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BIG PICTURE



- What should we prioritize?
- Dataset: World Happiness Report
- Several examples of possible contradictions which were investigated: such as Costa Rica and Bhutan

OUR DATASET

Top 10 Data Sample (2015)

Country	Region	Happiness Rank	Happiness Score	Standard Error	Economy (GDP per Capita)	Family	Health (Life Expectancy)	Freedo m	Trust (Government Corruption)	Generosity	Dystopia Residual
Switzerland	Western Europe	1	7.587	0.03411	1.39651	1.34951	0.94143	0.66557	0.41978	0.29678	2.51738
Iceland	Western Europe	2	7.561	0.04884	1.30232	1.40223	0.94784	0.62877	0.14145	0.4363	2.70201
Denmark	Western Europe	3	7.527	0.03328	1.32548	1.36058	0.87464	0.64938	0.48357	0.34139	2.49204
Norway	Western Europe	4	7.522	0.0388	1.459	1.33095	0.88521	0.66973	0.36503	0.34699	2.46531
Canada	North America	5	7.427	0.03553	1.32629	1.32261	0.90563	0.63297	0.32957	0.45811	2.45176
Finland	Western Europe	6	7.406	0.0314	1.29025	1.31826	0.88911	0.64169	0.41372	0.23351	2.61955
Netherlands	Western Europe	7	7.378	0.02799	1.32944	1.28017	0.89284	0.61576	0.31814	0.4761	2.4657
Sweden	Western Europe	8	7.364	0.03157	1.33171	1.28907	0.91087	0.6598	0.43844	0.36262	2.37119
New Zealand	Australia and New Zealand	9	7.286	0.03371	1.25018	1.31967	0.90837	0.63938	0.42922	0.47501	2.26425
Australia	Australia and New Zealand	10	7.284	0.04083	1.33358	1.30923	0.93156	0.65124	0.35637	0.43562	2.26646



Top 10 Data Sample (2020)

2020										
Rank	Country	Region	Score	Logged GDP	Social Support	Health (Life Expectancy)	Freedom	Generosity	Corruption	Dystopia + residual
1	Finland	Western Europe	7.808700085	10.63926697	0.954329729	71.9008255	0.949172199	-0.059482019	0.195444584	2.762835026
2	Denmark	Western Europe	7.645599842	10.77400112	0.955990791	72.40250397	0.951444268	0.066201776	0.168489456	2.432740688
3	Switzerland	Western Europe	7.559899807	10.97993279	0.942846596	74.10244751	0.921336651	0.105911039	0.303728431	2.35026741
4	Iceland	Western Europe	7.504499912	10.77255917	0.974669576	73	0.948891878	0.246944219	0.711709738	2.460688114
5	Norway	Western Europe	7.487999916	11.08780384	0.952486575	73.20078278	0.955750287	0.13453263	0.263218194	2.168266296
6	Netherlands	Western Europe	7.448900223	10.81271172	0.93913883	72.30091858	0.908547819	0.20761244	0.364717126	2.352117062
7	Sweden	Western Europe	7.353499889	10.75879383	0.926311195	72.60076904	0.939144194	0.111614622	0.250880182	2.246299267
8	New Zealand	North America and ANZ	7.299600124	10.50094318	0.949118972	73.20262909	0.936217487	0.191598073	0.22113885	2.128108025
9	Austria	Western Europe	7.294199944	10.7428236	0.928045869	73.00250244	0.899989486	0.085429221	0.499954879	2.398446083
10	Luxembourg	Western Europe	7.237500191	11.45068073	0.906912208	72.59999847	0.90563643	-0.004620588	0.367084295	2.153700352

Data Cleaning



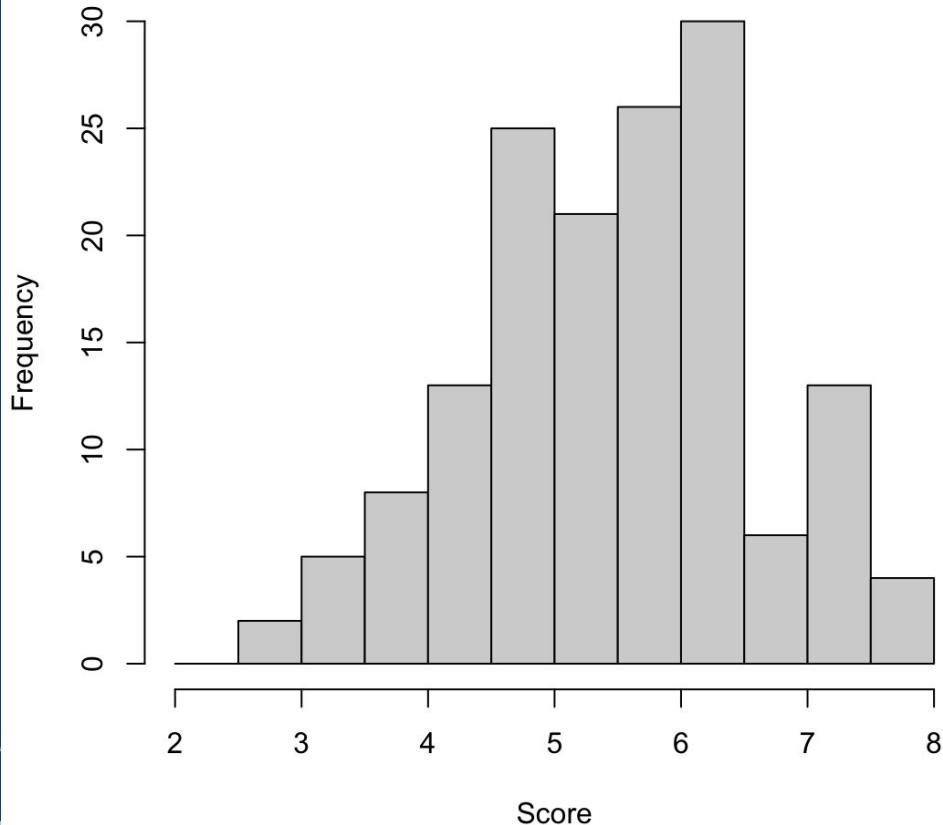
- The World Happiness Report required a lot of cleaning.
- had several missing values that were either NA's or zeroes in the datasets from 2015-2019
- Columns were inconsistent
- 2020 data was already clean

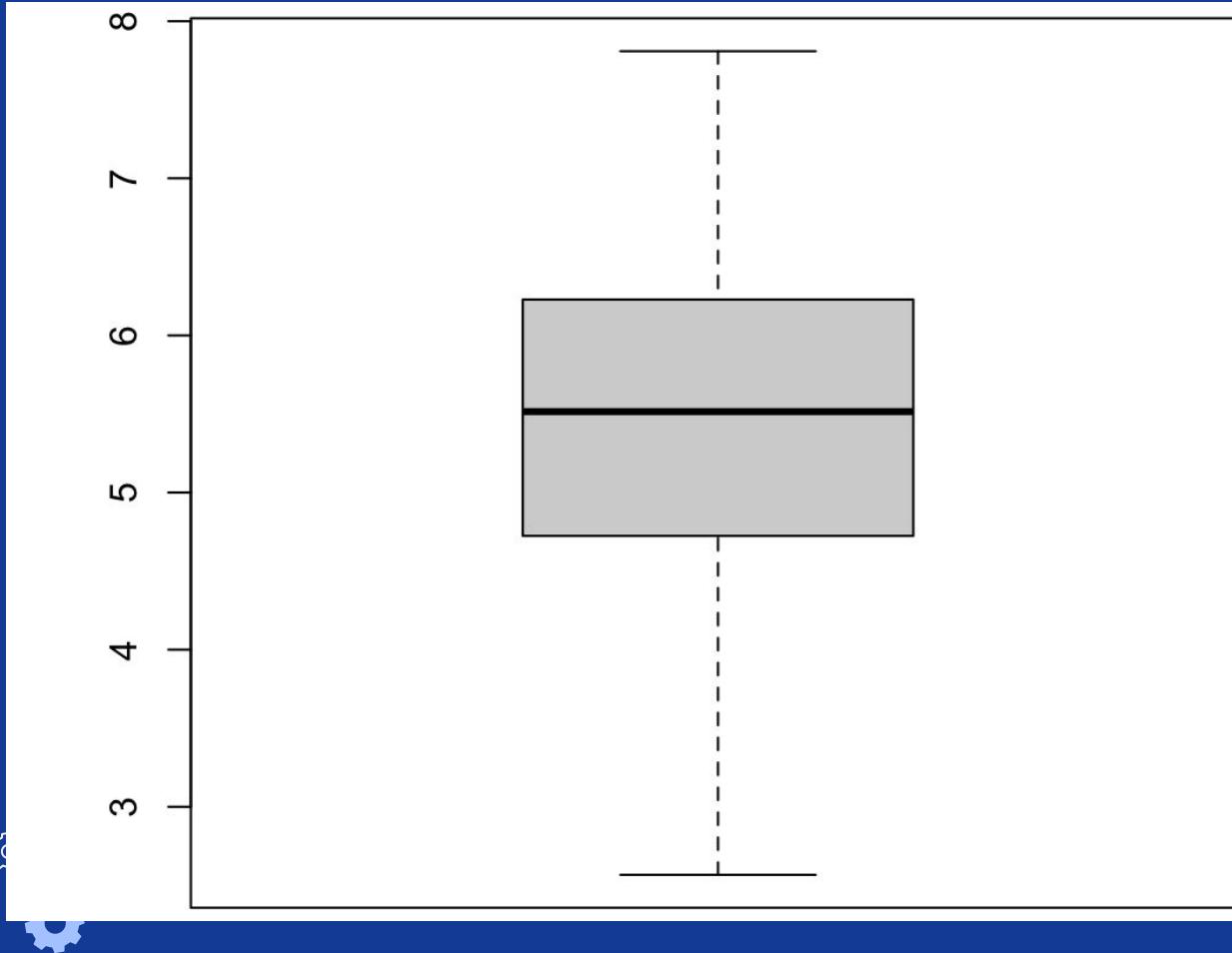


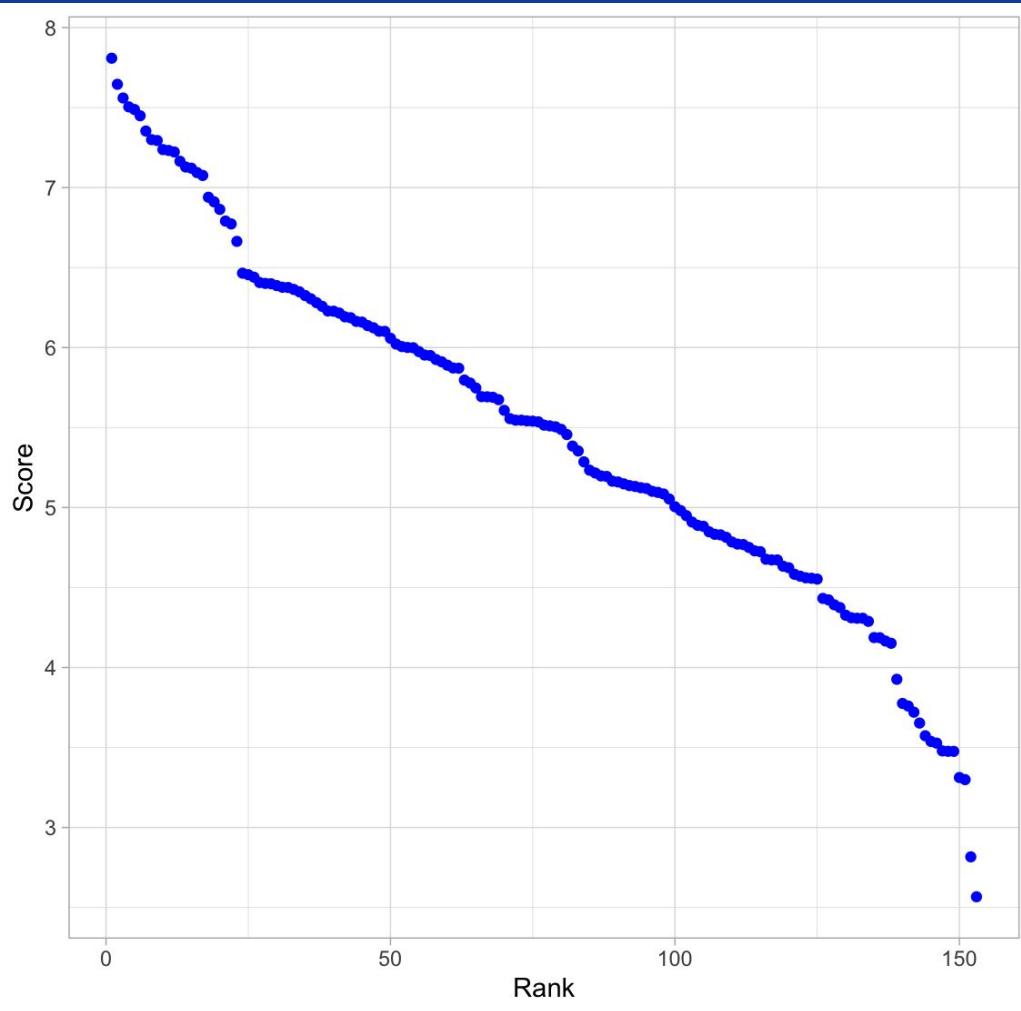
Exploratory Analysis

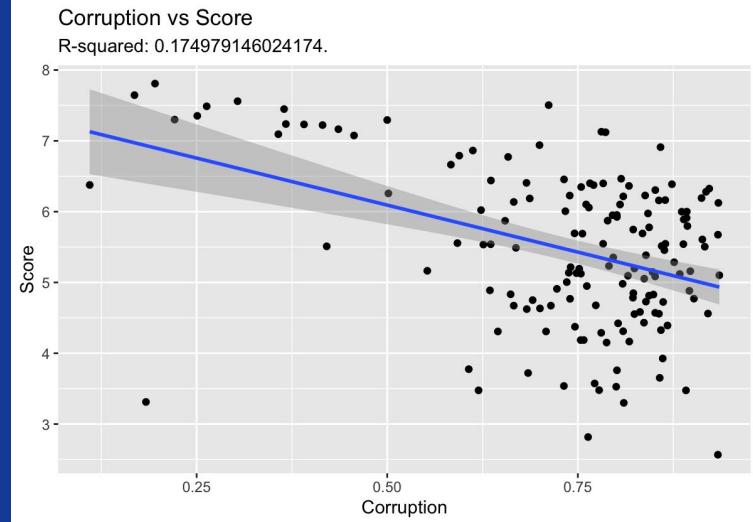
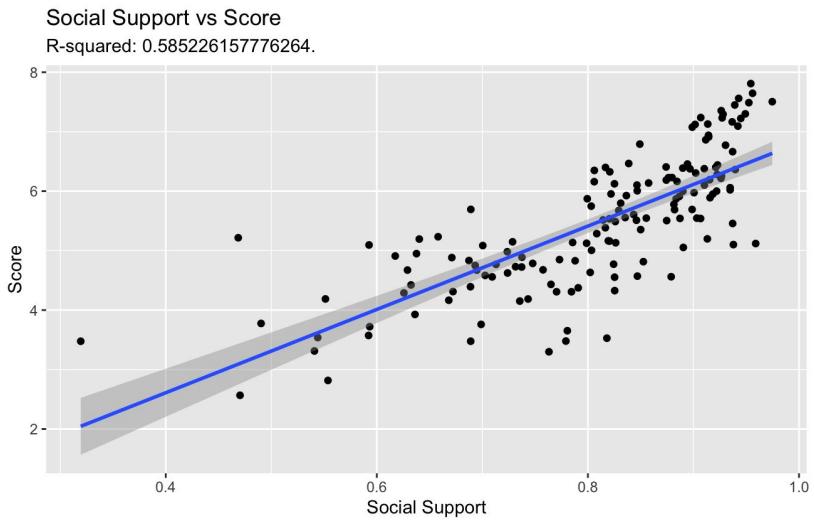


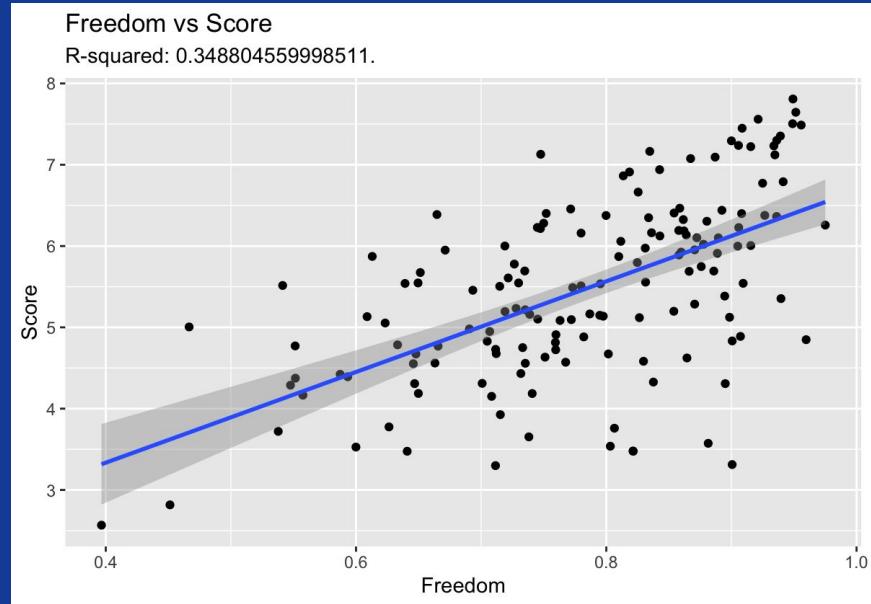
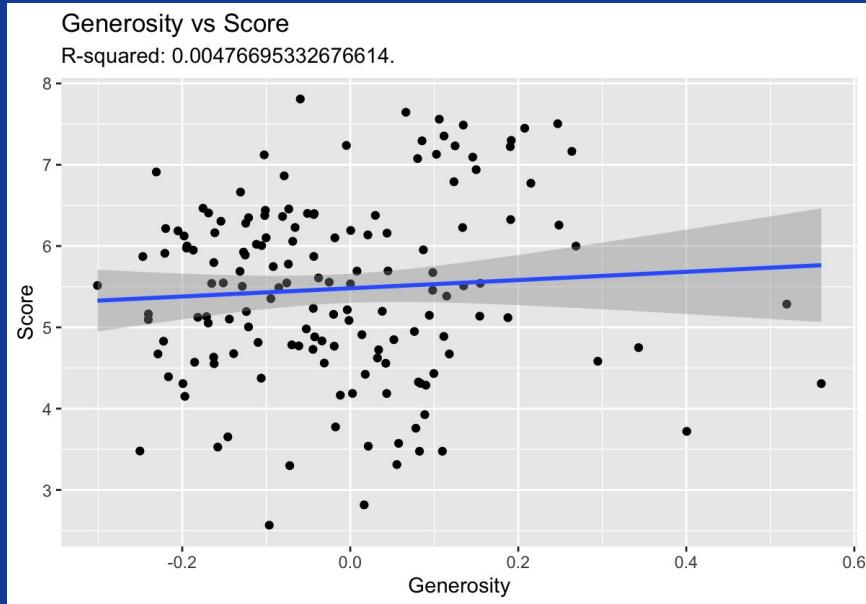
Happiness Score Distribution

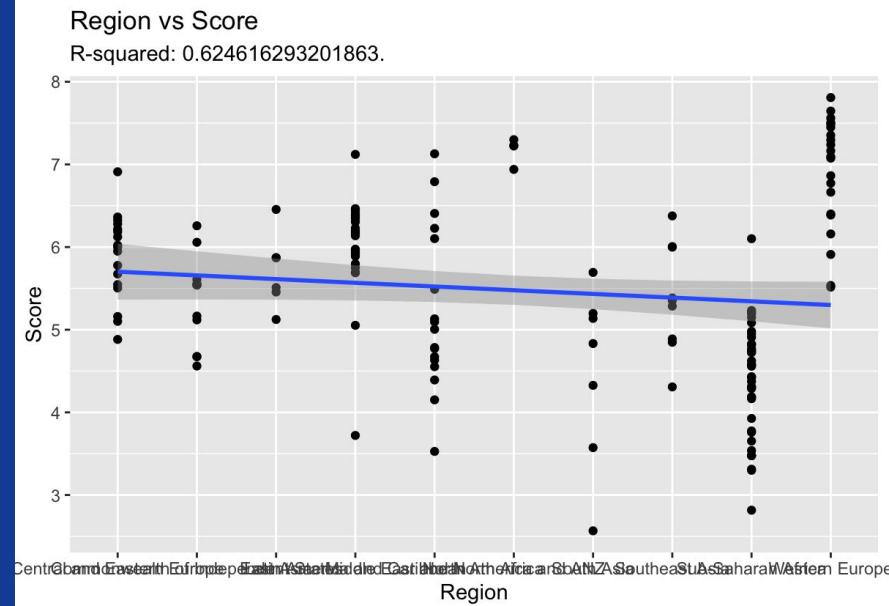
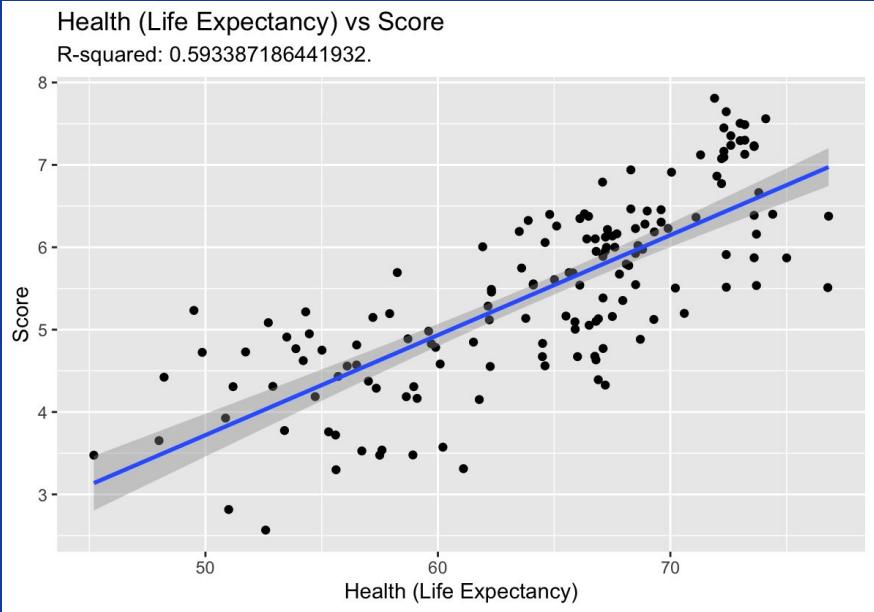








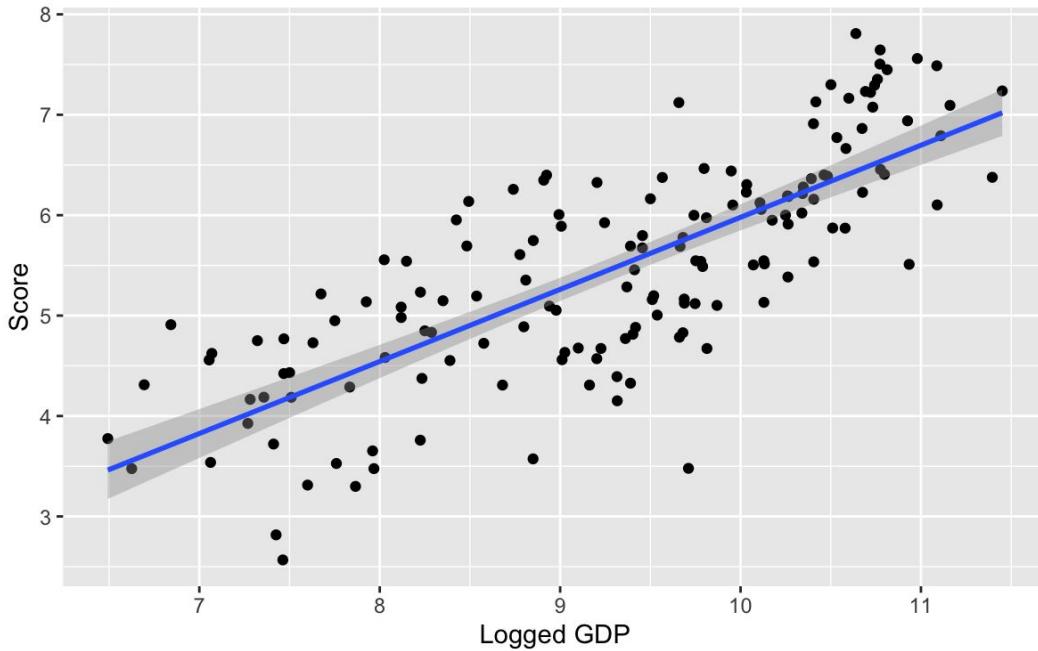






Logged GDP vs Score

R-squared: 0.601205461342584.



Data Reduction

Data Reduction



Country name	Regional indicator	Ladder score	Standard error of upperwhisker	lowerwhisker	Logged GDP per i	Social support	Healthy life expect	Freedom to make	Generosity	Perceptions of coi	Ladder score in D	Explained by: Log	Explained by: Soc	Explained by: He	Explained by: Fr	Explained by: Ger	Explained by: Per	Dystopia + residual	
Finland	Western Europe	7.807450001	0.031156005	7.869762305	7.747633934	10.63926697	0.954329729	71.9002857	0.949172199	-0.059482010	0.195444584	1.972316742	1.285169509	1.499525905	0.961271405	0.66231674	0.159670442	0.477857262	2.762835026
Denmark	Western Europe	7.645599842	0.033492286	7.711244583	7.579895101	10.77400112	0.955907971	72.40250397	0.951444268	0.066201776	0.168489456	1.972316742	1.326948524	1.503449202	0.979332565	0.665039897	0.247793396	0.495260328	2.432740688
Switzerland	Western Europe	7.559899807	0.035014171	7.628576741	7.4917271973	10.97993279	0.942846596	74.10244751	0.921336651	0.105911038	0.303728431	1.972316742	1.39077425	1.472043047	1.040531815	0.62895447	0.260955754	0.407945901	2.35026741
Iceland	Western Europe	7.504499912	0.05615862	7.621346951	7.387652874	10.77255917	0.974669576	74.10244751	0.948891878	0.246944219	0.717109738	1.972316742	1.326501608	1.547567487	1.000843406	0.661980748	0.36230228	0.14450772	2.460688114
Norway	Western Europe	7.487799916	0.034837384	7.55628103	7.419718742	11.08780384	0.952486575	73.20078278	0.955750287	0.13453263	0.263218194	1.972316742	1.42420733	1.495172501	1.008071899	0.670200884	0.287985086	0.434100568	2.188262692
Netherlands	Western Europe	7.448799948	0.035014171	7.503377192	7.394428253	10.812711172	0.93913883	72.30091858	0.908547819	0.20761244	0.364717126	1.972316742	1.339864328	1.463845935	0.975675344	0.613626848	0.336317569	0.368569762	2.352117062
Sweden	Western Europe	7.353499889	0.036234196	7.424519062	7.282480717	10.75879383	0.926311195	72.60076904	0.939414419	0.111614622	0.250808182	1.972316742	1.322235227	1.433347702	0.986470461	0.650297701	0.272827893	0.442063671	2.246299267
New Zealand	North America and Oceania	7.299600124	0.034645856	7.376952648	7.222247601	10.500943182	0.949118972	72.2026909	0.916742178	0.191598073	0.22113885	1.972316742	1.242317915	1.48721838	0.80138299	0.64789903	0.327526211	0.461288276	2.128108205
Austria	Western Europe	7.294199844	0.033365164	7.359585776	7.288041111	10.7428236	0.928045869	73.00250244	0.898989486	0.085482221	0.499954879	1.972316742	1.317785538	1.437444925	1.000933528	0.603368878	0.255509764	0.281256139	0.398446083
Luxembourg	Western Europe	7.237501901	0.030851794	7.297969818	7.177030563	11.45068073	0.906912208	72.59989847	0.90563643	-0.04620588	0.367084295	1.972316742	1.536676049	1.387528419	0.986442685	0.610137045	0.1955932	0.367041469	2.153700352
Canada	North America and Oceania	7.23210001	0.04040546	7.311294556	7.152905464	10.69236851	0.921716654	73.60160065	0.933913231	0.124770768	0.390843632	1.972316742	1.301647663	1.435391903	1.022501945	0.644028127	0.28152892	0.351701856	2.195269108
Australia	North America and Oceania	7.227799778	0.04841116	7.30480814	7.140791416	10.72059361	0.944854617	73.60453796	0.91541738	0.190406106	0.415169162	1.972316742	1.310936443	1.477124628	0.822677193	0.339596149	0.212804134	2.128080413	
United Kingdom	Western Europe	7.164500237	0.037161909	7.237373759	7.09166282	10.60013485	0.93668282	73.20160522	0.834743679	0.2683732493	0.435915917	1.972316742	1.273061037	1.457844973	0.975700008	0.525168657	0.373434441	0.322601564	2.236721992
Israel	Middle East and N Africa	7.128600121	0.04251518	7.211929873	7.045270443	10.41752938	0.913571723	73.20025635	0.747580588	0.102593727	0.78058056	1.972316742	1.216463585	1.402655774	0.862661796	0.09989845	0.271358402	0.348265574	
Costa Rica	Latin America and Oceania	7.13198987	0.044816118	7.209394883	7.033562067	9.658156395	0.901545942	71.29988394	0.848373894	-0.10242971	0.786332428	1.972316742	0.981107712	1.374853611	0.639563536	0.645017743	0.132663111	0.295135014	
Ireland	Western Europe	7.093699923	0.039863452	7.171832085	7.015597788	11.16097382	0.94201571	72.30078888	0.886892977	0.145784794	0.357184172	1.972316742	1.446888674	0.710598443	0.873433282	0.549265995	0.194378174	0.283012874	
Germany	Western Europe	7.075799942	0.036069804	7.145695074	7.006094081	7.3128186	0.873688462	72.67301874	0.86731078	0.080179386	0.456423034	1.972316742	1.314194546	1.368453744	0.564274132	0.262037704	0.309382623	0.296544642	
United States	North America and Oceania	7.039599991	0.047316168	7.032339573	6.848686049	10.92576885	0.914219022	68.2994951	0.949917314	0.699715316	1.972316742	1.373988664	1.404786760	0.831618011	0.534660285	0.294814039	0.152284741	2.344244749	
Czech Republic	Central and Eastern Europe	6.91090106	0.042891297	6.994969848	6.826833248	10.40461336	0.914430678	70.04793549	0.858173543	0.2203861515	0.390844624	1.972316742	1.212322354	1.405286677	0.894545445	0.505744545	0.046392592	2.796808343	
Belgium	Western Europe	6.863500118	0.034307355	6.930866241	6.796139561	10.67363933	0.911632538	72.001647495	0.815832083	0.078691119	0.612297952	1.972316742	1.298542767	1.398877588	0.964901149	0.498905142	0.169661511	0.209274052	2.348626614
United Arab Emira	Middle East and N Africa	6.790000905	0.046988379	6.876508752	6.711031437	11.1099897	67.08278656	0.941345513	0.123450845	0.594502211	1.972316742	1.410861486	1.521107093	0.787814344	0.652936101	0.28085598	2.166965961		
Malta	Western Europe	6.772279969	0.042958103	6.856699797	6.688601971	10.53383327	0.93037951	72.19996995	0.924911439	0.142694585	0.658457482	1.972316742	1.252513289	1.442969624	0.373118083	0.118083031	0.271864077	0.195201202	
France	Western Europe	6.663799873	0.037576791	6.737450123	6.590149403	6.848822797	6.810422279	73.80139322	0.854676486	0.130641967	0.583831218	1.972316742	1.268129394	1.458839178	0.912071427	0.514050901	0.112606703	0.205198337	
Mexico	Latin America and Oceania	6.486600153	0.046124269	6.559139973	6.370803322	9.79779723	0.838665426	66.29902649	0.886901727	0.0806016357	0.809804807	1.972316742	1.204387479	1.226333499	0.831601024	0.553829553	0.083094485	0.081336868	
Taiwan Province of China	Eastern Asia	6.355399998	0.031039576	6.533113852	6.378688622	9.776885513	0.894031093	69.599898477	0.771150333	-0.073198899	0.731188293	1.972316742	1.474705411	1.357670668	0.847839796	0.449404389	0.160598705	0.131519652	0.160320743
Uruguay	Latin America and Oceania	6.440100193	0.045419082	6.529121399	6.351078987	9.948102598	0.929112111	69.00254822	0.892323254	0.0710110112	0.635994136	1.972316742	1.471000477	1.425081114	0.856928885	0.59426707	0.132143691	0.193425070	2.167276382
Saudi Arabia	Middle East and N Africa	6.406499863	0.056536132	6.517039851	6.209589374	10.797124648	0.874067068	66.303514526	0.854191244	-0.168895062	0.682619152	1.972316742	1.334285253	1.405286677	0.894545445	0.505744545	0.046392592	2.796808343	
Spain	Western Europe	6.409088987	0.042430037	6.483809517	6.317997257	10.46292686	0.921125412	74.40270996	0.751989543	0.096517141	0.765859902	1.972316742	1.23055269	1.412091866	0.510534083	0.429883816	0.16530548	0.10597979	2.190780842
Guatemala	Latin America and Oceania	6.398900032	0.056938903	6.5133605	6.244344954	8.924846564	6.808499447	70.908417573	0.908239368	0.042393866	0.783237457	1.972316742	1.072042024	1.372024024	0.973232093	0.622723093	0.10957979	0.282273093	
Italy	Western Europe	6.387400115	0.043288074	6.472244744	6.320555621	10.481639054	0.916481833	73.601648547	0.866465199	-0.034460999	0.873404682	1.972316742	1.236396746	1.347296796	0.973230573	0.613220492	0.120268611	0.043105561	2.249450597
Singapore	Southeast Asia	6.377099984	0.032525867	6.442268744	6.311952113	9.910268622	0.921668622	76.804580586	0.826465339	0.029682224	0.109784193	1.972316742	1.215980126	1.395698126	0.917311423	0.533162236	0.093703146	0.132663111	
Latvia	Central and Eastern Europe	6.363399882	0.043841314	6.449328899	6.271471069	10.393223254	0.93957672	71.102692	0.936426263	-0.086030383	0.817070121	1.972316742	1.208652496	1.464687791	0.932548406	0.646770044	0.147601498	0.076516233	1.886856521
El Salvador	Latin America and Oceania	6.348299866	0.052648438	6.432134324	6.809072262	66.108226111	0.883058262	6.110822611	0.833805263	-0.121207178	0.754319906	1.972316742	1.57200012	1.524034838	0.111893526	0.117030052	0.293719125	2.190780842	
Kosovo	Central and Eastern Europe	6.325200081	0.052212677	6.427544117	6.222565045	9.204429626	0.820726514	6.838855527	0.86135907	0.190933764	0.922328293	1.972316742	1.464084134	1.183962822	0.522686865	0.080859024	0.273690274	2.056797981	
Panama	Latin America and Oceania	6.304800034	0.059724931	6.421606095	6.187739372	0.902094483	69.60301208	0.880366504	-0.153927714	0.851598905	1.972316742	1.097667813	1.376142927	0.878549636	0.579849787	0.097207308	0.054230526	2.221164741	
Slovakia	Central and Eastern Europe	6.280600071	0.03889757	6.35683918	6.043630962	10.34774971	0.922493756	69.80634155	0.749952674	-0.124409303	0.918096125	1.972316742	1.194837689	1.424331188	0.853465259	0.423542529	0.116729774	0.011291441	2.256420243
Uzbekistan	Commonwealth of Independent States	6.257599831	0.054227555	6.363885685	6.151317823	8.740371704	6.92659807	65.10757446	0.974998116	0.248427153	0.501473988	1.972316742	1.096852949	1.343020042	0.716702373	0.639321023	0.363311023	0.280260265	2.073346615
Chile	Latin America and Oceania	6.221949889	0.045723889	6.318118572	6.138881877	10.0320549	0.879713595	69.900196151											

Rank	Country	Region	Score	Logged GDP	Social Suppo	Health (Life Freedom)	Generosity	Corruption	Dystopia + residual
1	Finland	Western Europe	7.80870009	10.639267	0.95432973	71.9008255 0.9491722	-0.059482	0.19544458	2.76283503
2	Denmark	Western Europe	7.64559984	10.7740011	0.95599079	72.402504 0.95144427	0.06620178	0.16848946	2.43274069
3	Switzerland	Western Europe	7.55989981	10.9799328	0.9428466	74.1024475 0.92133665	0.10591104	0.30372843	2.35026741
4	Iceland	Western Europe	7.50449991	10.7725592	0.97466958	73 0.94889188	0.24694422	0.71170974	2.46068811
5	Norway	Western Europe	7.48799992	11.0878038	0.95248658	73.2007828 0.95575029	0.13453263	0.26321819	2.1682663
6	Netherlands	Western Europe	7.44890022	10.8127117	0.93913883	72.3009186 0.90854782	0.20761244	0.36471713	2.35211706
7	Sweden	Western Europe	7.35349989	10.7587938	0.9263112	72.600769 0.93914419	0.11161462	0.25088018	2.24629927
8	New Zealand	North America	7.29960012	10.5009432	0.94911897	73.2026291 0.93621749	0.19159807	0.22113885	2.12810803
9	Austria	Western Europe	7.29419994	10.7428236	0.92804587	73.0025024 0.89998949	0.08542922	0.49995488	2.39844608
10	Luxembourg	Western Europe	7.23750019	11.4506807	0.90691221	72.5999985 0.90563643	-0.0046206	0.3670843	2.15370035
11	Canada	North America	7.23210001	10.6923685	0.92717665	73.6016007 0.93391323	0.12477077	0.39084336	2.19526911
12	Australia	North America	7.22279978	10.7205963	0.94485462	73.604538 0.91543174	0.19046016	0.41516912	2.12980413
13	United Kingdom	Western Europe	7.16450024	10.6001349	0.93668282	72.3016052 0.83474368	0.26373249	0.43591592	2.23672199
14	Israel	Middle East	7.12860012	10.4175253	0.91357124	73.2002564 0.74758059	0.10259372	0.78085506	2.7133584
15	Costa Rica	Latin America	7.12139988	9.6581564	0.90154594	71.2998505 0.93473893	-0.1024297	0.78633243	2.95313501
16	Ireland	Western Europe	7.09369993	11.1609783	0.94208157	72.3007889 0.88698298	0.14578497	0.35718417	1.94387817
17	Germany	Western Europe	7.07579994	10.7328186	0.89887446	72.2020187 0.86737108	0.08017939	0.45642203	2.29524946
18	United States	North America	6.93959999	10.9257689	0.91421902	68.2994995 0.84261954	0.14989173	0.69971532	2.34412479
19	Czech Republic	Central and Eastern Europe	6.91090012	10.4041634	0.91443068	70.0479355 0.81853735	-0.2308615	0.85844624	2.79680824
20	Belgium	Western Europe	6.86350012	10.6736393	0.91163254	72.001648 0.81358206	-0.0786912	0.61229795	2.34862661
21	United Arab Emirates	Middle East	6.7908001	11.1099987	0.84918112	67.0827866 0.94134551	0.12345085	0.59450221	2.16696596

Standard Error	Lower Confidence Interval	Upper Confidence Interval	Whisker.high	Whisker.low
0.03411	7.46	7.592	7.59444482058287	7.47955553799868
0.04884	7.428	7.59	7.58172806486487	7.46227160707116

03

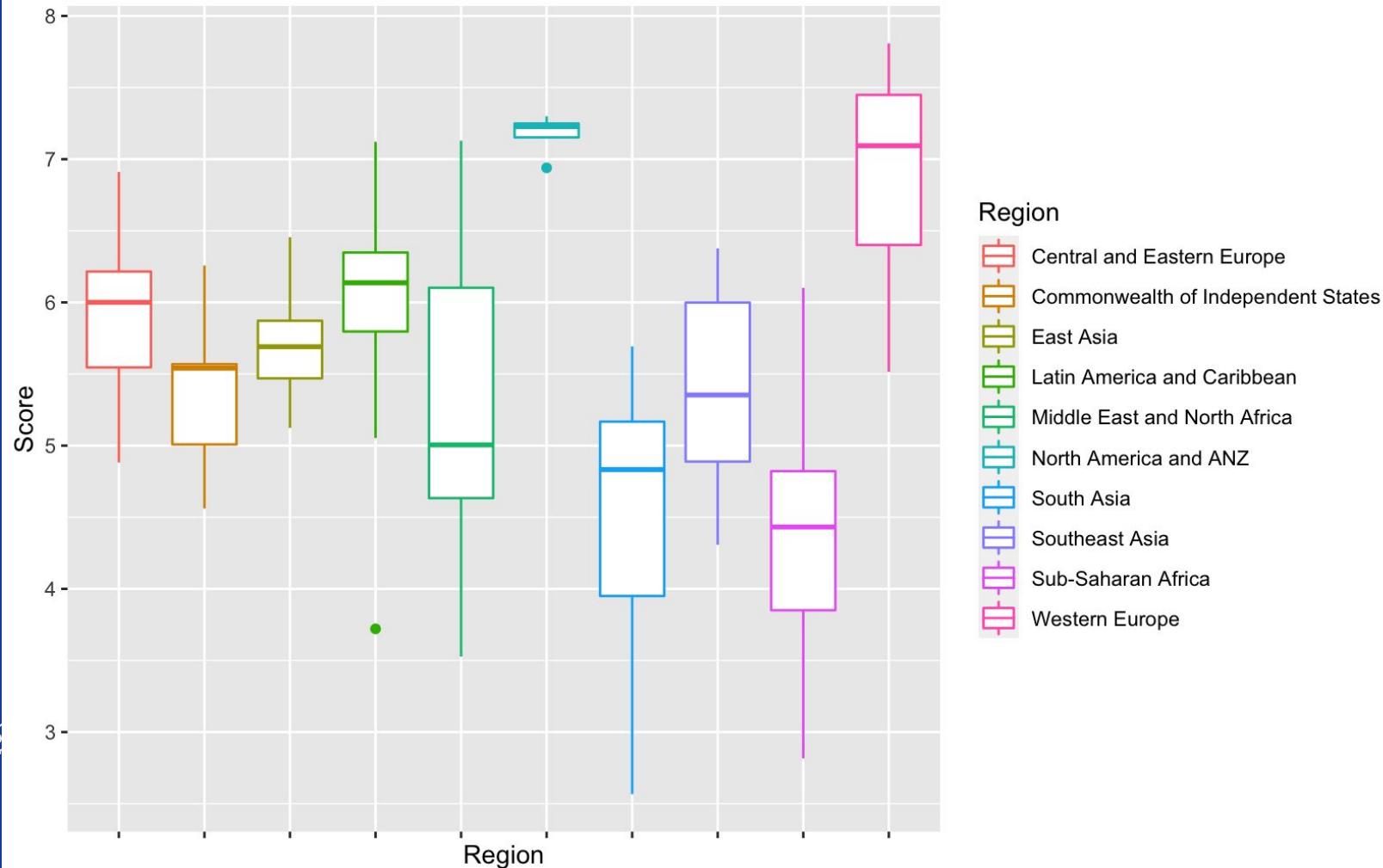


ANALYSIS



Are there regions of the world that are
happier than others?

Happiness by Region



Analysis



What factors seem the most crucial in contributing to the overall happiness of a country? Which ones aren't as significant?



Methodology 3 WAYS



Method 1: Linear Regression

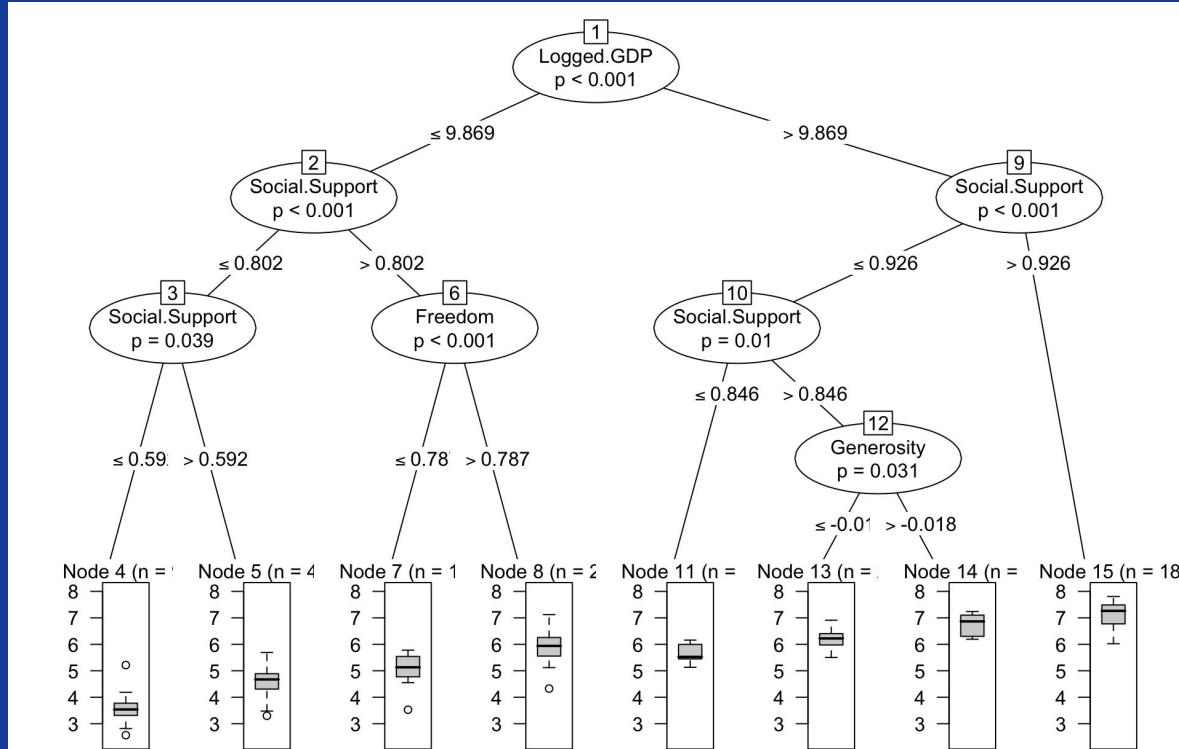
Attribute <i><chr></i>	Linear R-Squared <i><dbl></i>
1 Region	0.625
2 Logged GDP	0.601
3 Health (Life Expectancy)	0.593
4 Social Support	0.585
5 Freedom	0.349
6 Corruption	0.175
7 Generosity	0.004 <u>77</u>



Methodology 3 WAYS



Method 2: Decision Tree



Methodology

3 WAYS



Method 3: Random Forest

	Attribute	IncNodePurity
1	Social.Support	42.666217
2	Health	38.402206
3	Logged.GDP	35.851910
4	Region	30.538199
5	Freedom	18.033554
6	Corruption	11.567810
7	Generosity	5.592944





Summary of attributes deemed most important factors

Linear Regression	Decision Tree	Random Forest
Region	GDP per capita	Social Support
GDP per capita	Social Support	Health
Health (Life Expectancy)	Freedom	GDP per capita





Can we predict happiness? How accurately?
What's the best method?



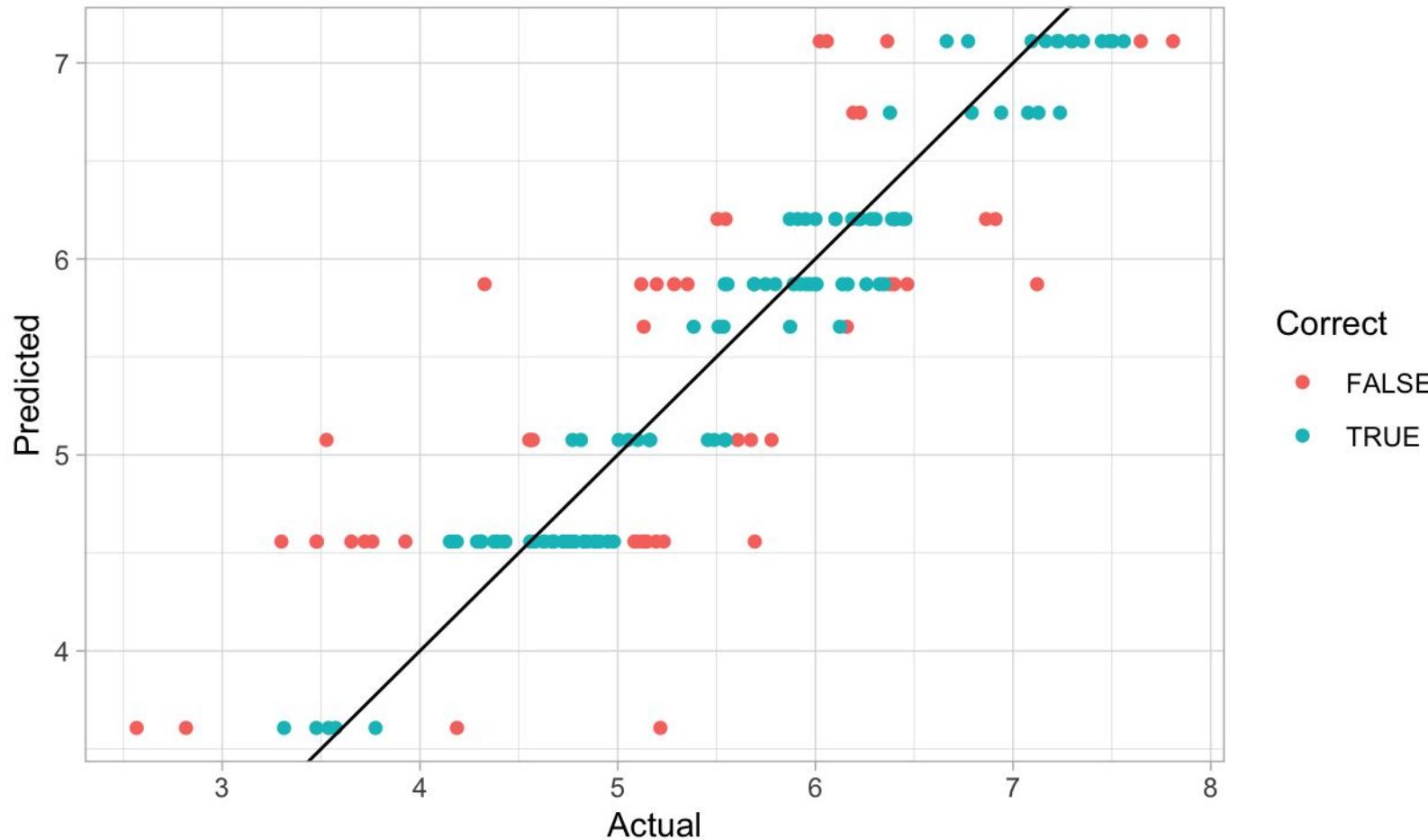
Methodology

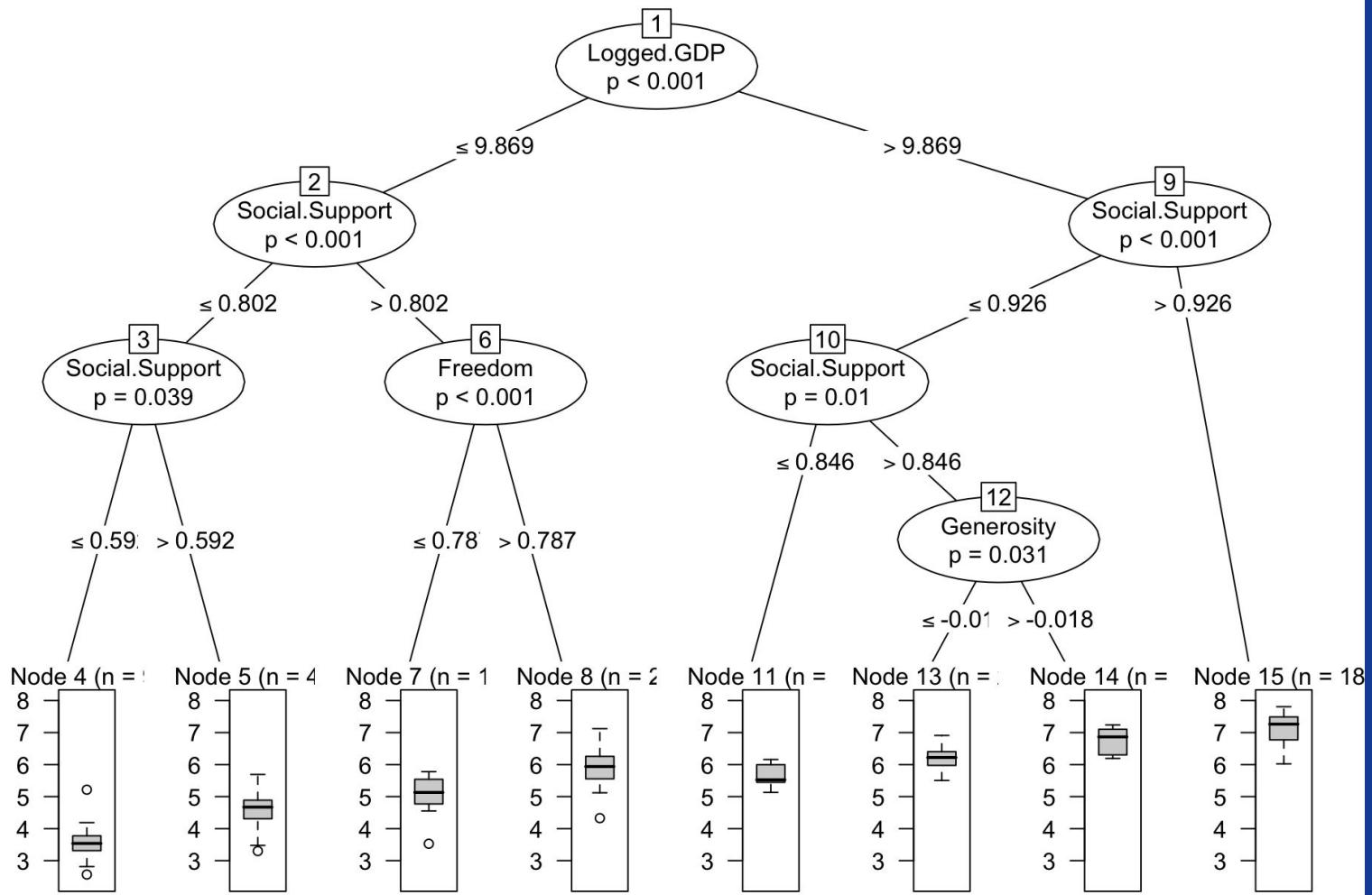


Correct = $|Actual - Predicted| < 0.5$

Decision Tree Accuracy

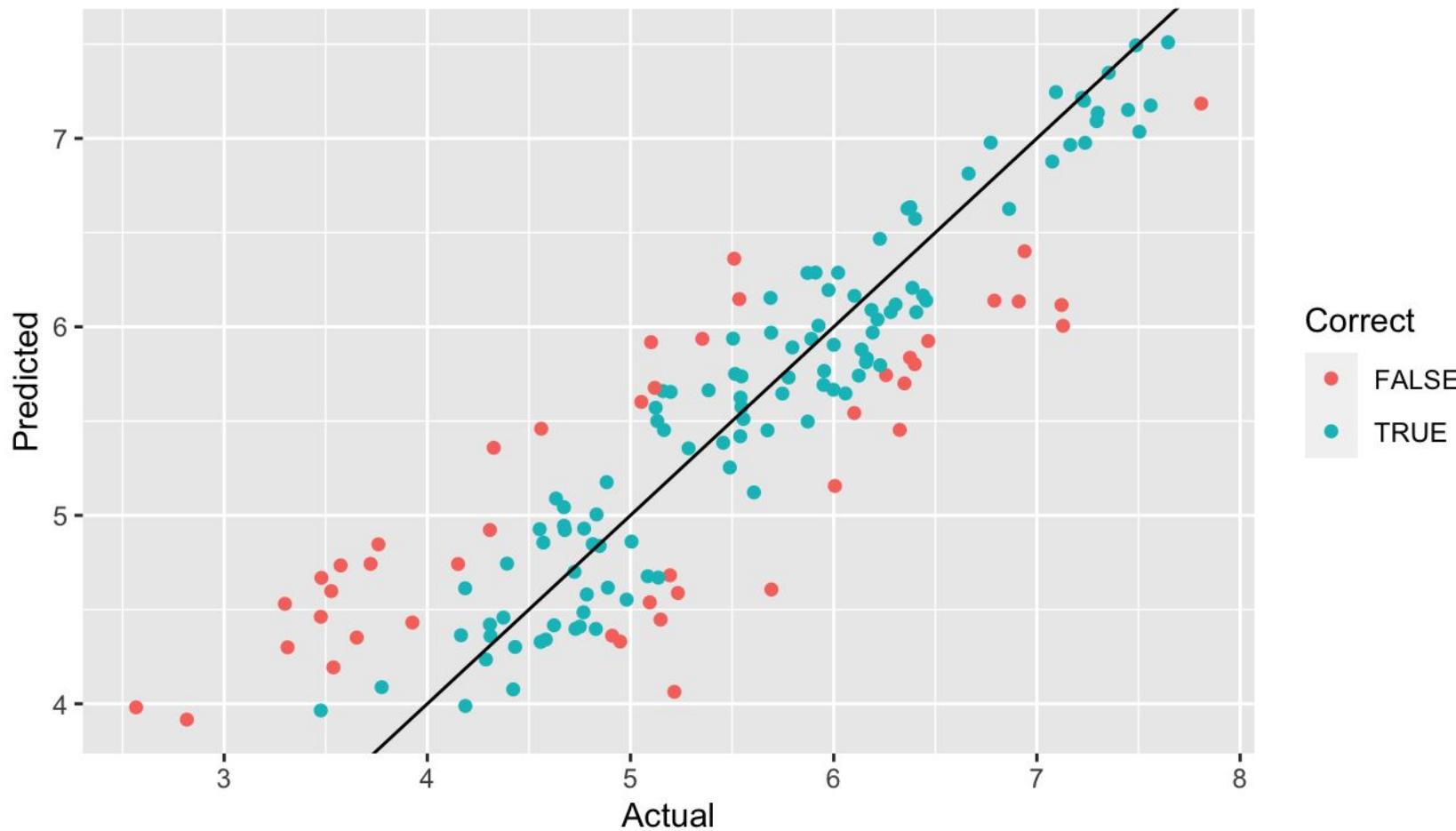
68.627% of countries were predicted within 0.5 of their happiness score.



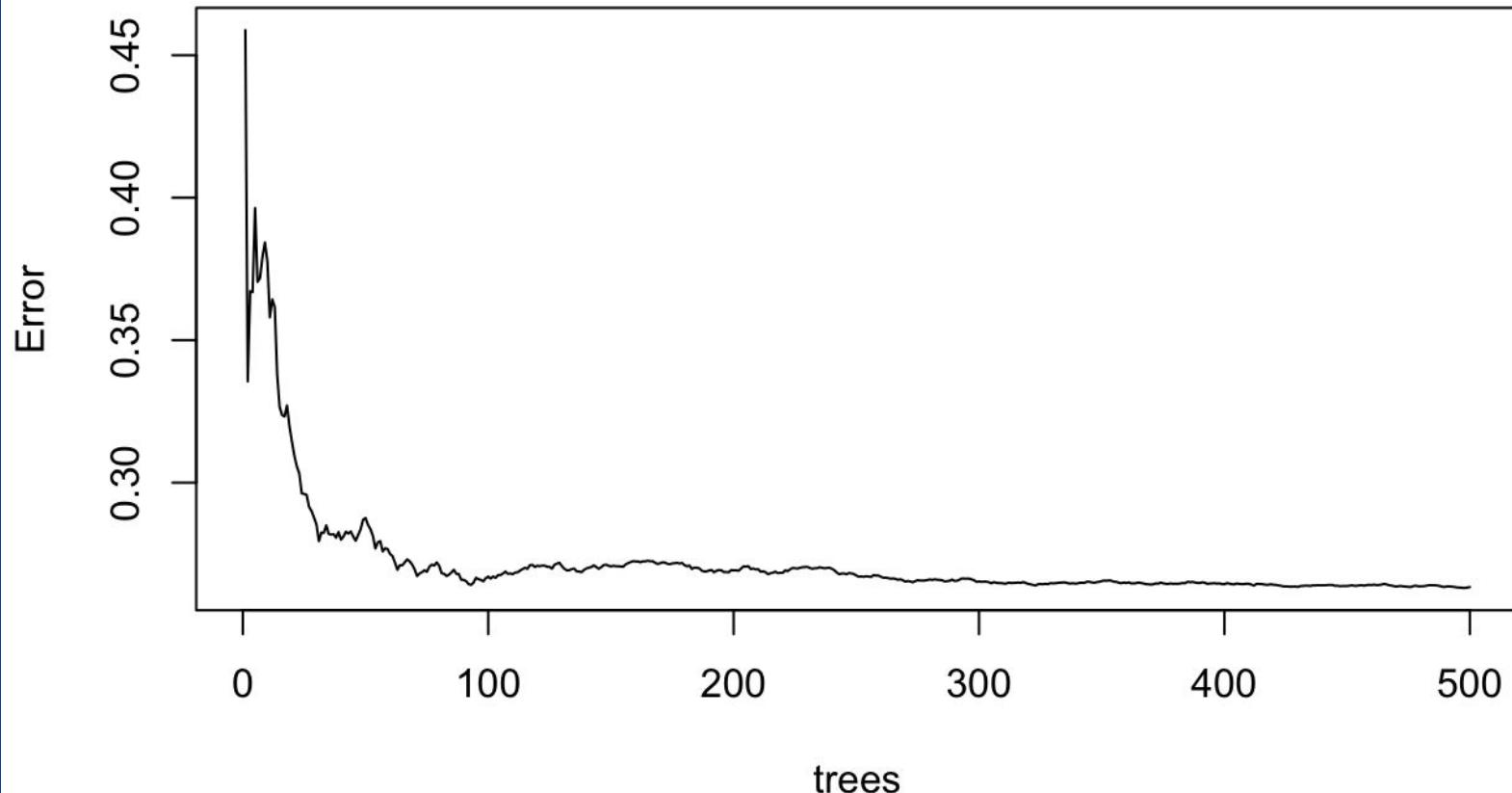


Random Forest Accuracy

70.588% of countries were predicted within 0.5 of their happiness score.

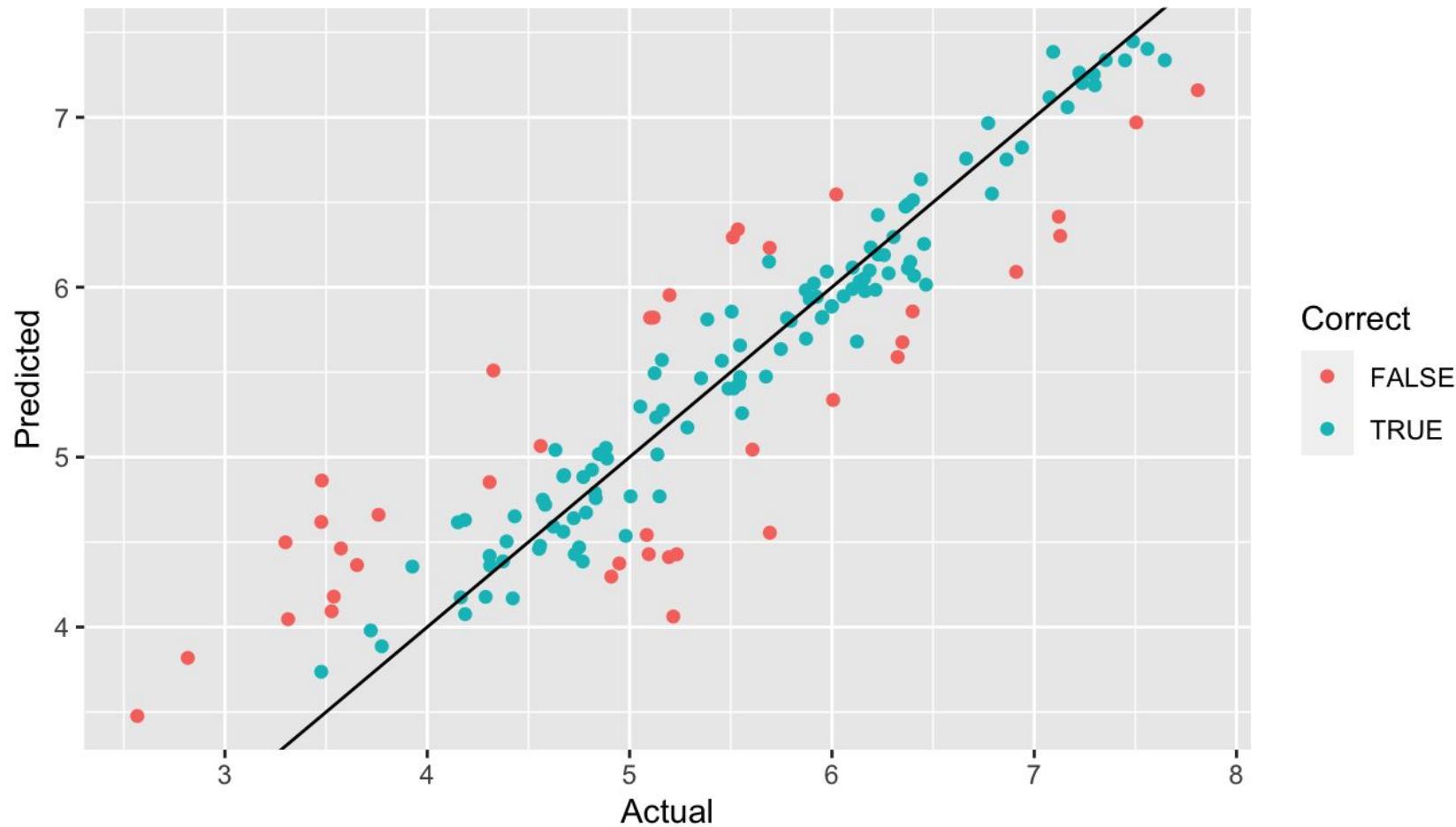


rf



SVM Accuracy

74.51% of countries were predicted within 0.5 of their happiness score.





Which countries' happiness doesn't seem explainable by the data? What unforeseeable factors could be involved?

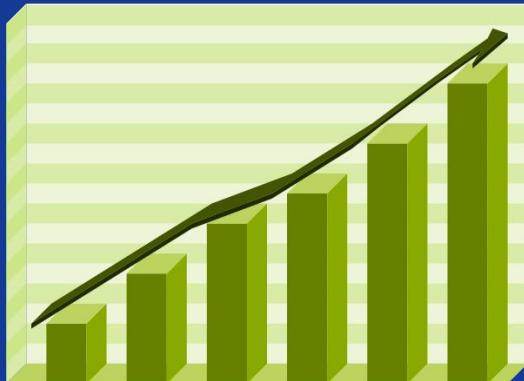


-Costa Rica

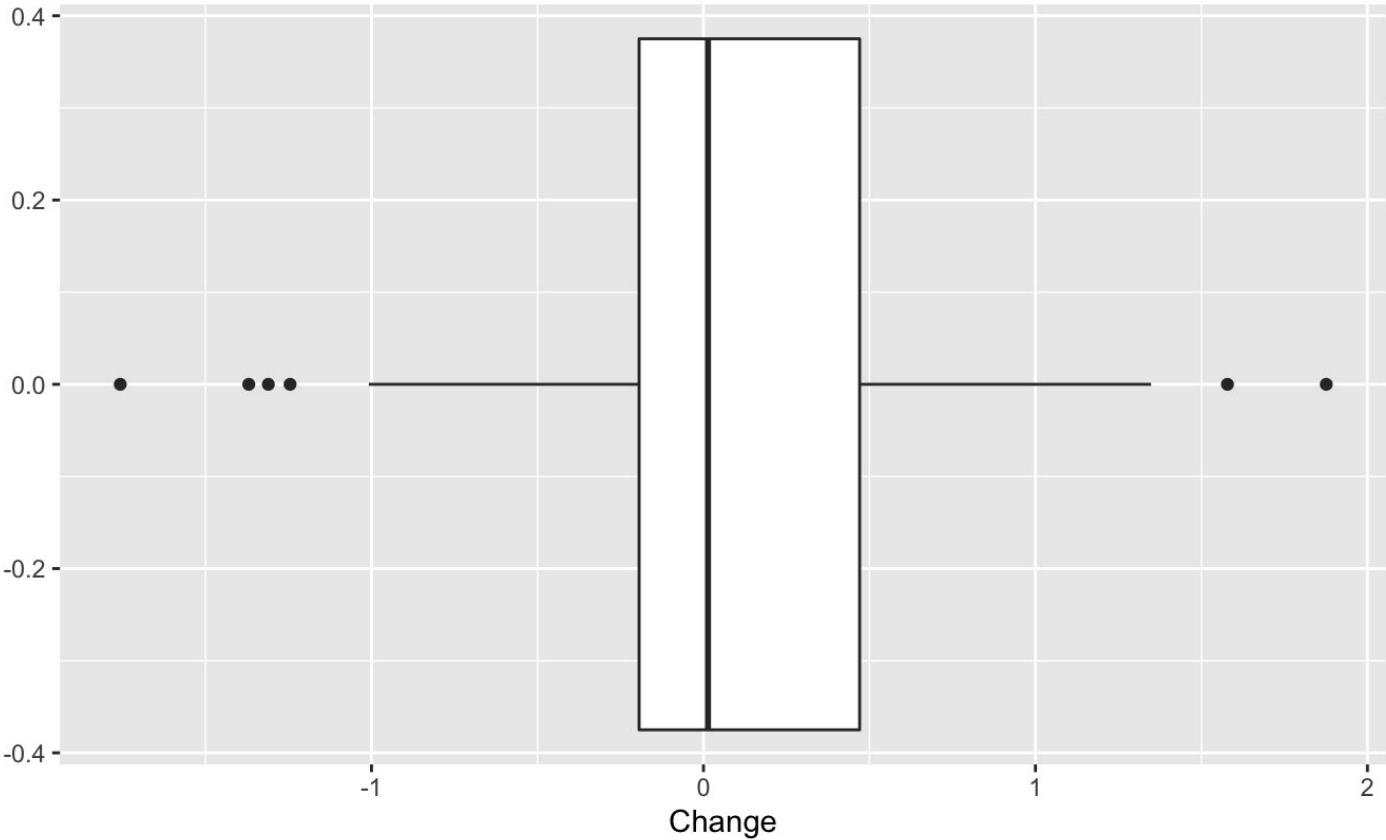




Are there trends in world happiness? Is the
world getting happier or sadder?



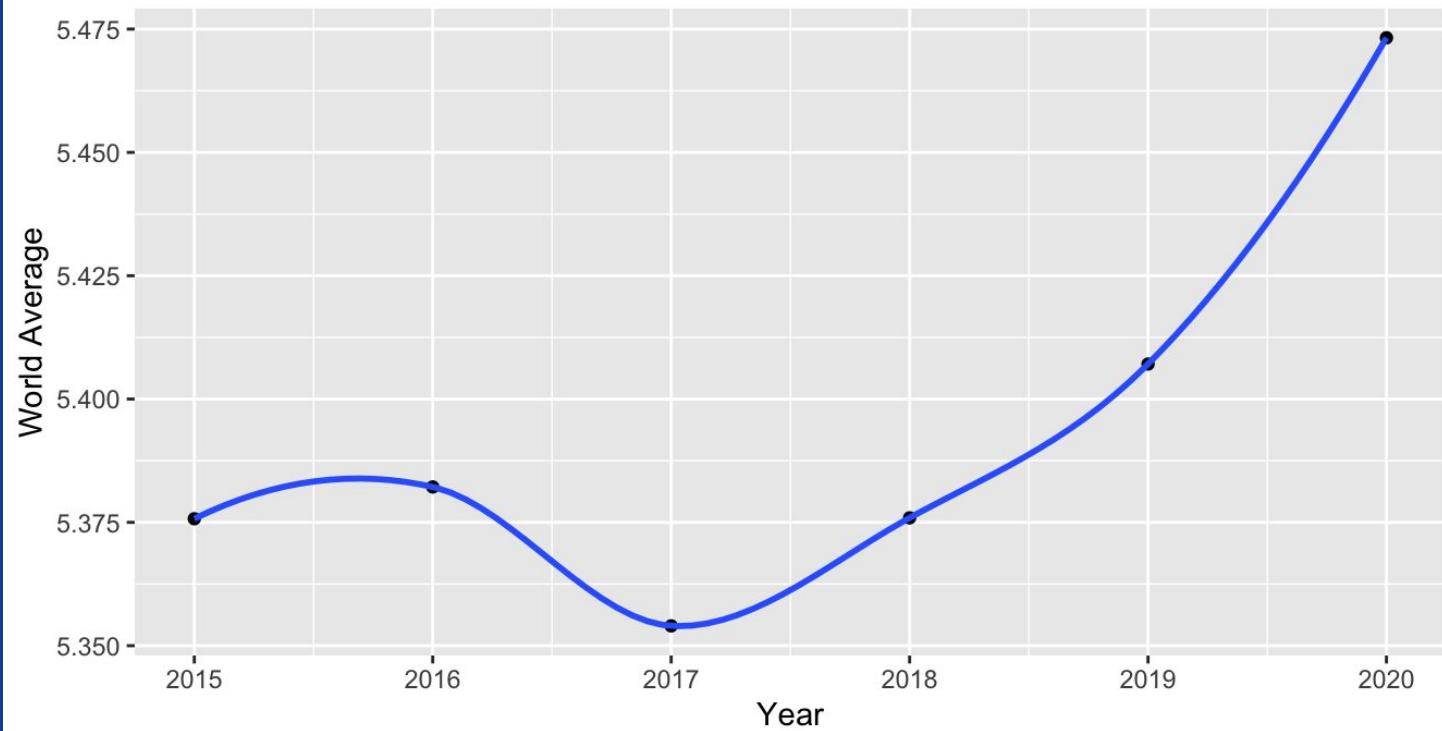
Country Happiness Changes, 2015-2020

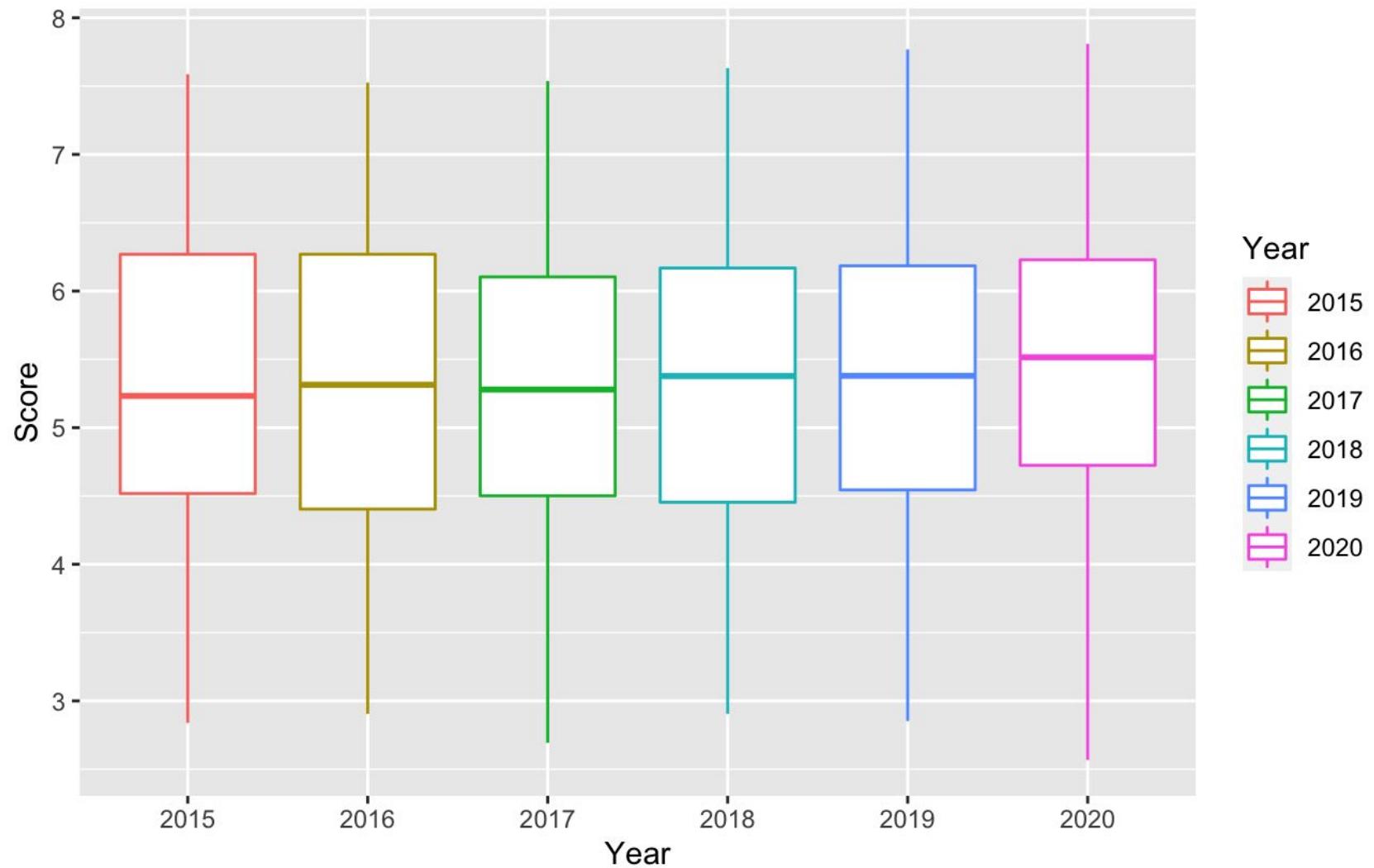


https://media.ap.org/assets/images/2677812N/1000w-t1111-gettyimages-432192626_kide-d9tad0q2d0s0ew0d44460f7c3cf16e214.jpg

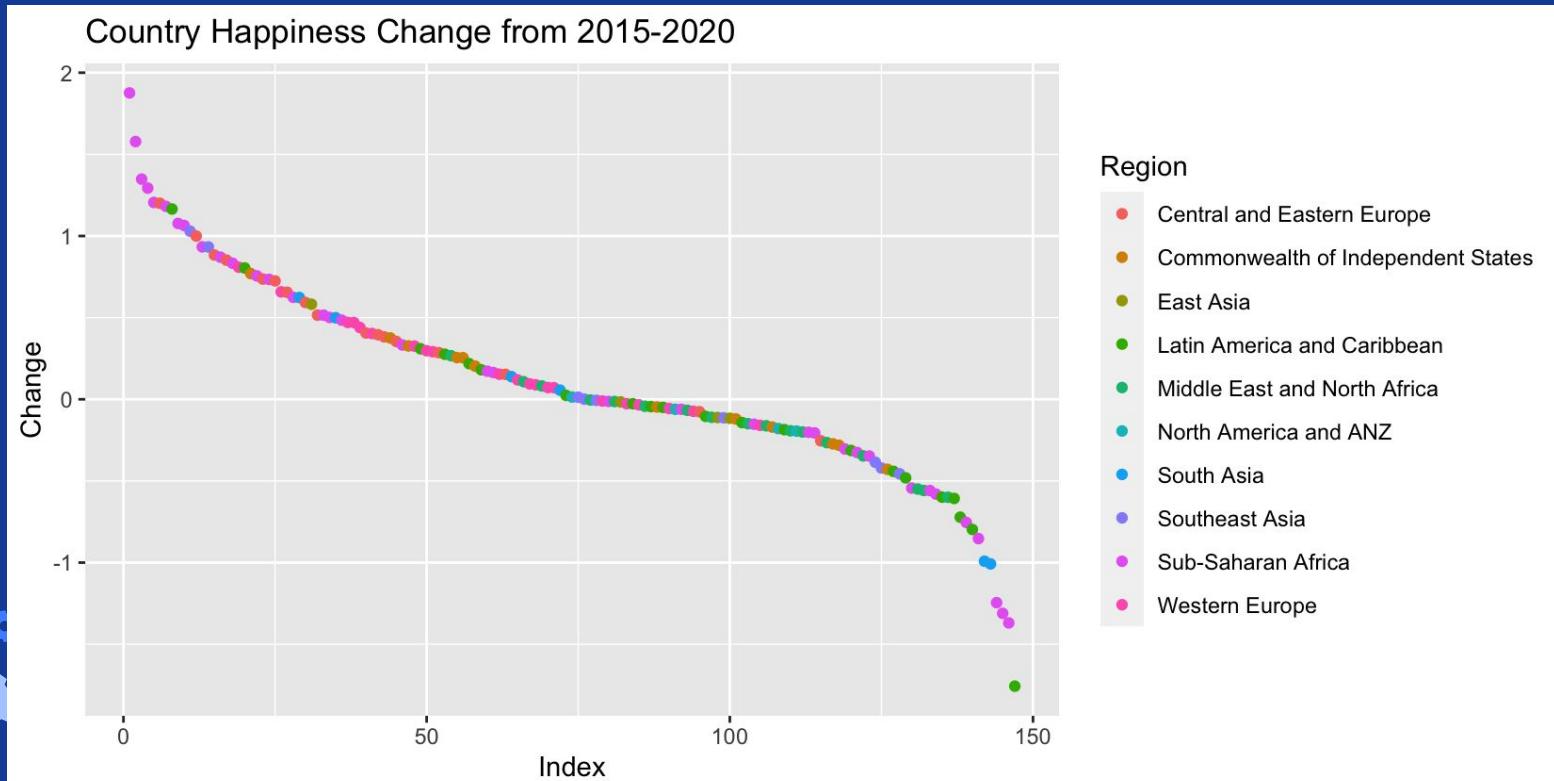
https://www.apnews.com/assets/2019/02/22/55478c78039e-8956-4baa-8995-3a27fb88bf49_California_victims_several_died_in_a_catastrophic_wildfire_in_northern_California_1200x630.jpg

Mean Happiness

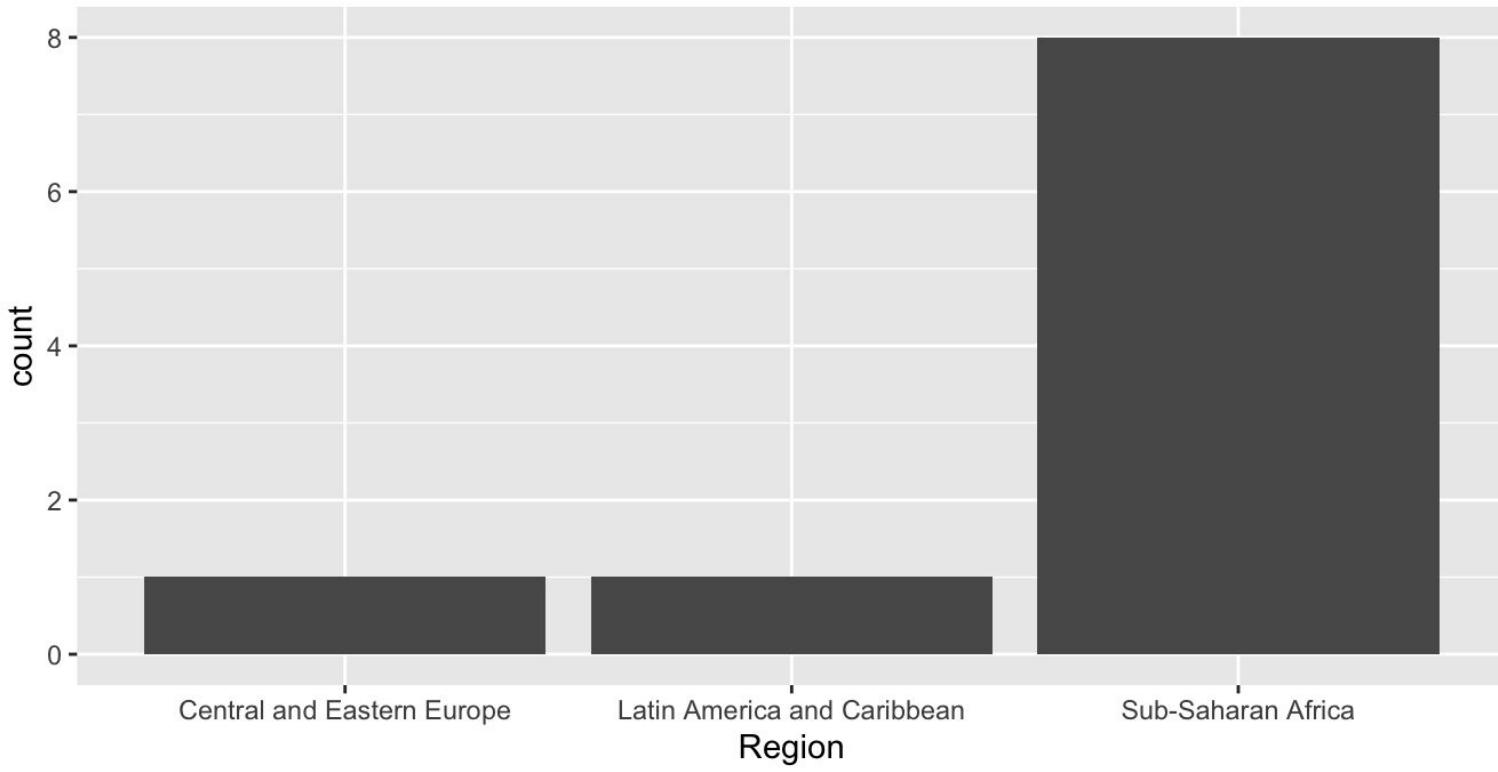




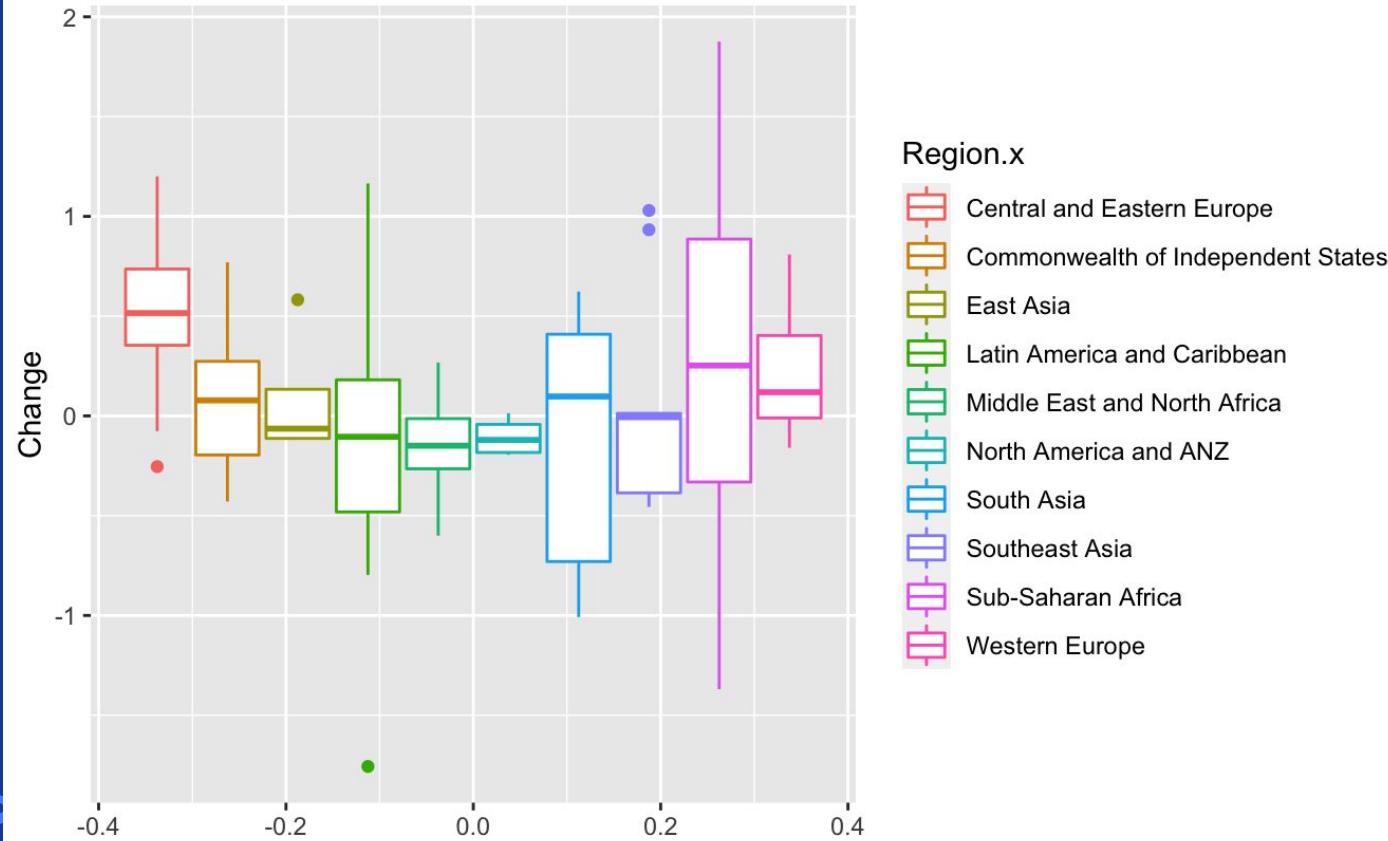
Which countries' happiness have changed the most over time? Does the data explain the shift?



Top 10 Most Changed Countries



Happiness Change by Region, 2015-2020



Key Question 6

If you look at the table from 2019, 5 out of the 10 top countries are in Northern Europe, why is this and what did they do right to maintain the happiness of their people?





Code and Data Walkthrough



Reproducibility



•••

Our code is fully reproducible! By downloading all the datasets from 2015-2020, then following our data cleaning steps, you can run our code, and even make your own analysis!

Cleaned data link:
<https://drive.google.com/drive/folders/1TggJz0Bytt4gCNaAde3wygmv9w39yMI1?usp=sharing>

Results



To combine the factors together and look at how they directly affect a country's happiness, let's compare 3 countries: one happy, one neutral, and one sad.



Finland



Russia



Haiti



Results



Certain regions are happier — location is a crucial component in deciding a country's happiness.

It's hard to predict happiness, but it isn't impossible. There are numerous factors that contribute to the overall score.





The End

Thanks for listening!



28m < * SUNDAY 5/5





26m

Audrey Wang

Siddharth B

Sanjana Subramanyan

Leo Ding

i , m
just
from the
upside
down

