Econometrics Project
Happiness Index Analysis To Facilitate Policy Making

DELHI TECHNOLOGICAL UNIVERSITY

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Abstract - **Happiness is considered to be the proper measure of social progress and the goal of public policy making. It is one of the most important factors to be taken into consideration while discussing sustainable living and general well-being, both for an individual and the nation. This report seeks to determine a relation between econometric variables such as GDP, population etc and happiness index of the countries. The aim is to find attributes which influence the happiness of people in a country. Additionally, it also draws logical inferences to assist in the formulation of governmental policies.**

1.INTRODUCTION

The dominating factor encouraging and pushing all human endeavor is the search for the forever-elusive concept of happiness. Happiness can be defined in the context of feelings of joy, satisfaction, and general mental and physical well-being, and is one of the principal pursuits of societies at large today. The quest for happiness is the driving force behind most (and all) of our actions, culture, history, and life.

Happiness is also linked to productivity and ability/willingness to pay taxes, ultimately increasing the standard of living for all the members of the society. It thus becomes imperative to quantify and study this state of mind, and perhaps its impact on various matters of social, economic and political interest. Many organizations and governments have come up with methods for quantifying and promoting the usage of happiness as an evaluation factor of a country's progress.

The United Nations, for instance, publishes regular World Happiness Reports that rank countries based on their happiness index. The first World Happiness Report was published in April 2012, in support of the United Nations High-Level Meeting on happiness and well-being. Since then the world has come a long way. In June 2016 the Organisation for Economic Co-operation and Development (OECD) committed itself "to redefine the growth narrative to put people's well-being at the center of governments' efforts". Many such initiatives and reports continue to be put forth.

States within a country with comparable happiness metrics can be ranked globally as well. Ranking states thusly can show similarly predisposed countries and through a thorough analysis of similarities in positions and policies, policy-related roadmaps can be developed and even collaborated on. The principal motive of this study is to analyze and quantify happiness, and the

factors related to and affected by it. This is done using a statistical machine learning-based analysis. This will further contribute to research on happiness, mental health and the wellness of a population. Apart from such benefits, happiness can also prove to be a valuable indicator of a nation's development levels and state of governance. Additionally, this report will serve as a backbone of investment strategies and reframing policies to lower the crime and suicide rates in the country, thus improving the quality of living.

2. RELATED WORK

The subject of happiness and its impact on various factors concerning human resources and development has been studied extensively. One of the earliest analytical works on happiness and its impact on general well-being was by Tatarkiewicz [1]. Zidansek [2] tried to establish a correlation between happiness and sustainable development and proposed that there is no need to sacrifice happiness for the development of future generations. Musa et al. [3] integrated policy outcomes of the government and its impacts on human well-being. The findings reveal that the level of community happiness depends on the existing level of sustainable urban development.

Several variants and alternative versions of the happiness index have been proposed for better quantification and development as well. Hervas and Vasquez [4] introduced the Pemberton Happiness Index, which measured well-being and happiness in seven different languages. Wang et al. [5] evaluated the suitability of Facebook's Gross National Happiness Index, which estimates the aggregated mood and well-being of the Facebook population by applying automated sentiment analysis to the status updates of millions of Facebook users [6]. Cloutier, Jambeck and Scott [7] proposed the Sustainable Neighborhoods for Happiness Index (SNHI), which is a tool to assess and compare how well individual cities, towns, neighborhoods, and communities embrace sustainable practices and how these practices translate to opportunities for residents to pursue happiness. Kaczmarek, Bujacz, and Eid [8] zeroed in on being satisfied with life as a primary factor in developing happiness indices and presented the Steen Happiness Index.

Many other indices continue to be developed and proposed, and many more are currently in the works. There, however, needs to exist sufficient research and justification behind developing such evaluation metrics for happiness. There is enough research to support our claims of happiness being an evaluation metric of importance. For instance, Frey [9] describes how government can provide the conditions under which people can achieve well-being, arguing that effective political institutions and decentralized decision making play crucial roles. Ryff [10] explored the meaning of psychological well-being and its correlation with happiness.

3. EXPERIMENT DESCRIPTION

3.1 Model Description

We used machine learning techniques to analyze the collected data and draw relevant inferences. The basic goal of a machine learning model is to develop a hypothesis that can be used to estimate some output based on the input. There are two categories of machine learning models based on the kind of outputs expected, namely classification (for discrete-valued output) and regression (for continuous-valued output). Our problem statement necessitates the usage of a regression algorithm because we expect continuous-valued output (happiness score).

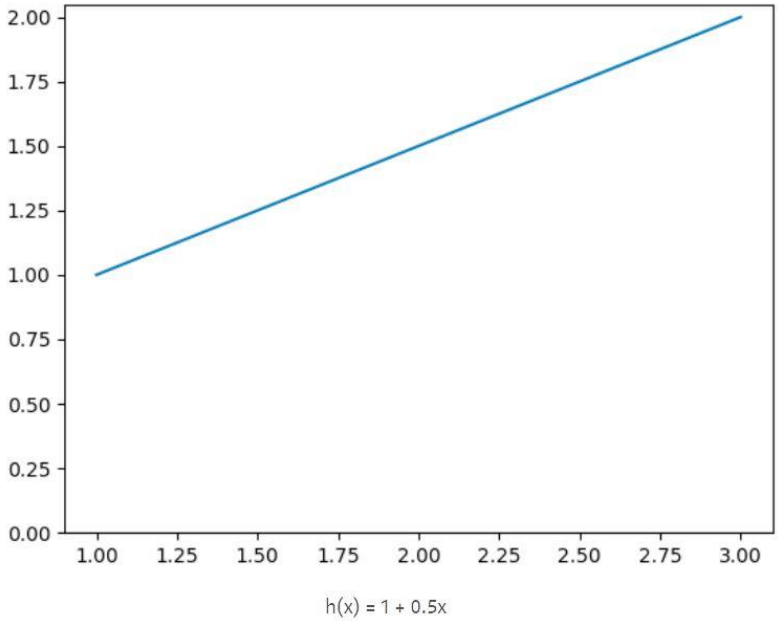
The core idea behind linear regression is to obtain a curve that best fits the data. Simple linear regression is used when we wish to find a linear curve for the hypothesis i.e. the line of best fit. The line of best fit is the one for which total prediction error (for all data points) is the minimal. The error is defined as the distance between the observed point to the regression line for that parameter. The hypothesis curve for simple linear regression is usually of the form:

$$h_\theta(x) = \theta_0 + \theta_1 x \qquad \text{....(2)}$$

Here θ is a hyper-parameter use for fitting the model.
For example,

$$\theta_0 = 1$$
$$\theta_1 = 0.5$$

Gives $h_\theta(x) = 1 + 0.5x$, which is a straight line with a slope of 0.5 and a y-intercept of 1.



The components that went into building our statistical linear regression model are elaborated on below.

3.1.1 Cost Function

Cost function maps an event or values of one or more variables onto a real number intuitively representing some 'cost' associated with the event.

In this report, our event is the difference between estimated values, or the hypothesis and the real values—the actual data we are trying to fit a line to. The cost function, J(θ) is a function of the hyper-parameter θ and can be represented as follows:

$$J(\theta_0, \theta_1) = \frac{1}{2m} \sum_{i=1}^{m} \left(h_\theta(x^{(i)}) - y^{(i)}\right)^2 \quad \text{....(1)}$$

Here $h_\theta(x)$ is hypothesis, or outcome predicted by our linear regression model, as a function of θ and input variable and *y* is the actual outcome variable. For our multivariate linear regression model, we extend the above binary equation by generalising it for *n* values of θ, where *n* represents the number of attributes or independent variables. Our aim is to minimise the cost function - that is, to reduce the overall error.

$$\text{Goal:} \qquad \underset{\theta_0, \theta_1}{\text{minimize}}\ J(\theta_0, \theta_1)$$

3.1.2 Gradient Descent

Gradient Descent is a general function used for optimization. It changes the θ values bit by bit until we *hopefully* arrive at a minimum. To compute gradient descent we compute the partial differential of the cost function with respect to θ and substitute in the equation given by equation 1.

$$\begin{aligned} &\text{repeat until convergence } \{ \\ &\quad \theta_j := \theta_j - \alpha \frac{\partial}{\partial \theta_j} J(\theta_0, \theta_1) \\ &\qquad (\text{for } j = 1 \text{ and } j = 0) \\ &\} \end{aligned}$$

Here α is another hyper-parameter called the learning rate which determines how fast the system converges to the local minima. It is important to choose a learning rate which is not too slow but not very fast either, in which case the algorithm fails to find a local minimum or converges to the local minima after a large number of epochs, which results in a suboptimal solution.

3.1.3 Correlation

The term correlation refers to a mutual relationship between quantities. If two quantities have a strong correlation, one can be used to predict the other.

Pearson's Correlation Coefficient

The Pearson's correlation coefficient is a useful statistical formula that measures the strength between variables and relationships. In the field of statistics, this formula is often referred to as the Pearson R test. When conducting a statistical test between two variables, it is a good idea to compute the Pearson's correlation coefficient value to determine just how strong that relationship is between those two variables.

The coefficient value can range between -1.00 and 1.00. If the coefficient value is in the negative range, then that means the relationship between the variables is negatively correlated. That is, as one value increases, the other decreases. If the value is in the positive range, then that means the relationship between the variables is positively correlated, or both values increase or decrease together.

The formula for computing the Pearson's correlation coefficient is given below.

$$r = \frac{N\Sigma xy - (\Sigma x)(\Sigma y)}{\sqrt{[N\Sigma x^2 - (\Sigma x)^2][N\Sigma y^2 - (\Sigma y)^2]}}$$

Where:

N	=	number of pairs of scores
Σxy	=	sum of the products of paired scores
Σx	=	sum of x scores
Σy	=	sum of y scores
Σx^2	=	sum of squared x scores
Σy^2	=	sum of squared y scores

The P-value is the probability of evaluating the results correctly if the correlation coefficient were in fact zero (null hypothesis). If this probability is lower than the conventional 5% ($P<0.05$) the correlation coefficient is said to be statistically significant.

3.2 Dataset description

The happiness scores and rankings use data from the Gallup World Poll [11]. The scores are based on answers to the main life evaluation question asked in the poll. This question, known as the Cantril ladder, asks respondents to think of a ladder with the best possible life for them being

a 10 and the worst possible life being a 0 and to rate their own current lives on that scale. The scores are from nationally representative samples for the years 2013-2016 and use the Gallup weights to make the estimates representative. The columns following the happiness score estimate the extent to which each of six factors – economic production, social support, life expectancy, freedom, absence of corruption, and generosity – contribute to making life evaluations higher in each country than they are in Dystopia, a hypothetical country that has values equal to the world's lowest national averages for each of the six factors.
The features present in the data are described in figure 1.

wp5_country	WP5 is GWP's coding of countries, including some sub-country territories such as Hong Kong.
country	Country
year	Year
life_ladder	Happiness score or subjective well-being (variable name ladder).
log_gdp_per_capita	Statistics of GDP per capita (variable name gdp) in purchasing power parity (PPP) at constant 2011 int. dollar prices
social_support	Social support (or having someone to count on in times of trouble) is the national avg of the binary responses (0 or 1)
healthy_life_expectancy_at_birth	The time series of healthy life expectancy at birth calculated by WHO, WDI, and other published stats
freedom_to_make_life_choices	National avg responses to "Are you satisfied or dissatisfied with your freedom to choose what you do with your life?"
generosity	National avg responses to "Have you donated money to a charity in the past month?" on GDP per capita
perceptions_of_corruption	Avg response to "Is corruption widespread throughout the government..." "Is corruption widespread within businesses..."
positive_affect	The average of three positive affect measures in GWP: happiness, laugh and enjoyment in the Gallup World Poll waves 3-7
negative_affect	The average of three negative affect measures in GWP, worry, sadness and anger
confidence_in_national_government	From the GWP "Do you have confidence in each of the following, or not? How about the national government?"
democratic_quality	Based on Worldwide Governance Indicators (WGI) project (Kaufmann, Kraay and Mastruzzi)
delivery_quality	Based on Worldwide Governance Indicators (WGI) project (Kaufmann, Kraay and Mastruzzi)
standard_deviation_of_ladder_by_country_year	Alternative measures of inequality in happiness scores by wp5-year
standard_deviation_mean_of_ladder_by_country_year	Alternative measures of inequality in happiness scores by wp5-year

Figure 1

For a better understanding of the data, we plotted happiness data comparison of various countries, as depending on the various factors listed above.

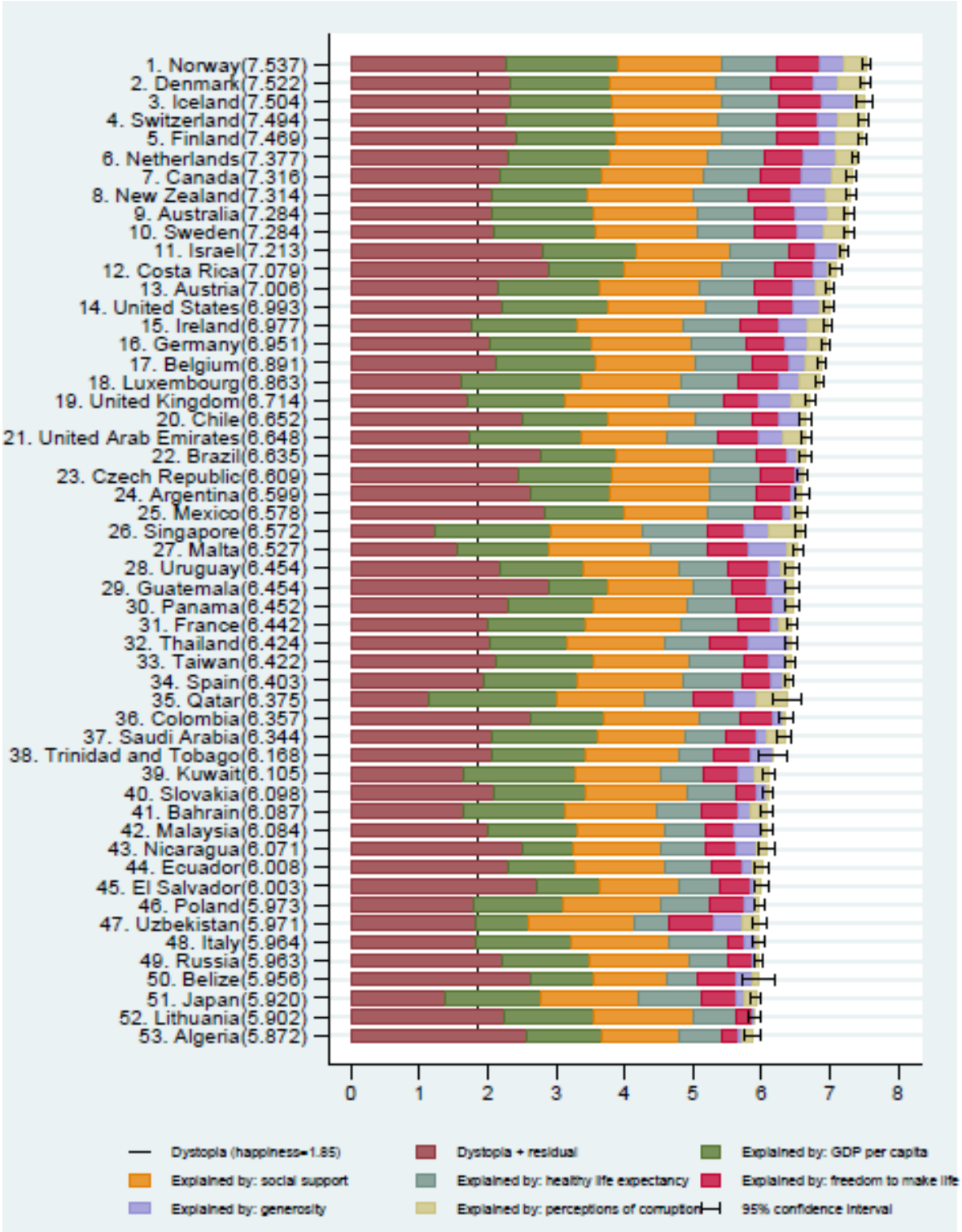
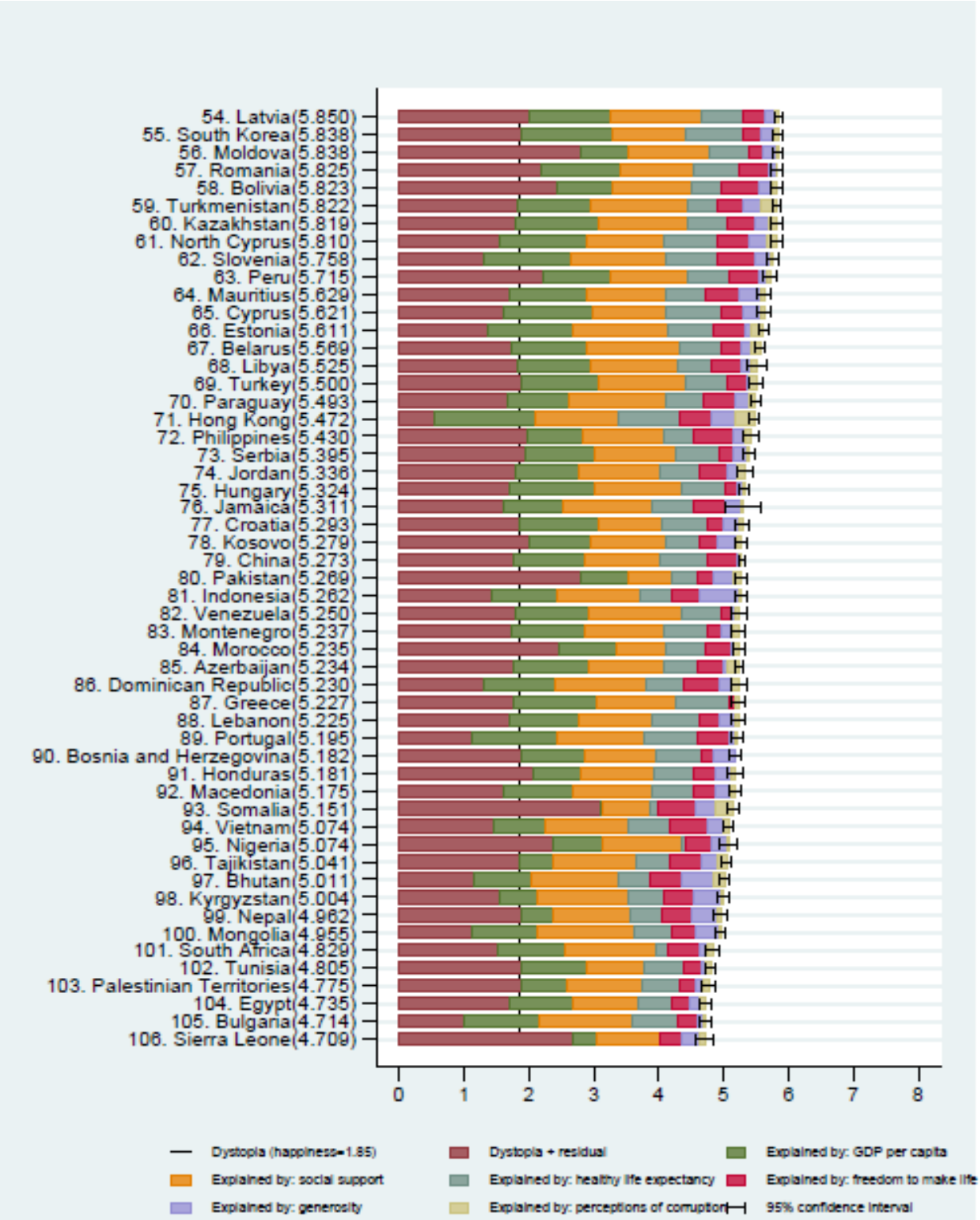

1. Norway(7.537)
2. Denmark(7.522)
3. Iceland(7.504)
4. Switzerland(7.494)
5. Finland(7.469)
6. Netherlands(7.377)
7. Canada(7.316)
8. New Zealand(7.314)
9. Australia(7.284)
10. Sweden(7.284)
11. Israel(7.213)
12. Costa Rica(7.079)
13. Austria(7.006)
14. United States(6.993)
15. Ireland(6.977)
16. Germany(6.951)
17. Belgium(6.891)
18. Luxembourg(6.863)
19. United Kingdom(6.714)
20. Chile(6.652)
21. United Arab Emirates(6.648)
22. Brazil(6.635)
23. Czech Republic(6.609)
24. Argentina(6.599)
25. Mexico(6.578)
26. Singapore(6.572)
27. Malta(6.527)
28. Uruguay(6.454)
29. Guatemala(6.454)
30. Panama(6.452)
31. France(6.442)
32. Thailand(6.424)
33. Taiwan(6.422)
34. Spain(6.403)
35. Qatar(6.375)
36. Colombia(6.357)
37. Saudi Arabia(6.344)
38. Trinidad and Tobago(6.168)
39. Kuwait(6.105)
40. Slovakia(6.098)
41. Bahrain(6.087)
42. Malaysia(6.084)
43. Nicaragua(6.071)
44. Ecuador(6.008)
45. El Salvador(6.003)
46. Poland(5.973)
47. Uzbekistan(5.971)
48. Italy(5.964)
49. Russia(5.963)
50. Belize(5.956)
51. Japan(5.920)
52. Lithuania(5.902)
53. Algeria(5.872)
0
1
2
3
4
5
6
7
8
Dystopia (happiness=1.85)
Dystopia + residual
Explained by: GDP per capita
Explained by: social support
Explained by: healthy life expectancy
Explained by: freedom to make life choices
Explained by: generosity
Explained by: perceptions of corruption
95% confidence interval

Figure 2


54. Latvia(5.850)
55. South Korea(5.838)
56. Moldova(5.838)
57. Romania(5.825)
58. Bolivia(5.823)
59. Turkmenistan(5.822)
60. Kazakhstan(5.819)
61. North Cyprus(5.810)
62. Slovenia(5.758)
63. Peru(5.715)
64. Mauritius(5.629)
65. Cyprus(5.621)
66. Estonia(5.611)
67. Belarus(5.569)
68. Libya(5.525)
69. Turkey(5.500)
70. Paraguay(5.493)
71. Hong Kong(5.472)
72. Philippines(5.430)
73. Serbia(5.395)
74. Jordan(5.336)
75. Hungary(5.324)
76. Jamaica(5.311)
77. Croatia(5.293)
78. Kosovo(5.279)
79. China(5.273)
80. Pakistan(5.269)
81. Indonesia(5.262)
82. Venezuela(5.250)
83. Montenegro(5.237)
84. Morocco(5.235)
85. Azerbaijan(5.234)
86. Dominican Republic(5.230)
87. Greece(5.227)
88. Lebanon(5.225)
89. Portugal(5.195)
90. Bosnia and Herzegovina(5.182)
91. Honduras(5.181)
92. Macedonia(5.175)
93. Somalia(5.151)
94. Vietnam(5.074)
95. Nigeria(5.074)
96. Tajikistan(5.041)
97. Bhutan(5.011)
98. Kyrgyzstan(5.004)
99. Nepal(4.962)
100. Mongolia(4.955)
101. South Africa(4.829)
102. Tunisia(4.805)
103. Palestinian Territories(4.775)
104. Egypt(4.735)
105. Bulgaria(4.714)
106. Sierra Leone(4.709)
0
1
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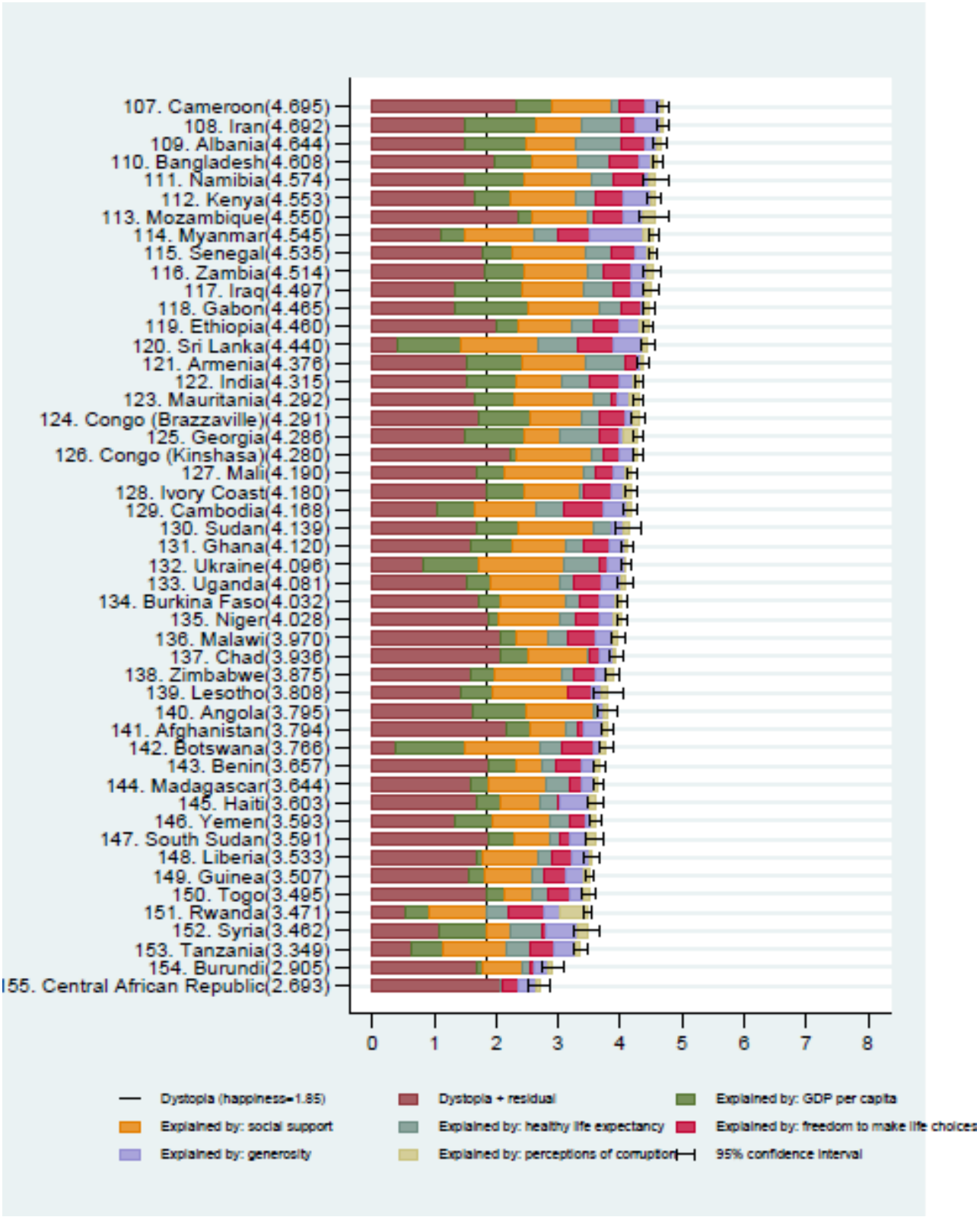
6
7
8
Dystopia (happiness=1.85)
Dystopia + residual
Explained by: GDP per capita
Explained by: social support
Explained by: healthy life expectancy
Explained by: freedom to make life choice
Explained by: generosity
Explained by: perceptions of corruption
95% confidence interval

Figure 3


107. Cameroon(4.695)
108. Iran(4.692)
109. Albania(4.644)
110. Bangladesh(4.608)
111. Namibia(4.574)
112. Kenya(4.553)
113. Mozambique(4.550)
114. Myanmar(4.545)
115. Senegal(4.535)
116. Zambia(4.514)
117. Iraq(4.497)
118. Gabon(4.465)
119. Ethiopia(4.460)
120. Sri Lanka(4.440)
121. Armenia(4.376)
122. India(4.315)
123. Mauritania(4.292)
124. Congo (Brazzaville)(4.291)
125. Georgia(4.286)
126. Congo (Kinshasa)(4.280)
127. Mali(4.190)
128. Ivory Coast(4.180)
129. Cambodia(4.168)
130. Sudan(4.139)
131. Ghana(4.120)
132. Ukraine(4.096)
133. Uganda(4.081)
134. Burkina Faso(4.032)
135. Niger(4.028)
136. Malawi(3.970)
137. Chad(3.936)
138. Zimbabwe(3.875)
139. Lesotho(3.808)
140. Angola(3.795)
141. Afghanistan(3.794)
142. Botswana(3.766)
143. Benin(3.657)
144. Madagascar(3.644)
145. Haiti(3.603)
146. Yemen(3.593)
147. South Sudan(3.591)
148. Liberia(3.533)
149. Guinea(3.507)
150. Togo(3.495)
151. Rwanda(3.471)
152. Syria(3.462)
153. Tanzania(3.349)
154. Burundi(2.905)
155. Central African Republic(2.693)
0
1
2
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4
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6
7
8
Dystopia (happiness=1.85)
Dystopia + residual
Explained by: GDP per capita
Explained by: social support
Explained by: healthy life expectancy
Explained by: freedom to make life choices
Explained by: generosity
Explained by: perceptions of corruption
95% confidence interval

Figure 4

4. EXPERIMENTAL METHOD

4.1 Data Pre-processing

We imported data for the year 2016 and selected the following attributes from the dataset:

1. Logarithm of GDP per capita
2. Social Support
3. Healthy life expectancy at birth
4. Freedom to make life choices
5. Generosity
6. Perceptions of Corruption
7. Positive Effect

Life Ladder was chosen as the target variable and missing attribute values were replaced with the mean of all the values of the attribute.

Data was also collected from over 250 students across Delhi and the following parameters were computed from the data:

Attributes	Values
SDP per capita- 2016 [19]	5,14,87,079 lakhs
Currency rate average in 2016	69.956
SDP per capita in dollars	73599.23 million
Log of sdp per capita	11.86687
Social Support	0.84426230
Freedom to make life choices	0.7500000
Perception towards corruption (government)	0.89344262
Generosity	0.29098361
Life expectancy[16]	73.2
positive effect	0.48633880

Table 1

4.2 Model Building and Training

We split the data into training and test set in 70:30 ratio. Upon applying linear regression to the training data, the intercept and coefficients obtained were as follows:

```
Intercept:  -3.0957450108679003
Coefficients :  [ 0.30266101  2.51988575  0.02752633  1.61325872  0.87888163 -0.16486079
  1.41016673  0.48579743 -0.72048787]
```

5. OBSERVATIONS AND CONCLUSIONS (*Dataset*)

The results of training the regression model are given below.

Training accuracy	Test accuracy
81.22%	90.71%

To understand and draw inferences from this analysis, we next visualise each attribute with our happiness score and find its correlation with happiness index.

For each attribute A, we plot the correlation of A with happiness index. The red dots represent the training samples and the blue dots represent the values predicted by our multivariate linear regression model.

5.1 Effect of GDP

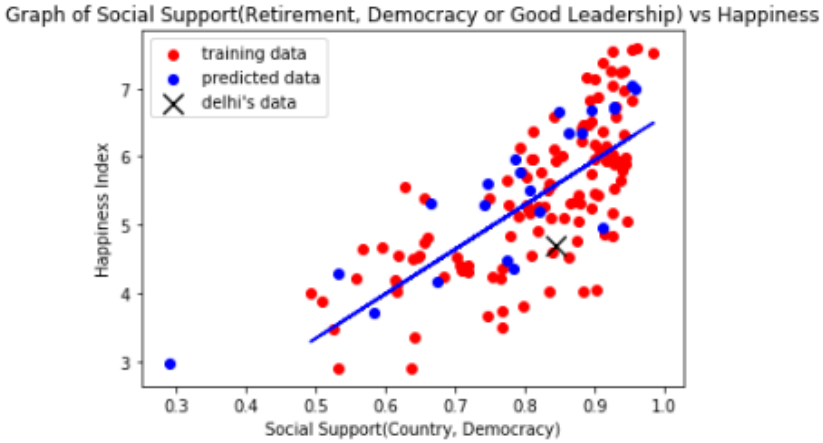

```
Correlation between data is :  0.8454841946217829
```

Inferences:

The data shows strong correlation between GDP and happiness index.

Higher the GDP per capita in a country, better the affordability of goods and services for the people; a population whose basic demands are met easily is a happier population.

5.2 Effect of Social Support




```
Correlation between data is :  0.8451723936883699
```

Inferences:

The data shows strong correlation between social support (government pension, insurance, schemes etc.) and happiness index.

Hence, for any country to project a good happiness index, investing in social support is definitely the way to go. This can be done by increasing pension amount, child care allowances, shelters for poor etc.

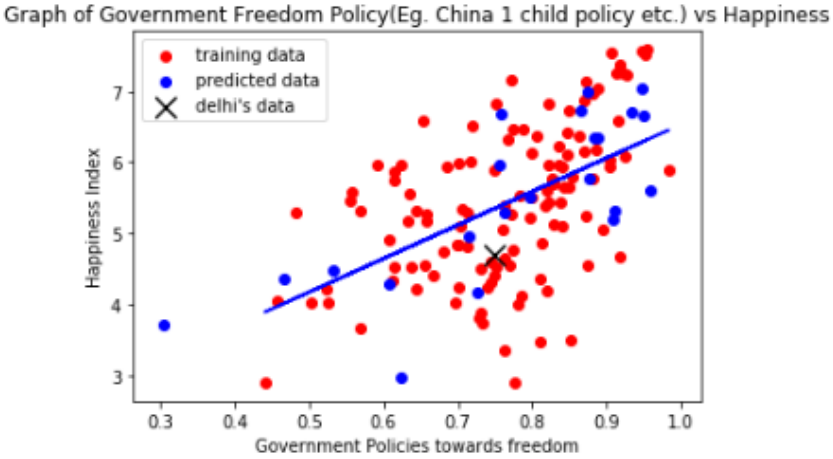
5.3 Effect of Life Expectancy


```
Correlation between data is :  0.9016344393225639
```

Inferences:

The data shows very strong correlation between life expectancy and happiness index. Hence, for any country to project a good happiness index, investments in health care, subsidy on insurance etc. are one of the primary ways to make a difference.

5.4 Effect of Government Policies towards Freedom of Speech and Expression




```
Correlation between data:  0.5867337757242498
```

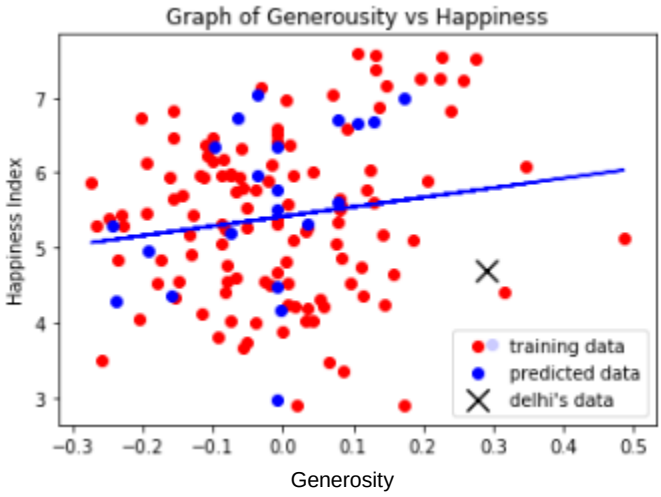
Inferences:

The data shows average correlation between government policies towards freedom of speech and expression and happiness index.

Hence, for any country to increase its happiness index, changing policies regarding provision of freedom will only have an underwhelming effect.

In developed countries with relatively high societal freedom, the government can choose to provide additional freedom to increase happiness index. For developing countries, other aspects are more important.

5.5 Effect of Generosity




```
Correlation between data:  0.020665968904855742
```

Inferences:

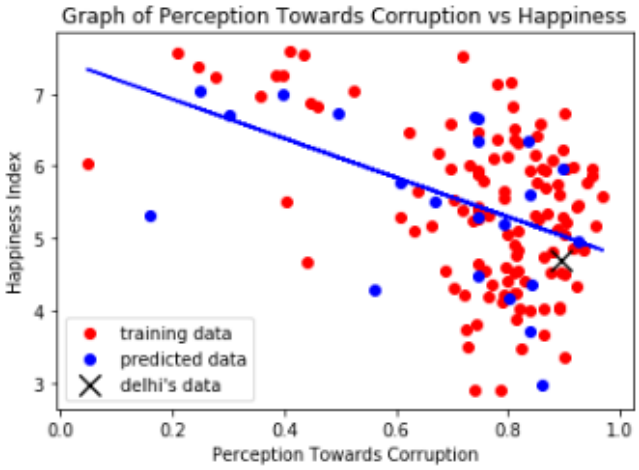
The data shows almost no correlation between generosity (people's tendency to express compassion and contribute to the welfare of the needy) and happiness index.

This is counter-intuitive at first but makes a lot of sense if one considers the following:

Affluent countries having strong government support can demote or de-advertise donations. This leads to happier poor population but also reduction in generosity (Denmark and Sweden, for instance.). Developing countries may have huge number of generous people but may not be happy owing to issues like high taxes, corruption etc. Hence, generosity can't be correlated directly with a country's happiness index.

In this case, state-led campaigns and donations, encouraging people to give alms, donations etc. could help improve a country's happiness index.

5.6 Effect of Perception of Corruption




```
Correlation between data is :  -0.8454841946217829
```

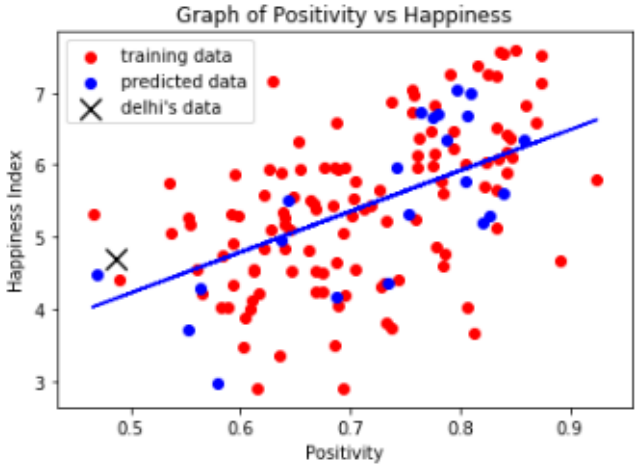
Inferences:

The data shows strong negative correlation between perception towards corruption (involving private and public sector, reported scams and misgovernance of funds etc.) and the happiness index.

The graph shows that people in most countries feel strongly about corruption, and those who don't are very happy except a few outliers. This trend vanishes among people in more corrupt countries [perceived not implied].

Creating committees and task forces, eliminating middlemen and making the government's allocation of funds more transparent will be crucial while increasing happiness index of a country as suggested by the data.

5.7 Effect of Positivity of People




```
Correlation between data is :  0.8454841946217828
```

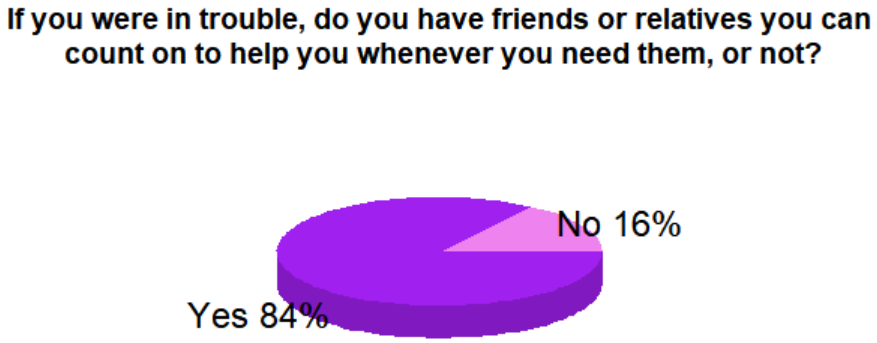
Inferences:
The data shows strong positive correlation between positivity and happiness index. This provides strong impetus for accelerating efforts towards boosting the morale of the population by giving them recreational and mental health facilities, organizing various events, interactions, functions etc. and working on economic and social issues, which do have a direct impact on the mindset, outlook towards the future and well-being of a population.

6. OBSERVATIONS AND CONCLUSIONS (*Survey*)

The following responses were obtained from the survey:

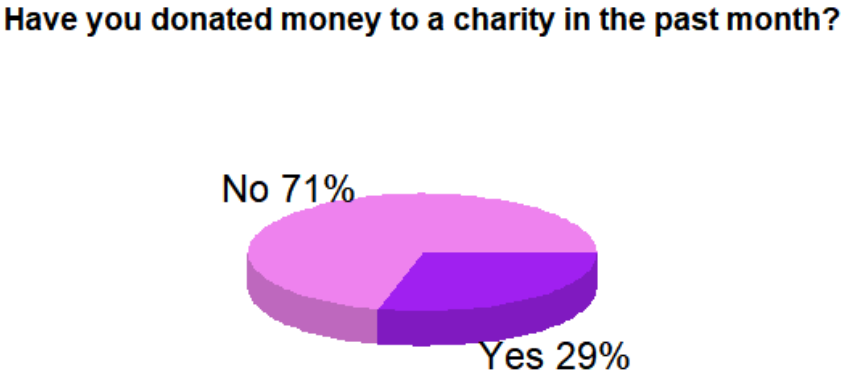
i) Happiness Score

ii) Social Support

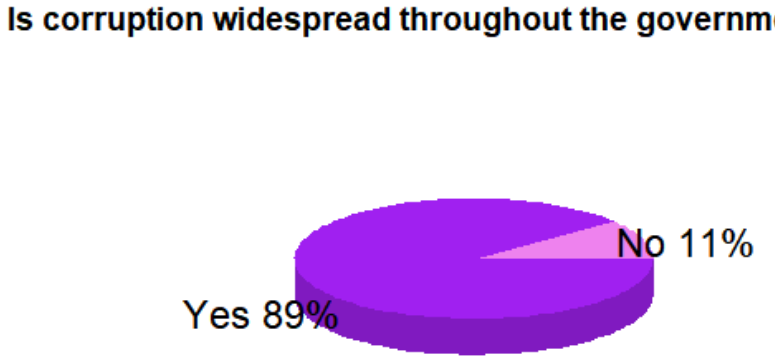


iii) Freedom

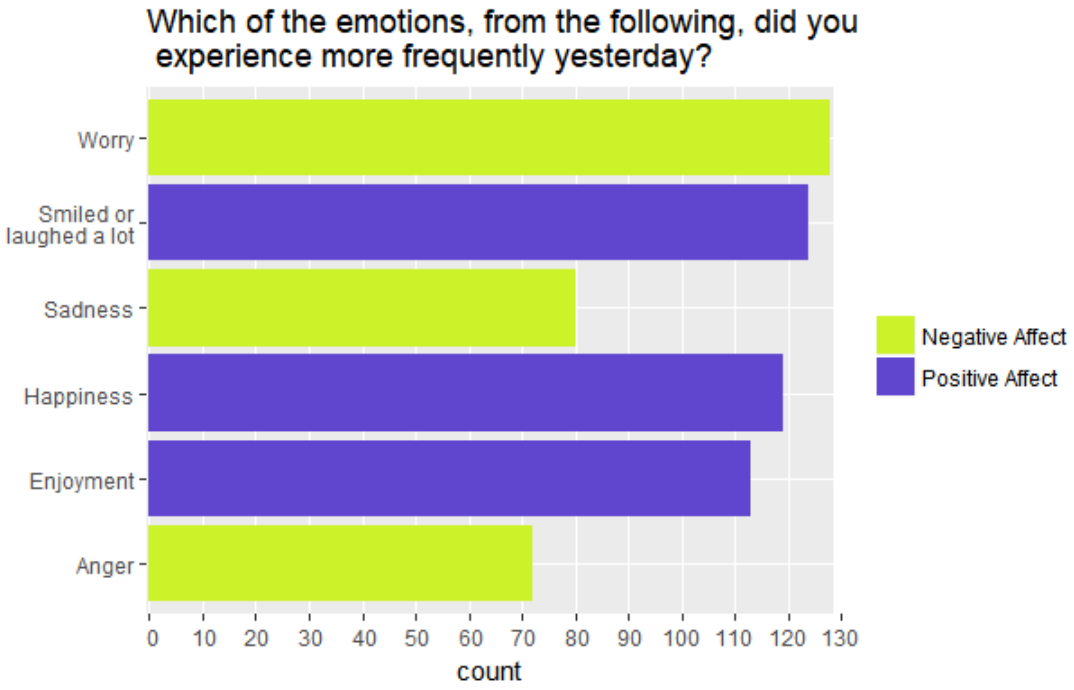
iv) Generosity



v) Perception towards government (corruption)



vi) Positive Effect and Negative Effect



On predicting the Happiness Index of Delhi based on our survey responses as inputs to our regression model, we obtain:

Delhi's Happiness Score, as predicted	5.89689138
Delhi's Rank from Computed Machine Learning Model	98
Average Happiness Score, as obtained from the survey	6.77049180

Table 2

We have hence obtained a fairly accurate model and successfully applied it on a dataset collected from across the National Capital.

References:

1. Tatarkiewicz, W. (1976). Analysis of happiness.
2. Zidansek, A. (2007). Sustainable Development and Happiness in Nations, Energy Volume 32, Issue 6, June 2007.
3. Musa H.D., Yacob M.R., Abdullah A.M., Ishak M.Y. (2018). Enhancing subjective well-being through strategic urban planning: Development and application of community happiness index, Sustainable Cities and Society Volume 38.
4. Hervás, G., & Vázquez, C. (2013). Construction and validation of a measure of integrative well-being in seven languages: The Pemberton Happiness Index. Health and quality of life outcomes, 11(1), 66.
5. Wang, N., Kosinski, M., Stillwell, D. J., & Rust, J. (2014). Can well-being be measured using Facebook status updates? Validation of Facebook's Gross National Happiness Index. Social Indicators Research, 115(1), 483-491.
6. Facebook Data Team. (2011). Gross National Happiness.
7. Cloutier, S., Jambeck, J., & Scott, N. (2014). The Sustainable Neighborhoods for Happiness Index (SNHI): A metric for assessing a community's sustainability and potential influence on happiness. Ecological Indicators, 40, 147-152.
8. Frey, B. S. (2008). Munich lectures in economics. Happiness: A revolution in economics. Cambridge, MA, US: MIT Press. http://dx.doi.org/10.7551/mitpress/9780262062770.001.0001
9. Ryff, C. D. (1989). Happiness is everything, or is it? Explorations on the meaning of psychological well-being. Journal of personality and social psychology, 57(6), 1069.
10. Kaczmarek, L. D., Bujacz, A., & Eid, M. (2015). Comparative latent state–trait analysis of satisfaction with life measures: The Steen Happiness Index and the Satisfaction with Life Scale. Journal of Happiness Studies, 16(2), 443-453.
11. Helliwell, J., Layard, R., & Sachs, J. (2017). World Happiness Report 2017, New York: Sustainable Development Solutions Network.
12. https://medium.com/@lachlanmiller_52885/machine-learning-week-1-cost-function-gradient-descent-and-univariate-linear-regression-8f5fe69815fd
13. https://www.datascience.com/blog/introduction-to-correlation-learn-data-science-tutorials
14. http://www.delhi.gov.in/wps/wcm/connect/37e0e6804057fc118d63dda1527a7156/Estimates+of+State+Domestic+Product+of+Delhi+2016-17.pdf?MOD=AJPERES&lmod=-1298441221&CACHEID=37e0e6804057fc118d63dda1527a7156
15. https://www.irs.gov/individuals/international-taxpayers/yearly-average-currency-exchange-rates -- average currency rate in dollars in a year - SRC - IRS(US Fedral Reserve Data)
16. https://en.wikipedia.org/wiki/List_of_Indian_states_by_life_expectancy_at_birth - Life expectancy Delhi
17. https://study.com/academy/lesson/pearson-correlation-coefficient-formula-example-significance.html
18. https://www.medcalc.org/manual/correlation.php
19. http://www.epwrfits.in/DisplaySDPTreeViewData.aspx