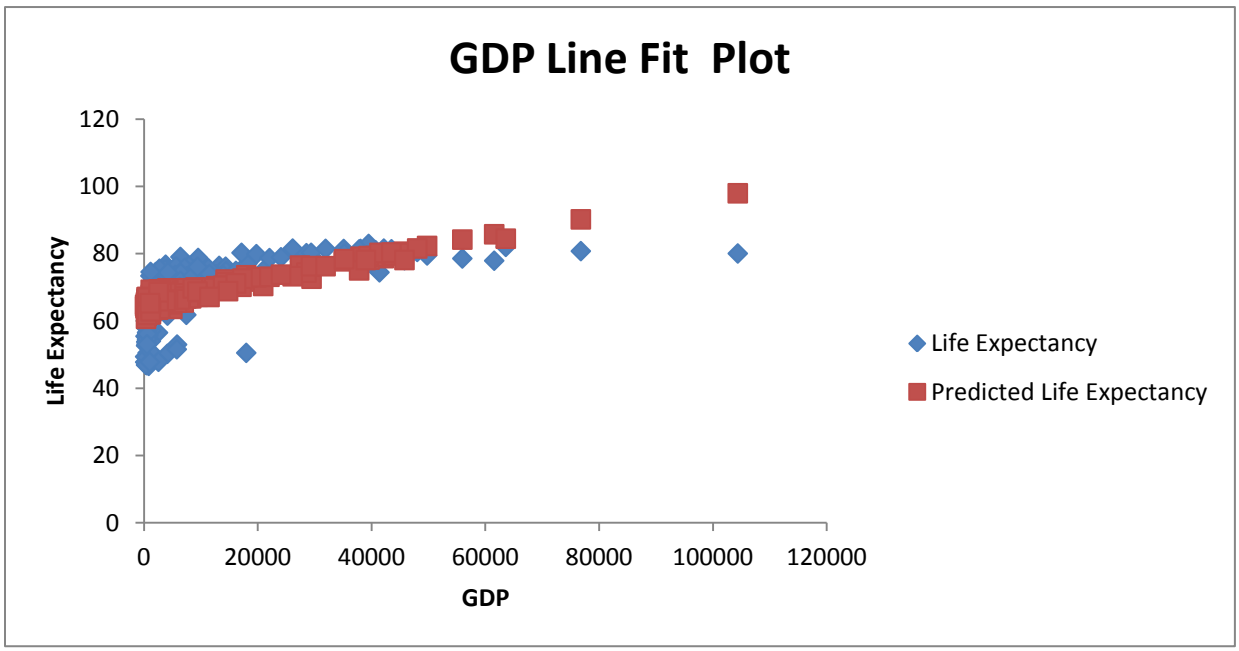
Regression Statistics	
Multiple R	0.597952
R Square	0.357547
Adjusted R Square	0.350076
Standard Error	7.979128
Observations	175

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	2	6094.396	3047.198	47.86188	2.98E-17
Residual	172	10950.64	63.66649		
Total	174	17045.03			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	59.87024	2.006309	29.84098	6.5E-70	55.91008	63.8304
Spending	0.096987	0.035091	2.763901	0.006334	0.027723	0.16625
GDP	0.000296	3.91E-05	7.582631	2.02E-12	0.000219	0.000374




GDP Line Fit Plot
Life Expectancy
120
100
80
60
40
20
0
0
20000
40000
60000
80000
100000
120000
GDP
Life Expectancy
Predicted Life Expectancy

References

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World Bank. (2011c). *GDP per capita (current U.S. dollars)* [Data set]. Retrieved from: http://data.worldbank.org/indicator/NY.GDP.PCAP.CD