

HUMAN FREEDOM INDEX ANALYSIS

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ABSTRACT

A central purpose of The Human Freedom Index is to paint a broad but reasonably accurate picture of the extent of overall freedom in the world. A larger purpose is to more carefully explore what we mean by freedom and to better understand its relationship to any number of other social and economic phenomena.

DESCRIPTION

The Human Freedom Index is a report that attempts to summarize the idea of "freedom" through a bunch of different variables for many countries around the globe. It serves as a rough objective measure for the relationships between the different types of freedom - whether it's political, religious, economical or personal freedom - and other social and economic circumstances. The Human Freedom Index is an annually co-published report by the Cato Institute, the Fraser Institute, and the Liberales Institut at the Friedrich Naumann Foundation for Freedom.

It measures economic freedoms such as the freedom to trade or to use sound money, and it captures the degree to which people are free to enjoy the major freedoms often referred to as civil liberties—freedom of speech, religion, association, and assembly— in the countries in the survey. In addition, it includes indicators on rule of law, crime and violence, freedom of movement, and legal discrimination against same-sex relationships. We also include nine variables pertaining to women-specific freedoms that are found in various categories of the index.

AIM

To analyze the dataset and obtain insights, by performing the following:

1. Data Preprocessing
 - Handle missing data.
 - Obtain overview on data.
 - Obtain target statistics.
2. Exploratory Data Analysis
 - Analyze target attribute trends.
 - Perform attribute analysis.
 - Obtain correlation among attributes.
3. Target Prediction
 - Predict ef_score and pf_score individually.
 - Predict hf_score as a whole.

DATASET FORMAT

It is used as a data frame with 1782 observations on the following 112 whose variables contains information from Human Freedom Index reports from 2008-2018.

Parameters

year: Year

ISO_code: ISO code of country

countries: Name of country

region: Region where country is located

Personal Freedom Measures

pf_rol_procedural: Procedural justice

pf_rol_civil: Civil justice

pf_rol_criminal: Criminal justice

pf_rol: Rule of law

pf_ss_homicide: Homicide

pf_ss_disappearances_disap: Disappearances

pf_ss_disappearances_violent: Violent conflicts

pf_ss_disappearances_organized: Violent conflicts

pf_ss_disappearances_fatalities: Terrorism fatalities

pf_ss_disappearances_injuries: Terrorism injuries

pf_ss_disappearances: Disappearances, conflict, and terrorism

pf_ss_women_fgm: Female genital mutilation

pf_ss_women_missing: Missing women

pf_ss_women_inheritance_widows: Inheritance rights for widows

pf_ss_women_inheritance_daughters: Inheritance rights for daughters

pf_ss_women_inheritance: Inheritance

pf_ss_women: Women's security

pf_ss: Security and safety

pf_movement_domestic: Freedom of domestic movement

pf_movement_foreign: Freedom of foreign movement

pf_movement_women: Women's movement

pf_movement: Freedom of movement

pf_religion_estop_establish: Freedom to establish religious organizations

pf_religion_estop_operate: Freedom to operate religious organizations

pf_religion_estop: Freedom to establish and operate religious organizations

pf_religion_harassment: Harassment and physical hostilities

pf_religion_restrictions: Legal and regulatory restrictions

pf_religion: Religious freedom

pf_association_association: Freedom of association

pf_association_assembly: Freedom of assembly

pf_association_political_establish: Freedom to establish political parties

pf_association_political_operate: Freedom to operate political parties

pf_association_political: Freedom to establish and operate political parties

pf_association_prof_establish: Freedom to establish professional organizations

pf_association_prof_operate: Freedom to operate professional organizations

pf_association_prof: Freedom to establish and operate professional organizations

pf_association_sport_establish: Freedom to establish educational, sporting, and cultural organizations

pf_association_sport_operate: Freedom to operate educational, sporting, and cultural organizations

pf_association_sport: Freedom to establish and operate educational, sporting, and cultural organizations

pf_association: Freedom to associate and assemble with peaceful individuals or organizations

pf_expression_killed: Press killed

pf_expression_jailed: Press jailed

pf_expression_influence: Laws and regulations that influence media content



pf_expression_control: Political pressures and controls on media content

pf_expression_cable: Access to cable/satellite

pf_expression_newspapers: Access to foreign newspapers

pf_expression_internet: State control over internet access

pf_expression: Freedom of expression

pf_identity_legal: Legal gender

pf_identity_parental_marriage: Parental rights in marriage

pf_identity_parental_divorce: Parental rights after divorce

pf_identity_parental: Parental rights

pf_identity_sex_male: Male-to-male relationships

pf_identity_sex_female: Female-to-female relationships

pf_identity_sex: Same-sex relationships

pf_identity_divorce: Divor

pf_identity: Identity and relationships

pf_score: Personal Freedom (score)

pf_rank: Personal Freedom (rank)

Economic Freedom Measures

ef_government_consumption: Government consumption

ef_government_transfers: Transfers and subsidies

ef_government_enterprises: Government enterprises and investments

ef_government_tax_income: Top marginal income tax rate - Top marginal income tax rates

ef_government_tax_payroll: Top marginal income tax rate - Top marginal income and payroll tax rate

ef_government_tax: Top marginal tax rate

ef_government: Size of government

ef_legal_judicial: Judicial independence

ef_legal_courts: Impartial courts

ef_legal_protection: Protection of property rights

ef_legal_military: Military interference in rule of law and politics

ef_legal_integrity: Integrity of the legal system

ef_legal_enforcement: Legal enforcement of contracts

ef_legal_restrictions: Regulatory restrictions on the sale of real property

ef_legal_police: Reliability of police

ef_legal_crime: Business costs of crime

ef_legal_gender: Gender adjustment

ef_legal: Legal system and property rights

ef_money_growth: Money growth

ef_money_sd: Standard deviation of inflation

ef_money_inflation: Inflation - most recent year

ef_money_currency: Freedom to own foreign currency bank account

ef_money: Sound money

ef_trade_tariffs_revenue: Tariffs - Revenue from trade taxes (percentage of trade sector)

ef_trade_tariffs_mean: Tariffs - Mean tariff rate

ef_trade_tariffs_sd: Tariffs - Standard deviation of tariffs rates

ef_trade_tariffs: Tariffs

ef_trade_regulatory_nontariff: Regulatory trade barriers - Nontariff trade barriers

ef_trade_regulatory_compliance: Regulatory trade barriers - Compliance costs of importing and exporting

ef_trade_regulatory: Regulatory trade barriers

ef_trade_black: Black-market exchange rates

ef_trade_movement_foreign: Controls of the movement of capital and people - Foreign ownership/investment restrictions

ef_trade_movement_capital: Controls of the movement of capital and people - Capital controls

ef_trade_movement_visit: Controls of the movement of capital and people
- Freedom of foreigners to visit

ef_trade_movement: Controls of the movement of capital and people

ef_trade: Freedom to trade internationally

ef_regulation_credit_ownership: Credit market regulations - Ownership of banks

ef_regulation_credit_private: Credit market regulations - Private sector credit

ef_regulation_credit_interest: Credit market regulations - Interest rate controls/negative real interest rates

ef_regulation_credit: Credit market regulation

ef_regulation_labor_minwage: Labor market regulations - Hiring regulations and minimum wage

ef_regulation_labor_firing: Labor market regulations - Hiring and firing regulations

ef_regulation_labor_bargain: Labor market regulations - Centralized collective bargaining

ef_regulation_labor_hours: Labor market regulations - Hours regulations

ef_regulation_labor_dismissal: Labor market regulations - Dismissal regulations

ef_regulation_labor_conscription: Labor market regulations - Conscription

ef_regulation_labor: Labor market regulation

ef_regulation_business_adm: Business regulations - Administrative requirements

ef_regulation_business_bureaucracy: Business regulations - Bureaucracy costs

ef_regulation_business_start: Business regulations - Starting a business

ef_regulation_business_bribes: Business regulations - Extra payments/bribes/favoritism

ef_regulation_business_licensing: Business regulations - Licensing restrictions

f_regulation_business_compliance: Business regulations - Cost of tax compliance

ef_regulation_business: Business regulation

ef_regulation: Economic freedom regulation score

ef_score: Economic freedom score

ef_rank: Economic freedom rank

Economic Freedom Measures

hf_score: Human freedom score

hf_rank: Human freedom rank

hf_quartile: Human freedom quartile

PRECISION RESULT

Personal Freedom (pf_score)

1. Equation

$$\begin{aligned} \text{pf_score} = & 7.129408942621376 + -0.007255149406461302 * \\ & \text{pf_rol_procedural} + 0.0002955638957091722 * \text{pf_rol_civil} + \\ & 0.005209719261992496 * \text{pf_rol_criminal} + 0.382931455169134 * \text{pf_rol} + \\ & 0.25137151654845186 * \text{pf_ss_homicide} + 0.003326007791153495 * \\ & \text{pf_ss_disappearances_disap} + 0.005952011517736703 * \\ & \text{pf_ss_disappearances_violent} + -0.0012183668448219173 * \\ & \text{pf_ss_disappearances_organized} + 0.004767384116985554 * \\ & \text{pf_ss_disappearances_fatalities} + -0.0068681453448048045 * \\ & \text{pf_ss_disappearances_injuries} + 0.15493229219833393 * \\ & \text{pf_ss_disappearances} + -0.0027748796266747863 * \text{pf_ss_women_fgm} + \\ & 0.00946500794365305 * \text{pf_ss_women_inheritance} + 0.210243546208765 * \\ & \text{pf_ss_women} + -0.03455706312420085 * \text{pf_ss} + -0.015026952940778325 * \\ & \text{pf_movement_domestic} + -0.013086835538987136 * \text{pf_movement_foreign} \\ & + -0.010254961561143344 * \text{pf_movement_women} + 0.2949880264725114 * \\ & \text{pf_movement} + 0.0680980281099157 * \text{pf_religion_freedom} + \\ & 0.045086502122578365 * \text{pf_religion_repression} + 0.02653651281144464 * \\ & \text{pf_religion_harassment} + 0.04102247517854747 * \text{pf_religion_restrictions} + \\ & 0.0006374587042142295 * \text{pf_religion} + 0.0338376400405121 * \\ & \text{pf_association_entry} + 0.032379428344077366 * \text{pf_association_assembly} + \\ & 0.022030950869279198 * \text{pf_association_barries} + 0.016221723058418045 * \\ & \text{pf_association_bans} + -0.02304052187294522 * \\ & \text{pf_association_estopparties} + 0.025755149483222363 * \\ & \text{pf_association_opposition} + 0.023778371217253222 * \\ & \text{pf_association_civilrepression} + 0.10392755072523727 * \text{pf_association} + \\ & -0.004644678164586119 * \text{pf_expression_killed} + -0.005230236385152031 * \\ & \text{pf_expression_jailed} + -0.0005644839416751729 * \text{pf_expression_media} + \\ & -0.00464039137257586 * \text{pf_expression_cable} + -0.008564466178896439 * \\ & \text{pf_expression_newspapers} + -0.0005182000407370074 * \\ & \text{pf_expression_control} + 0.15866459246904413 * \text{pf_expression} + \\ & 0.0019597322221376577 * \text{pf_identity_legal} + -0.017073703639585498 * \\ & \text{pf_identity_sex_male} + -0.02038100811513495 * \text{pf_identity_sex_female} + \\ & 0.02604635205555885 * \text{pf_identity_sex} + -0.002277772965110003 * \\ & \text{pf_identity_divorce} + 0.33569575249161726 * \text{pf_identity} \end{aligned}$$

2. Accuracy

Test accuracy: 0.9951499893591607

Train accuracy: 0.9994104791381124

Economic Freedom (ef_score)

1. Equation

$$\begin{aligned} \text{ef_score} = & 6.814418537708693 + 0.0745501393791682 * \\ & \text{ef_government_consumption} + 0.06879700284066334 * \\ & \text{ef_government_transfers} + 0.10659615045431406 * \\ & \text{ef_government_enterprises} + 0.004360108595840399 * \\ & \text{ef_government_tax_income} + 0.0037125053758116635 * \\ & \text{ef_government_tax_payroll} + 0.07338995690339192 * \text{ef_government_tax} + \\ & 0.0647894722709737 * \text{ef_government_soa} + 0.049883644140770525 * \\ & \text{ef_government} + -0.005526458137395012 * \text{ef_legal_judicial} + \\ & 0.0005991787709741583 * \text{ef_legal_courts} + 0.008727915397343314 * \\ & \text{ef_legal_protection} + 0.00357928801186308 * \text{ef_legal_military} + \\ & 0.00599607528479211 * \text{ef_legal_integrity} + 0.0008914852111922833 * \\ & \text{ef_legal_enforcement} + 0.00897133099270566 * \text{ef_legal_regulatory} + \\ & 5.662039906395577e-05 * \text{ef_legal_police} + 0.0011117640731656137 * \\ & \text{ef_legal_gender} + 0.2748522967180098 * \text{ef_legal} + 0.02289085513362564 * \\ & \text{ef_money_growth} + 0.02735591447402145 * \text{ef_money_sd} + \\ & 0.01828433903001757 * \text{ef_money_inflation} + 0.059899666333888 * \\ & \text{ef_money_currency} + 0.19521736680587398 * \text{ef_money} + \\ & 0.001337491166069446 * \text{ef_trade_tariffs_revenue} + -0.01670028206123033 * \\ & \text{ef_trade_tariffs_mean} + -0.0027541145956942598 * \text{ef_trade_tariffs_sd} + \\ & 0.01325343791247606 * \text{ef_trade_tariffs} + 0.0017671425051777115 * \\ & \text{ef_trade_regulatory_nontariff} + 0.008680753993214017 * \\ & \text{ef_trade_regulatory_compliance} + -0.0035674089273920045 * \\ & \text{ef_trade_regulatory} + 0.00961756534079386 * \text{ef_trade_black} + \\ & 0.013679693022429999 * \text{ef_trade_movement_foreign} + \\ & 0.008701216189719446 * \text{ef_trade_movement_capital} + \\ & 0.018028891746694538 * \text{ef_trade_movement_visit} + -0.02471971156648184 * \\ & \text{ef_trade_movement} + 0.25710489933298575 * \text{ef_trade} + \\ & -0.0039518031172424105 * \text{ef_regulation_credit_ownership} + \\ & 0.0007578292182124011 * \text{ef_regulation_credit_private} + \\ & -0.001681755531927745 * \text{ef_regulation_credit_interest} + \\ & 0.09394667357243718 * \text{ef_regulation_credit} + -0.006317302171455479 * \\ & \text{ef_regulation_labor_minwage} + -0.0032763777489415533 * \\ & \text{ef_regulation_labor_firing} + -0.003572139557049374 * \\ & \text{ef_regulation_labor_bargain} + -0.005708150576785115 * \\ & \text{ef_regulation_labor_hours} + -0.0047827104569097625 * \\ & \text{ef_regulation_labor_dismissal} + -0.008472339192726996 * \\ & \text{ef_regulation_labor_conscription} + 0.11065253629474939 * \\ & \text{ef_regulation_labor} + 0.005349976186874911 * \\ & \text{ef_regulation_business_adm} + 0.011345497508073309 * \\ & \text{ef_regulation_business_bureaucracy} + 0.0001728144886454855 * \\ & \text{ef_regulation_business_start} + 0.01249485213050723 * \\ & \text{ef_regulation_business_bribes} + 0.0028517479592059802 * \\ & \text{ef_regulation_business_licensing} + 0.010002657305286627 * \\ & \text{ef_regulation_business_compliance} + 0.04535608191864842 * \\ & \text{ef_regulation_business} + 0.007905525156770878 * \text{ef_regulation} \end{aligned}$$

2. Accuracy

Test accuracy: 0.9969495386339511

Train accuracy: 0.9974176438214803

Human Freedom (hf_score)

1. Equation

$$\begin{aligned} \text{hf_score} = & 6.9742940894262135 + -0.00026598449756073034 * \\ & \text{pf_rol_procedural} + -0.0008744946900850203 * \text{pf_rol_civil} + \\ & -0.003186077053356877 * \text{pf_rol_criminal} + 0.19693595782220027 * \text{pf_rol} + \\ & 0.0948627211373588 * \text{pf_ss_homicide} + 0.008481639909653352 * \\ & \text{pf_ss_disappearances_disap} + 0.005323680093914568 * \\ & \text{pf_ss_disappearances_violent} + 0.006649449355567036 * \\ & \text{pf_ss_disappearances_organized} + 0.006395598383411433 * \\ & \text{pf_ss_disappearances_fatalities} + 0.0004577243492539518 * \\ & \text{pf_ss_disappearances_injuries} + 0.03932757503882203 * \\ & \text{pf_ss_disappearances} + 0.004907474574137408 * \text{pf_ss_women_fgm} + \\ & 0.004289678333505534 * \text{pf_ss_women_inheritance} + \\ & 0.07873679190542815 * \text{pf_ss_women} + 0.028310868758627674 * \text{pf_ss} + \\ & -0.009254599368581553 * \text{pf_movement_domestic} + \\ & -0.010134187885665441 * \text{pf_movement_foreign} + -0.01076943479991509 * \\ & \text{pf_movement_women} + 0.15462228783453602 * \text{pf_movement} + \\ & 0.051965197756651337 * \text{pf_religion_freedom} + 0.04027771037435354 * \\ & \text{pf_religion_repression} + 0.019975126715231203 * \text{pf_religion_harassment} + \\ & 0.03723365566046459 * \text{pf_religion_restrictions} + -0.054879142680499135 * \\ & \text{pf_religion} + 0.028337665237230563 * \text{pf_association_entry} + \\ & 0.020554101100198535 * \text{pf_association_assembly} + 0.022255131374033572 \\ & * \text{pf_association_barries} + 0.008712158407897616 * \text{pf_association_bans} + \\ & -0.010791583748899464 * \text{pf_association_estopparties} + \\ & 0.012899648357766497 * \text{pf_association_opposition} + \\ & 0.007221957208895773 * \text{pf_association_civilrepression} + \\ & 0.028242209399054793 * \text{pf_association} + -0.0051527535769166286 * \\ & \text{pf_expression_killed} + -0.004154390874390523 * \text{pf_expression_jailed} + \\ & -0.005228222709007156 * \text{pf_expression_media} + -0.008014898792049918 \\ & * \text{pf_expression_cable} + -0.007396691260965184 * \\ & \text{pf_expression_newspapers} + 0.0015395367047967203 * \\ & \text{pf_expression_control} + 0.09286484793956926 * \text{pf_expression} + \\ & 0.0032613319963867987 * \text{pf_identity_legal} + -0.01066835143941984 * \\ & \text{pf_identity_sex_male} + -0.009513744766018725 * \text{pf_identity_sex_female} + \\ & 0.020732236580542344 * \text{pf_identity_sex} + -0.0021823701339263243 * \\ & \text{pf_identity_divorce} + 0.16764007153699356 * \text{pf_identity} + \\ & 0.03276748359825424 * \text{ef_government_consumption} + \\ & 0.027186967485321553 * \text{ef_government_transfers} + \\ & 0.045593522323067404 * \text{ef_government_enterprises} + \\ & -0.0015995791657716068 * \text{ef_government_tax_income} + \\ & -0.006030249651733256 * \text{ef_government_tax_payroll} + \\ & 0.04194224497169666 * \text{ef_government_tax} + 0.026390540137667166 * \\ & \text{ef_government_soa} + 0.04025996182468535 * \text{ef_government} + \\ & -0.0028421147594924305 * \text{ef_legal_judicial} + 0.0021127870744413677 * \\ & \text{ef_legal_courts} + 0.0022546773802094994 * \text{ef_legal_protection} + \\ & -0.0031407189606307145 * \text{ef_legal_military} + 0.0066858961408611806 * \\ & \text{ef_legal_integrity} + 0.002370681315695594 * \text{ef_legal_enforcement} + \\ & 0.0023827533385085836 * \text{ef_legal_regulatory} + 0.0006680177096235109 * \end{aligned}$$

ef_legal_police + 0.0031295475863592423 * ef_legal_gender +
 0.1329986378749644 * ef_legal + 0.0061148506560100395 *
 ef_money_growth + 0.008304890040319583 * ef_money_sd +
 0.00591432215813922 * ef_money_inflation + 0.01896400642275764 *
 ef_money_currency + 0.11486699278525217 * ef_money +
 -0.0006032524022203598 * ef_trade_tariffs_revenue +
 -0.01145787558506517 * ef_trade_tariffs_mean + -0.0034648292720933452
 * ef_trade_tariffs_sd + 0.016850441726947066 * ef_trade_tariffs +
 0.005348489116156863 * ef_trade_regulatory_nontariff +
 0.0032762542606615055 * ef_trade_regulatory_compliance +
 0.011473158855255263 * ef_trade_regulatory + 0.01765441712366607 *
 ef_trade_black + 0.009319916516663793 * ef_trade_movement_foreign +
 0.013163556792012095 * ef_trade_movement_capital +
 0.019745850124738874 * ef_trade_movement_visit +
 -0.013105072160276468 * ef_trade_movement + 0.08737109326749837 *
 ef_trade + 0.0014877953217948478 * ef_regulation_credit_ownership +
 0.003909556709974624 * ef_regulation_credit_private +
 0.0003953443026343609 * ef_regulation_credit_interest +
 0.04533589728095827 * ef_regulation_credit + -0.0029550234253723703 *
 ef_regulation_labor_minwage + 0.00020273331275916934 *
 ef_regulation_labor_firing + -0.0021758903368086883 *
 ef_regulation_labor_bargain + -0.003097014091733026 *
 ef_regulation_labor_hours + -0.0018248826738213896 *
 ef_regulation_labor_dismissal + -0.002480906070877996 *
 ef_regulation_labor_conscription + 0.055487327996431704 *
 ef_regulation_labor + 0.002442877136639744 *
 ef_regulation_business_adm + 0.0022657637571488476 *
 ef_regulation_business_bureaucracy + 0.001303451831379393 *
 ef_regulation_business_start + 0.007179532110015804 *
 ef_regulation_business_bribes + -0.0001919272936655031 *
 ef_regulation_business_licensing + -0.0006604856915633159 *
 ef_regulation_business_compliance + 0.034209333759497716 *
 ef_regulation_business + 0.002080359700870678 * ef_regulation

2. Accuracy

Test accuracy: 0.9969495386339511

Train accuracy: 0.9974176438214803



SOURCES

1. Dataset

Schneider, G. S. (2021, January 1). The human freedom index. Kaggle.
[https://www.kaggle.com/gsutters/the-human-freedom-index?
select=hfi_cc_2020.csv](https://www.kaggle.com/gsutters/the-human-freedom-index?select=hfi_cc_2020.csv).

2. World Bank Economic Review

Datat Sets. hfi. OpenIntro.
<https://www.openintro.org/data/index.php?data=hfi>

3. Journal

Ian Vásquez and Fred McMahon, The Human Freedom Index 2020: A
Global Measurement of Personal, Civil, and Economic Freedom
(Washington: Cato Institute and the Fraser Institute, 2020).