3. Appendices: Methodology and Definitions

3. Приложения: Методология и определения

Selection of Indicators

Выбор индикаторов

These parameters were first assembled to illustrate the comparative position of the countries of the world.

The criteria I was guided by in selecting indicators were:

- Small total number of indicators
- Their importance;
- Availability for the maximal number of countries;
- Statistical reliability;
- Independence of technological and industrial level of the countries.

Missing data was projected with the help of regressions.

Selection of Countries

Выбор стран

I selected

- Independent states;
- Dependent territories — they are marked with (Depend);
- Autonomous territories — they are marked with (Auto);
- Territories with active separatist movements — they are marked with (Separ).

Selection of Sources

Выбор источников

For most of the tables the principles for the selection of sources are simple: the most recent year available takes precedence and the corresponding source is indicated. Only if data is unavailable, a regression is used. When faced with a choice among several alternative sources, a deliberate and a priori defined choice between the sources, based on the quality of the sources, is made as described below.

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Where possible the main source of data is the World Bank World Development Indicators Online for the latest year, version 2024-12-16 or later.

For GDP at market exchange rates per capita and GDP at purchasing power parities per capita, the hierarchy of sources within the latest year is: WB, IMF, UN, EUROSTAT, GDL, E, CIA, IISS, OFFICIAL, WIKI.

The CIA's GDP per capita data from the *World Factbook* is inexact, being rounded to the hundred or thousand dollars, and is often out of sync with the CIA's gross GDP numbers. The obvious way to synchronize CIA gross GDP and GDP per capita numbers and to increase the precision of GDP per capita estimates would be to recalculate GDP per capita by dividing CIA gross GDP numbers by CIA population data for the corresponding years. Unfortunately, sometimes CIA gross GDP numbers appear to be even rougher estimates than CIA GDP per capita numbers. Therefore, in synchronizing CIA gross GDP and GDP per capita, I used the following rule: if after these calculations, the CIA number does not look like a rounded one (to the precision of 100) of my calculated number, a maximum of the CIA number and my calculated number is taken. If either of these two indicators is missing, a regression is used to obtain the other one of the pair.

For electricity consumption per capita, the hierarchy of sources within the latest year is: WB, E, CIA, WIKI. When I had to rely on the CIA data, I have divided the CIA number of the total electricity consumption by the population data for the corresponding year (usually WB population data). If either of these two indicators is missing, a regression is used to obtain the other one of the pair.

For the data about infant mortality and life expectancy, the hierarchy of sources within the latest year is: DBEARTH, WB, EUROSTAT, CIA, E, WIKI. If an indicator is available but not for the latest year, it is weighted against the U.S. for that year and then this weight is multiplied by the U.S. value of this indicator for the latest year. Only if data is unavailable for any year, a regression is used.

For GDP at market exchange rates per capita, GDP at purchasing power parities per capita, infant mortality, and life expectancy, if an indicator is available but not for the latest year, it is weighted against the U.S. for that year and then this weight is multiplied on the U.S. value of this indicator for the latest year.

These four indicators belong to the "expanding universe of indicators" which have a tendency to improve from year to year. To leave them at the values of previous years would mean to underestimate the situation in the corresponding countries for the current year.

For the Civil and Political Rights Index, the source for the latest year is: FH and other sources mentioned in the sub-section "Definition of Civil and Political Rights Index."

For the Freedom of the Press Index, the source for the latest year is: RWB. Only if data is unavailable for any year, a regression is used.

For the Human Development Index, the source for the latest year is: GDL. Only if data is unavailable for the year in the title of the table, a regression is used.

For the Gini coefficient of income inequality (before and after taxes and transfers) and of wealth

inequality, the hierarchy of sources within the latest year is: WB, CIA, UNDP, WIID, GPI, WIKI. Where the year of estimate is the same, I am using the higher number. Only if data is unavailable for any year, an estimate is used.

For the forest cover, the hierarchy of sources within the latest year is: WB, EUROSTAT, WIKI. Only if data is unavailable for any year, an estimate is used.

For the precipitation, the source within the latest year is: WIKI.

For the total freshwater resources, the source within the latest year is: WB. Only if data is unavailable for any year, an estimate based on precipitation is used.

For the use of basic drinking services and the use of basic sanitation facilities, the hierarchy of sources within the latest year is: WB, WIKI. Only if data is unavailable for any year, a regression is used.

For the murder rate, the hierarchy of sources within the latest year is: WB, EUROSTAT, WIKI, CHATGPT. Only if data is unavailable for any year, a regression is used.

For the suicide rate, age-standardized rates are given priority over non-standardized. The hierarchy of sources for standardized rates within the latest year is: EUROSTAT, WHO, WIKI, CHATGPT. The hierarchy of sources for non-standardized rates within the latest year is: WB, WIKI, CHATGPT. Only if data is unavailable for any year, a regression is used.

For the data about fertility rate, the hierarchy of sources within the latest year is: DBEARTH, EUROSTAT, WB, CIA, WIKI. Only if data is unavailable for any year, a regression is used.

For the data about female participation rate, the hierarchy of sources within the latest year is: WB, EUROSTAT, ILO, GDL, WIKI. Only if data is unavailable for any year, a regression is used.

For the population data, the hierarchy of sources within the latest year is as described in the section “Definition of Area and Population”.

For military personnel, I took the data for the latest available year. The hierarchy of sources within the latest year is: IISS, WB, E, CIA, WIKI.

For military expenditures as a share of GDP, I took the data for the latest available year; the hierarchy of sources within the latest year is: WB, IISS, E, CIA.

For the data about nuclear weapons, the hierarchy of sources within the latest year is: SIPRI, BULL, IISS, WIKI.

For the data about weapons of mass destruction, the hierarchy of sources within the latest year is: BULL, E, CIA, WIKI.

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For the data about the global stocks of highly enriched uranium and separated plutonium, the hierarchy of sources within the latest year is: SIPRI, BULL, CIA, WIKI.

Definition of Correlation

Определение корреляции

A correlation is a technique for analyzing the interrelationship between two random variables. Correlation coefficient is a number ranging between -1 and +1 indicating how well the assumed distribution describes the relationship between these two variables; zero indicates no relationship.[1]

Definition of Multiple Correlation

Определение множественной корреляции

Multiple correlation is a technique for analyzing the interrelationship between a random variable and a set of random variables. Correlation coefficient is a number ranging between -1 and +1 indicating how well the assumed distribution describes the relationship between these the variable and the set of variables; zero indicates no relationship.[2]

Definition of Canonical Correlation

Определение канонической корреляции

Canonical correlation is a technique for analyzing the interrelationship between two sets of random variables. Each set contains several variables. Correlation coefficient is a number ranging between 0 and +1 indicating how well the assumed distribution describes the relationship between these the variable and the set of variables; zero indicates no relationship. Ordinary and multiple correlations are special cases of canonical correlation, in which one or both sets consist of one variable. For two given sets of variables, the canonical correlation finds a linear combination for each set, named the canonical variable, such that the correlation between two canonical variables is maximized. This correlation between two canonical variables is the first canonical correlation.[3]

[1] Mathematics: SAS Institute, Inc. (1988), Kiyosi (2000), Kotz (1985).

[2] Mathematics: SAS Institute, Inc. (1988), Kiyosi (2000), Kotz (1985).

[3] Mathematics: SAS Institute, Inc. (1988), Kiyosi (2000), Kotz (1985).

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Definition of Principal Component 1

Определение главной компоненты 1

Principal component analysis is a multidimensional technique for studying the interrelationship between several quantitative variables. For a given set of data with p numerical variables, p principal components can be computed. Each principal component is a linear combination of the initial variables with coefficients equal to the eigenvector of the correlational or covariational matrix. The eigenvectors are typically selected to have a length of one. The principal components are sorted in descending order of characteristic values, which are equal to the variation of the components. The principal components have a number of useful properties; among these are:

The first principal component accounts for the greatest variation of any linear combination of observed variables of the unit length.

In geometrical terms a j-dimensional linear subspace of the first j principal components provides the best possible arrangement of data points measured as the sum of squares of the perpendicular distances from each point to the subspace.[4]

Definition of the Economic Quality-of-Life Index

Определение индекса экономического качества жизни

I computed the Economic Quality-of-Life Index as principal component 1 of the five economic indicators of the quality of life given in this yearbook:

log(GPC)	Logarithm of GDP per capita at market exchange rates
log(GPCPPP)	Logarithm of GDP per capita at purchasing power parities
log(ELCONS)	Logarithm of electricity consumption
log(INFMRT)	Logarithm of infant mortality
log(max(LIFEXP) – LIFEXP)	Logarithm of the difference between maximum of life expectancy and life expectancy of this country (in 2021, women of Monaco enjoyed the maximum, which was equal to 93.40 years)

[4] Mathematics: SAS Institute, Inc. (1988), Kiyosi (2000), Kotz (1985).

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Definition of the Generalized Human Rights Index

Определение обобщенного индекса прав человека

In an attempt to estimate the level of human rights, I computed a human rights index as principal component 1 of seven indicators of the political quality of life:

SCINTX	The index of societal integration
FPX	The freedom of the press index
log(100 – CPRX)	Logarithm of the difference between maximum of the civil and political rights index and the civil and political rights index of this country
HDX	The human development index
GIN1	Gini coefficient of income inequality before taxes and transfers
GIN2	Gini coefficient of income inequality after taxes and transfers
GINWLTH	Gini coefficient of wealth inequality

Definition of the Economico-Political Quality-of-Life Index

Определение индекса экономико-политического качества жизни

I computed the Economico-Political Quality-of-Life Index as principal component 1 of the 12 economic and political indicators of the quality of life given in this yearbook:

log(GPC)	Logarithm of GDP per capita at market exchange rates
log(GPCPPP)	Logarithm of GDP per capita at purchasing power parities
log(ELCONS)	Logarithm of electricity consumption
log(INFMRT)	Logarithm of infant mortality
log(max(LIFEXP) – LIFEXP)	Logarithm of the difference between maximum of life expectancy and life expectancy of this country
SCINTX	The index of societal integration
FPX	The freedom of the press index
log(100 – CPRX)	Logarithm of the difference between maximum of the civil and political rights index and the civil and political rights index of this country
HDX	The human development index
GIN1	Gini coefficient of income inequality before taxes

	and transfers
GIN2	Gini coefficient of income inequality after taxes and transfers
GINWLTH	Gini coefficient of wealth inequality

Definition of the Environmental Quality-of-Life Index

Определение индекса качества жизни окружающей среды

I computed the Environmental Quality-of-Life Index as principal component 1 of the seven environmental indicators of the quality of life given in this yearbook:

log(POPDEN)	Logarithm of population density
FRST	Forest cover
log(WATR)	Logarithm of freshwater per capita
log(CO2PC)	Logarithm of emissions of carbon dioxide per capita
log(CO2DEN)	Logarithm of emissions of carbon dioxide per square kilometer
log(100 – DRNK)	Logarithm of the difference between maximum of the people using drinking water and the people using drinking water
log(100 – SNTN)	Logarithm of the difference between maximum of the people using improved sanitation facilities water and the people using improved sanitation facilities

Definition of the Economico-Political-Environmental Quality-of-Life Index

Определение индекса экономико-политического качества жизни с учетом окружающей среды

I computed the Economico-Political-Environmental Quality-of-Life Index as principal component 1 of the 19 economic, political, and environmental indicators of the quality of life given in this yearbook:

log(GPC)	Logarithm of GDP per capita at market exchange rates
log(GPCPPP)	Logarithm of GDP per capita at purchasing power parities
log(ELCONS)	Logarithm of electricity consumption

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log(INFMRT)	Logarithm of infant mortality
log(max(LIFEXP) – LIFEXP)	Logarithm of the difference between maximum of life expectancy and life expectancy of this country
SCINTX	The index of societal integration
FPX	The freedom of the press index
log(100 – CPRX)	Logarithm of the difference between maximum of the civil and political rights index and the civil and political rights index of this country
HDX	The human development index
GIN1	Gini coefficient of income inequality before taxes and transfers
GIN2	Gini coefficient of income inequality after taxes and transfers
GINWLTH	Gini coefficient of wealth inequality
log(POPDEN)	Logarithm of population density
FRST	Forest cover
log(WATR)	Logarithm of freshwater per capita
log(CO2PC)	Logarithm of emissions of carbon dioxide per capita
log(CO2DEN)	Logarithm of emissions of carbon dioxide per square kilometer
log(100 – DRNK)	Logarithm of the difference between maximum of the people using drinking water and the people using drinking water
log(100 – SNTN)	Logarithm of the difference between maximum of the people using improved sanitation facilities water and the people using improved sanitation facilities

Definition of the Social Harmony Index

Определение индекса социальной гармонии

I computed the Social Harmony Index as principal component 1 of the four indicators of the social harmony given in this yearbook:

log(MRDR)	Logarithm of murder rate
log(SUIC)	Logarithm of suicide rate
log(FERTIL)	Logarithm of fertility rate
log(PARFEM)	Logarithm of female participation rate

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Definition of the Economico-Political-Environmental Quality-of-Life and Social Harmony Index

Определение индекса экономико-политического качества жизни с учетом окружающей среды и индикаторов социальной гармонии

I computed the Economico-Political-Environmental Quality-of-Life and Social Harmony Index as principal component 1 of the 23 economic, political, and environmental indicators of the quality of life and indicators of social harmony given in this yearbook:

log(GPC)	Logarithm of GDP per capita at market exchange rates
log(GPCPPP)	Logarithm of GDP per capita at purchasing power parities
log(ELCONS)	Logarithm of electricity consumption
log(INFMRT)	Logarithm of infant mortality
log(max(LIFEXP) – LIFEXP)	Logarithm of the difference between maximum of life expectancy and life expectancy of this country
SCINTX	The index of societal integration
FPX	The freedom of the press index
log(100 – CPRX)	Logarithm of the difference between maximum of the civil and political rights index and the civil and political rights index of this country
HDX	The human development index
GIN1	Gini coefficient of income inequality before taxes and transfers
GIN2	Gini coefficient of income inequality after taxes and transfers
GINWLTH	Gini coefficient of wealth inequality
log(POPDEN)	Logarithm of population density
FRST	Forest cover
log(WATR)	Logarithm of freshwater per capita
log(CO2PC)	Logarithm of emissions of carbon dioxide per capita
log(CO2DEN)	Logarithm of emissions of carbon dioxide per square kilometer
log(100 – DRNK)	Logarithm of the difference between maximum of the people using drinking water and the people using drinking water
log(100 – SNTN)	Logarithm of the difference between maximum of the people using improved sanitation facilities water and the people using improved sanitation facilities

log(MRDR)	Logarithm of murder rate
log(SUIC)	Logarithm of suicide rate
log(FERTIL)	Logarithm of fertility rate
log(PARFEM)	Logarithm of female participation rate

Definition of Gross Domestic Product at Market Exchange Rates

Определение Валового Внутреннего Продукта по рыночным обменным курсам

The Gross Domestic Product is the most frequently used indicator of national productivity. It represents the total value of products and services produced by the given country.

The GDP, which is recorded in terms of the national currency, has to be translated into a single currency to enable international comparison. GDP per capita at market exchange rates provides GDP data translated into U.S. dollars on the basis of the market exchange rate. In addition to the actual ratios among the buying powers of different currencies, the market rate is based on a number of other factors. From the point of view of actual buying power, the market typically overestimates the discrepancies in the income earned in different countries. (See also, GDP at purchasing power parities.)

In cases where values were missing, the following regression was used:

log(GPC) = REG(log(GPCPPP))

where

log(GPC)	Logarithm of GDP per capita at market exchange rates
log(GPCPPP)	Logarithm of GDP per capita at purchasing power parities
Number of observations	480
Correlation coefficient	0.9647

Definition of Electricity Consumption

Определение потребления электроэнергии

The indicator of electricity consumption is computed from the number of kW-hours per capita. In cases where values were missing, the following regression was used:

log(ELCONS) = REG(log(GPC))

where

log(ELCONS)	Logarithm of electricity consumption
log(GPC)	Logarithm of GDP per capita at market exchange rates
Number of observations	487
Correlation coefficient	0.8860

Definition of Infant Mortality

Определение младенческой смертности

The indicator of infant mortality is computed from the number of deaths during the first year of life per thousand live births. This is one of the most important indicators used, since it indirectly measures the state of health care, transportation, communications, and level of culture of the given country (this list can be extended indefinitely).

In cases where values were missing, the following regression was used:

log(INFMRT) = REG(log(GPC), log(ELCONS))

where

log(INFMRT)	Logarithm of infant mortality
log(GPC)	Logarithm of GDP per capita at market exchange rates
log(ELCONS)	Logarithm of consumption of electricity per capita
Number of observations	472
Correlation coefficient	0.8365

In Svalbard and Holy See no actual infant mortality is observed because there are no child births. Infant mortality figures for these two countries are probabilities of infant mortality if there were child births.

Definition of Life Expectancy

Определение ожидаемой продолжительности жизни

Life expectancy is probably the most accurate single indicator of quality of life. It sums up in one number all the natural and social stresses that affect an individual.

In cases where the data are taken from the Encyclopedia Britannica, I used the arithmetic mean

of the life expectancies of men and women as the indicator of overall life expectancy.

In cases where values were missing, the following regression was used:

log(max(LIFEXP) – LIFEXP) = REG(log(GPC), log(INFMRT))

where

log(max(LIFEXP) – LIFEXP)	Logarithm of the difference between maximum life expectancy and life expectancy of this country
log(GPC)	Logarithm of GDP per capita at market exchange rates
log(INFMRT)	Logarithm of infant mortality
Number of observations	478
Correlation coefficient	0.8817

Definition of Gross Domestic Product at Purchasing Power Parities

Определение Валового Внутреннего Продукта по паритетам покупательной способности

Typically, the GDP is translated into U.S. dollars. The market foreign currency exchange rate, however, does not necessarily reflect differences in actual purchasing power in different countries. The use of purchasing power parities is designed to eliminate this distortion. Purchasing power parities indicate how many currency units are needed in one country to buy the amount of goods and services that can be purchased for a currency unit in another country.

In cases where values were missing, the following regression was used:

log(GPCPPP) = REG(log(GPC), log(ELCONS), log(INFMRT), log(max(LIFEXP) – LIFEXP))

where

log(GPCPPP)	Logarithm of GDP per capita at purchasing power parities
log(GPC)	Logarithm of GDP per capita at market exchange rates
log(ELCONS)	Logarithm of consumption of electricity per capita
log(INFMRT)	Logarithm of infant mortality
log(max(LIFEXP) – LIFEXP)	Logarithm of the difference between maximum life expectancy and life expectancy of this country

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Number of observations	481
Correlation coefficient	0.9765

Definition of the Societal Integration Index

Определение индекса социетальной интеграции

The index of societal integration is an indicator of the intensity of open political life. It is computed as a coefficient of the heterogeneity of a parliament (legislature) of a country, under the condition that party seats in the parliament (legislature) are obtained as a result of competitive elections. This indicator can have values between zero and one; 0 means that all seats in the parliament (legislature) belong to one party or that there are no competitive elections; it approaches 1 if every person in the parliament (legislature) is his own party.

The concept of integration was introduced by Emile Durkheim in his work *Suicide*[5]. Durkheim interpreted integration as a function of the intensity of social communication. I interpreted this concept at the societal level, defining societal integration as the intensity of non-trivial exchanges of information at the highest level of society. I provide a purely structural definition of exchange of information, defining it as a number between 0 and 1, equal to the probability of interparty (i. e., political party) dialogue in society. As a measure of interparty exchange of information, I took the probability of interparty communication in parliament (the legislature):

$$SCINTX = \sum_{i=1}^{X} P_i \left(1 - P_i\right)$$

where P(i) is the proportion of members of party number (i) in parliament (the legislature), and X is the total number of political parties in parliament (the legislature).

The societal integration index defined by this formula has some interesting qualities. The maximum of the societal integration index in a given parliament (legislature) is (n-1)/n, where n is the number of parties in the parliament (legislature) (0 for one party, ½ for two parties, ⅔ for three parties, and so on). This maximum is achieved if each of the parties in the parliament (legislature) has equal number of seats. But if one party dominates the parliament (legislature), the societal integration index approaches zero, no matter how many parties are in the parliament (legislature).

The societal integration index is not intended to measure any particular parliamentary process, but rather something sociologically more essential - characteristics of political life as it is reflected in the parliament. Thus, societal integration index equal 0 is characteristic of an autocracy or a totalitarian state, while societal integration index from about 0.4 and higher would be characteristic of a society with developed political life (the latter is typically characteristic of a democracy). In this, it is not the any "process" which we measuring, but rather a fundamental nature of political life.

Though societal integration index is very important for determining the political nature of a given society, it should not be taken for some magic “democracy indicator”. It is just an important component for measuring the degree of democracy in a society. For example, it is used in computation of the civil and political rights index as a measure of one of its aspects. The introduction of this indicator

[5] Sociology: Durkheim (1993).

into the formula for computing the human rights index is based on the concept that the condition of political institutions (and the degree to which they can be called democratic) is closely related to human rights.

Data about the distribution of seats among parties for computation of the societal integration index is taken from an open CIA publication and the Internet. This indicator can be considered objective because no ruling party would give seats in the parliament (legislature) to the opposition willingly.

In cases where values were missing, the following regression was used:

SOCINTX = REG(log(GPC), log(GPCPPP), log(INFMRT), FPX, SI)

where

log(GPC)	Logarithm of GDP per capita at market exchange rates
log(GPCPPP)	Logarithm of GDP per capita at purchasing power parities
log(INFMRT)	Logarithm of infant mortality
log(max(LIFEXP) – LIFEXP)	Logarithm of the difference between maximum life expectancy and life expectancy of this country
FPX	Freedom of the press index
SI	Political pluralism and participation index of the Freedom House
Number of observations	392
Correlation coefficient	0.6235

Definition of the Freedom of the Press Index

Определение индекса свободы печати

The Freedom of the Press Index is an annual ranking of countries compiled and published by Reporters Without Borders based upon the organization's assessment of the countries' press freedom records in the previous year. It reflects the degree of freedom that journalists, news organizations, and citizens enjoy in each country, and the efforts made by the authorities to respect and ensure respect for this freedom.

There were no missing values, but we calculated the following regression:

FPX = REG(log(GPC), log(GPCPPP), log(ELCONS), log(max(LIFEXP) - LIFEXP), log(100 – CPRX), SCINTX, GINWLTH)

where

FPX	The freedom of the press index

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log(GPC)	Logarithm of GDP per capita at market exchange rates
log(GPCPPP)	Logarithm of GDP per capita at purchasing power parities
log(ELCONS)	Logarithm of consumption of electricity per capita
log(max(LIFEXP) - LIFEXP)	Logarithm of the difference between maximum life expectancy and life expectancy of this country
log(100 – CPRX)	Logarithm of the difference between maximum of the civil and political rights index and the civil and political rights index of this country
SCINTX	The societal integration index
GINWLTH	Gini coefficient of wealth inequality
Number of observations	485
Correlation coefficient	0.8744

Definition of the Civil and Political Rights Index

Определение индекса гражданских и политических свобод

Any index of civil and political rights is subjective. As such I have used the methodology of Charles Humana[6] in calculating this human rights index. The human rights index is a number between 0 and 100, where 0 means no human rights and 100 means complete human rights.

In calculating this index I have used the questionnaire of 40 indicators suggested by Humana plus the 41st indicator, Gay rights. These indicators are not selected through arbitrary choice; each is drawn from articles of the three major UN human rights instruments. The first of these instruments is the Universal Declaration of Human Rights (UDHR), which was adopted in 1948 without a dissenting vote and, although not considered to be binding at the time, it has now become part of customary international law. To reinforce it, however, two major covenants setting out more specifically certain categories of human rights were adopted in 1966 and came into force after they were ratified by 35 countries in 1976. They are the International Covenant on Civil and Political rights (ICCPR) and the International Covenant on Economic, Social and Cultural Rights (ICESCR). I have added a special 41st indicator, Gay rights, to reflect the prominence this particular right has acquired recently.

The assembled material for each indicator is graded into four categories or levels.

LEVEL	EXPLANATION
3	Represents the category of unqualified respect for the freedoms, rights, or guarantees.
2	Qualifies otherwise satisfactory situation on the grounds of occasional breaches of respect for the

[6] Law: Humana (1992).

	freedoms, rights or guarantees.
1	Indicates frequent violations of the freedoms, rights, or guarantees.
0	Indicates a constant pattern of violations of the freedoms, rights, or guarantees.

Treating all questions equally on the basis of the above ratings has, however, the obvious disadvantage of leveling all 41 of the human rights to a uniform degree of importance. A system of weighting has therefore been adopted for questions 7 through 13. They are weighted by a factor of 3.0. Here is the list of all 41 indicators.

FREEDOM NUMBER	FREEDOM TO
1	Travel in own country
2	Travel outside own country
3	Peacefully associate and assemble
4	Teach ideas and receive information
5	Monitor human rights violations
6	Publish and educate in ethnic language
FREEDOM NUMBER	FREEDOM FROM
7	Serfdom, slavery, forced or child labor
8	Extrajudicial killings or “disappearances”
9	Torture or coercion by the state
10	Compulsory work permits or conscription of labor
11	Capital punishment by the state
12	Court sentences of corporal punishment
13	Indefinite detention without charge
14	Compulsory membership of state organizations or parties
15	Compulsory religion or state ideology in schools
16	Deliberate state policies to control artistic works
17	Political censorship of press
18	Censorship of press or telephone tapping
FREEDOM NUMBER	FREEDOM FOR OR RIGHTS TO
19	Peaceful political opposition
20	Multiparty elections by secret and universal ballot
21	Political or legal equality for women
22	Social and economic equality for women
23	Social and economic equality for ethnic minorities
24	Independent newspapers
25	Independent book publishing
26	Independent radio and television networks
27	All courts to total independence
28	Independent trade unions

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FREEDOM NUMBER	LEGAL RIGHTS
29	From deprivation of nationality
30	To be considered innocent until proven guilty
31	To free legal aid when necessary and counsel of own choice
32	From civilian trials in secret
33	To be brought promptly before a judge or court
34	From police searches of home without a warrant
35	From arbitrary seizure of personal property
FREEDOM NUMBER	PERSONAL RIGHTS
36	To interracial, interreligious, or civil marriage
37	Equality of sexes during marriage and for divorce proceedings
38	To practice any religion
39	To use contraceptive pills and devices
40	To noninterference by state in strictly private affairs
41	Gay rights

To evaluate changes in the human rights index between 1991 (when Humana last made his estimates) and the current year, I used information by countries taken from the annual publication of the Freedom House based in New York. Freedom House gives scores between 1 (perfect score) and 7 (worst score) for political and civil rights for all countries every year. Since 2014 the Freedom House also publishes detailed scores for political rights between 0 (worst score) and 40 (perfect score) and civil rights between 0 (worst score) and 60 (perfect score).

For the United States and Russia, the author has made direct estimates of the answers to all 41 questions, based on his familiarity with life in both countries. These direct estimates are as follows:

FREEDOM NUMBER	United States	Russia
01	3	2
02	3	3
03	3	2
04	2	2
05	3	2
06	3	2
07	3	2
08	2	1
09	2	1
10	3	2
11	1	3
12	3	3
13	1	2
14	3	3
15	3	2
16	3	3
17	3	2

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FREEDOM NUMBER	United States	Russia
18	2	1
19	3	2
20	3	3
21	2	2
22	2	2
23	2	2
24	3	2
25	3	3
26	3	1
27	3	1
28	3	2
29	3	3
30	3	2
31	2	2
32	3	2
33	3	1
34	3	1
35	3	3
36	3	3
37	3	3
38	3	2
39	3	3
40	2	2
41	3	1

Also, special care was applied to estimates for Iceland, Iran, United Kingdom, non-Russian republics of the former Soviet Union, Iran, and Turkey.

Iceland is reputed to have the best human rights record among all Scandinavian countries, so its answers to the Humana human rights questions were made a proxy of maximum of its former parent state, Denmark, and of Finland, the Scandinavian country with the highest Humana human rights index. That is, Iceland's human rights indicators were copied from the maximum of the direct estimates for Denmark and Finland. Similarly, Iceland's score for freedom number 22 (concerned with social and economic equality for women) was estimated at the highest score, 3.

I considered Humana's direct estimate for Iran, putting it on the same level as North Korea, as too low; based on the information I have, the human rights situation in Iran is no worse than that of Saudi Arabia. Thus, for all human rights indicators I made Iran's human rights indicators for the 40 Humana indexes equal to the maximum of Iran and Saudi Arabia.

For all countries, Humana indexes for year 1991 are prorated to the estimates for the current year using scores for Civil Rights and Political Rights from Freedom house. The formulas used in prorating are:

For Civil Rights Indicators,

IF $CRFH_{CurrentYear} > CRFH_{1991}$

THEN

$CRINDICATOR_{CurrentYear} = CRINDICATOR_{1991} - ((CRFH_{CurrentYear} - CRFH_{1991}) / (Max(CRFH) - CRFH_{1991})) * (CRINDICATOR_{1991} - Min(CRINDICATOR))$;

ELSE

IF $CRFH_{CurrentYear} < CRFH_{1991}$

THEN

$CRINDICATOR_{CurrentYear} = CRINDICATOR_{1991} + ((CRFH_{1991} - CRFH_{CurrentYear}) / (CRFH_{1991} - Min(CRFH))) * (Max(CRINDICATOR) - CRINDICATOR_{1991})$;

Where

CRFH is Civil Rights Index of Freedom House,
CRINDICATOR is a particular Civil Rights Indicator question,
Max(CRFH) is maximum Civil Rights Index value, 7.0,
Min(CRFH) is minimum Civil Rights Index value, 1.0,
Max(CRINDICATOR) is maximum Civil Rights Indicator value, which is 3 * (minimum of Human Rights Index having the best Civil Rights Index) / 100 (equal to 2.52),
Min(CRINDICATOR) is minimum Civil Rights Indicator value, which is 3 * (maximum of Human Rights Index having the worst Civil Rights Index) / 100 (equal to 0.90).

A similar procedure is used for prorating the Political Rights Indicators:

IF $PRFH_{CurrentYear} > PRFH_{1991}$

THEN

$PRINDICATOR_{CurrentYear} = PRINDICATOR_{1991} - ((PRFH_{CurrentYear} - PRFH_{1991}) / (Max(PRFH) - PRFH_{1991})) * (PRINDICATOR_{1991} - Min(PRINDICATOR))$;

ELSE

IF $PRFH_{CurrentYear} < PRFH_{1991}$

THEN

$PRINDICATOR_{CurrentYear} = PRINDICATOR_{1991} + ((PRFH_{1991} - PRFH_{CurrentYear}) / (PRFH_{1991} - Min(PRFH))) * (Max(PRINDICATOR) - PRINDICATOR_{1991})$;

Where

PRFH is Political Rights Index of Freedom House,
PRINDICATOR is a particular Political Rights Indicator question,
Max(PRFH) is maximum Political Rights Index value, 7.0,
Min(PRFH) is minimum Political Rights Index value, 1.0,
Max(PRINDICATOR) is maximum Political Rights Indicator value, which is 3 * (minimum of Human Rights Index having the best Political Rights Index) / 100 (equal to 2.52),
Min(PRINDICATOR) is minimum Political Rights Indicator value, which is 3 * (maximum of Human Rights Index having the worst Political Rights Index) / 100 (equal to 0.90).

Freedoms numbered 1, 2, 7, 10, 22, 23, 36, 37, 38, 39, and 40 are considered Civil Rights Indicators; the other indicators are considered Political.

For all countries except the United Kingdom, the 1991 Freedom House estimate was used as a base for prorating. Freedom House gave the United Kingdom scores of 1.0 for political freedoms and

2.0 for civil rights in 1991. This is inconsistent with the scores of other major democratic countries in 1991. For example, the United States was given a score of 1.0 for both political and civil rights, with the Humana index of human rights at 90; France scored 1.0 and 1.0, likewise, with a Humana index of 94. The Humana index of human rights for the United Kingdom was set relatively high, at 93, in 1991. Freedom House changed its scores for the United Kingdom to 1.0 and 1.0 in later years. All this raises questions about the correctness of the Freedom House scores for political and civil rights for the United Kingdom in 1991, so that eventually I decided to adjust the scores for this country used as a base for the prorating to 1.0 and 1.0. This is especially important because the United Kingdom is used as a proxy for a number of countries.

For the non-Russian republics of the former Soviet Union, I used the above direct estimate of Russian human rights profile as the basis for calculation. The Russia's human rights profile is in fact the slightly modified Humana's human rights profile for the U.S.S.R. for 1991. It was used in combination with the Freedom House scores for political and civil rights for 1991 and the current year as a base for the proration. Sometimes this meant the human rights situation improved in comparison to the Soviet Union/Russia in 1991 and sometimes it meant it did not. We have noticed, however, that when we prorate human rights profiles according to the dynamics of the Freedom House scores of political and civil rights, we arrive to absurdly low human rights indexes for some of the former Soviet republics for the current year. That would indicate that the original Humana human rights profile (and the human rights index corresponding to it) for Russia (and the U.S.S.R.) for 1991 is considerably underestimated. We lacked the necessary information to reevaluate Humana's human rights profile for 1991. We have noticed, however, that the former Yugoslavia and the former U.S.S.R. had similar Humana human rights index in 1991 — Yugoslavia had 55 and U.S.S.R had 54. But Freedom House political and civil rights scores for Yugoslavia were 6 and 5, while for the U.S.S.R. 3 and 3. So, to avoid distortions in proration of Humana human rights profiles (and corresponding human rights indexes) we decided to take Yugoslavia's scores of 6 and 5 as the base for proration of the former Soviet republics according the Freedom House scores.

The Freedom House score for political and civil rights in Russia is 7 and 6 for the current year, which is the same score as China has. I do not believe it — the situation with political rights in Russia is vastly different from the totalitarian regime in China. By comparison, Kuwait (where I have spent a lot of time), which is a typical oriental despotia without any signs of open political life whatsoever, got the scores 5 and 5, and that is plainly ridiculous. My sense is that the Freedom House bases its scores to large degree based on self-reporting and that the particular low scores of Russia are caused by historically typical severe self-criticism of Russian intelligentsia, which makes those scores incompatible with the scores of other countries. I estimate Russia's score as a minimum 5 and 5. The detailed scores, which the Freedom House gave to Russia in 2017, were 5 out of 40 for political rights and 15 out of 60 for civil rights. I estimate the detailed political rights score at the top of the overall score of 5 for political rights as 17 and the detailed score of civil rights at the top of the overall score of 5 for civil rights as 25.

I also do not think that the current human rights situation in Iran is worse than in 1991, so I adjusted the base Freedom House scores for political and civil rights in 1991 in line with that.

For freedom number 11 (Capital punishment by the state), for countries currently not practicing capital punishment direct estimates were made using information from http://en.wikipedia.org/wiki/Capital_punishment. Such countries had their freedom number 11 updated to the highest score, 3.

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For freedom number 20 (Multiparty elections), direct estimates for all countries are made according to the following formula:

$PRINDICATOR_{20} = 6 * SCINTX;$

where SCINTX is a defined previously Societal Integration Index. This formula uses the fact that a minimally democratic multiparty system is a two-party system and that with two parties in a parliament, the maximum SCINTX is achieved when neither party dominates in the parliament (both parties have 50 percent of the seats in the parliament). In this situation, SCINTX = 0.5. That corresponds to the highest score of 3. In a two-party system, when the number of seats in a parliament is distributed less evenly between the two parties, SCINTX would be less than 0.5. In the extreme case when one party gets 100 percent of seats in the parliament, SCINTX = 0. If there are more than two parties in a parliament, SCINTX can be greater than 0.5 (which would seemingly correspond to a value for freedom number 20 that is greater than 3). Hypothetically, it is possible to say:

IF $PRINDICATOR_{20} > 3$
THEN
$PRINDICATOR_{20} = 3;$

Then we would be very close to the Humana definition of Freedom number 20. Humana does not make a distinction between a well-functioning two-party system and a system with more than two parties. However, people who have to cast their vote within the constraints of a two-party system often feel trapped. If we measure enhanced choice, which voters have in a system with more than two parties, it seems we would be more true to the nature of Freedom number 20. So I decided to allow SCINTX to have values between 0.5 and 1.0 in political systems of more than two parties. With this, the potential weight of Freedom number 20 also increases as it can have values between 0 and 6 as opposed to the regular interval of 0 to 3. But that also may make sense, because the freedom of choice while voting is a very important ingredient of a free society.

Freedom numbers 17 (Political censorship of press), 24 (Independent newspapers), 25 (Independent book publishing), and 26 (Independent radio and television networks) are all estimated as:

$PRINDICATOR_{17} = 3 * (100 – FPX) / 100;$
$PRINDICATOR_{24} = 3 * (100 – FPX) / 100;$
$PRINDICATOR_{25} = 3 * (100 – FPX) / 100;$
$PRINDICATOR_{26} = 3 * (100 – FPX) / 100;$

where FPX is the freedom of the press index from Reporters Without Borders, which can have values between 0 and 100, 0 meaning complete respect for the freedom of press and 100 meaning no respect for the freedom of press.

Thus, freedoms number 17, 24, 25, and 26 will have scores close to 3 if freedom of the press is highly respected and close to 0 if it is not respected.

For freedom number 41 (Gay rights), direct estimates for all countries are made using information from http://en.wikipedia.org/wiki/LGBT_rights_by_country_or_territory.

Naturally, the estimates for freedoms number 17, 20, 24, 25, 26, and 41 are not prorated.

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The final civil and political rights index for a given country is calculated as an average between thus calculated index and an overall detailed score of the Freedom House. The overall detailed score is obtained as a sum of detailed scores of the Freedom House for political rights and civil rights.

There were no missing values, but we calculated the following regression:

log(100 – CPRX) = REG(log(GPC), log(GPCPPP), FPX, SCINTX, HDX, GIN2)

where

log(100 – CPRX)	Logarithm of the difference between maximum of the civil and political rights index and the civil and political rights index of this country
log(GPC)	Logarithm of GDP per capita at market exchange rates
log(GPCPPP)	Logarithm of GDP per capita at purchasing power parities
log(max(LIFEXP) - LIFEXP)	Logarithm of the difference between maximum life expectancy and life expectancy of this country
FPX	Freedom of the press index
SCINTX	The societal integration index
HDX	Human development index
GIN2	Gini coefficient of income inequality after taxes and transfers
Number of observations	485
Correlation coefficient	0.9208

Definition of the Human Development Index

Определение индекса развития человека

The human development index is an objective indicator. It is the average of the level of income per capita in purchasing power parities, level of education, and level of health care. It is computed annually by a well-respected UN program. The introduction of this indicator into the formula for computing the human rights index is based on the idea that socio-economic rights are part of human rights. Some right-wing lawyers in the U.S. consider socio-economic rights a bad concept for a well-developed law-abiding state, because it is allegedly difficult to conduct judicial processes if socio-economic rights are recognized as full-blown rights. Even if we agree that there is some truth in this assertion and that there are difficulties for a strict judicial process that would take socio-economic rights as real rights, nevertheless, outside the U.S. socio-economic rights are commonly recognized as a lawful component of human rights. This can be seen, for example, from the Universal Declaration of Human Rights adopted by the UN in 1948.

In cases where values were missing, the following regression was used:

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HDX = REG(log(GPC), log(GPCPPP), log(ELCONS), log(INFMRT), log(max(LIFEXP) - LIFEXP), log(100 – CPRX))

where

HDX	The human development index
log(GPC)	Logarithm of GDP per capita at market exchange rates
log(GPCPPP)	Logarithm of GDP per capita at purchasing power parities
log(ELCONS)	Logarithm of consumption of electricity per capita
log(INFMRT)	Logarithm of infant mortality
log(max(LIFEXP) - LIFEXP)	Logarithm of the difference between maximum life expectancy and life expectancy of this country
log(100 – CPRX)	Logarithm of the difference between maximum of the civil and political rights index and the civil and political rights index of this country
Number of observations	480
Correlation coefficient	0.9637

Definition of Gini Coefficients of Inequality

Определение Гини коэффициентов неравенства

The fifth component of the human rights index is the Gini coefficients of inequality: of income inequality before taxes and transfers, of income inequality after taxes and transfers, and of wealth inequality. Gini indicator is computed as an integral representing the distance between equal distribution and the observed distribution of income in a given country. Its values range between 0 and 100; 0 signifies that the observed distribution of income or wealth is equal, and 100 signifies that all income or wealth of the country belongs to one person. The idea of including the Gini coefficient is based on an observation that formal judicial rights are only a potential that can be realized in a specific social context, and that the greater the inequality, the more difficult it is for an average person of a given society to insist on his or her formal judicial rights. Thus, in countries with developed market economies, the price of good lawyers is dictated by the material means available at the top of the society. For example, in the social context of the U.S., an average person often simply cannot afford a good lawyer. Because of this it is possible to say that in order to realize his formally proclaimed judicial rights, a person should possess a certain material potential. The less inequality there is in a country, the more likely it is that formal judicial rights are realized.

With the introduction of three Gini coefficients of inequality of income or wealth, we computed a canonical correlation between these Gini coefficients and other variables. The results are as follows:

Number of observations	486
Canonical correlation coefficient	0.602802
Canonical correlation coefficient weighted by population	0.778897

Definition of Forest Area

Определение территории лесов

Forest area is measured as percent of the territory of a country.
There were no missing values, but we calculated the following regression:

FRST = REG(log(POPDEN), log(WATR), log(100 – DRNK), log(100 – SNTN), log(INFMRT), SCINTX, FPX)

where

FRST	Forest cover
log(POPDEN)	Logarithm of population density
log(WATR)	Logarithm of freshwater per capita
log(100 – DRNK)	Logarithm of the difference between maximum of the percent of population having access to basic drinking water services and the percent of population having access to basic drinking services
log(100 – SNTN)	Logarithm of the difference between maximum of the percent of population having access to basic sanitation and the percent of population having access to basic sanitation
log(INFMRT)	Logarithm of infant mortality
SCINTX	The societal integration index
FPX	Freedom of the press index
Number of observations	485
Correlation coefficient	0.6124

Definition of Freshwater Per Capita

Определение пресной воды на душу населения

It is defined as renewable internal freshwater resources per capita, in cubic meters.
There were no missing values, but we calculated the following regression:

log(WATR) = REG(FRST, log(100 – CPRX), log(POPDEN), GIN1, GIN2, SCINTX)

where

log(WATR)	Logarithm of freshwater per capita
FRST	Forest cover
log(100 – CPRX)	Logarithm of the difference between maximum of the civil and political rights index and the civil and political rights index of this country
log(POPDEN)	Logarithm of population density
GIN1	Gini coefficient of income inequality before taxes and transfers
GIN2	Gini coefficient of income inequality after taxes and transfers
SCINTX	The societal integration index
Number of observations	485
Correlation coefficient	0.8126

Definition of Emissions of Carbon Dioxide Per Capita

Определение выбросов углекислого газа на душу населения

The emissions of carbon dioxide per capita are obtained by dividing of the total of the emissions of carbon dioxide by the population.

Data about the total emissions of carbon dioxide for the vast majority of countries are taken from WB.

In cases where data about the emissions of carbon dioxide per capita were missing, they were obtained by proxies.

There were no missing values, but we calculated the following regression:

log(CO2PC) = REG(log(max(LIFEXP) – LIFEXP), log(100 – CPRX), GIN1, log(GPCPPP), log(ELCONS), log(INFMRT), SCINTX, FPX, HDX)

where

log(CO2PC)	Logarithm of carbon dioxide emissions per capita
log(max(LIFEXP) – LIFEXP)	Logarithm of the difference between maximum life expectancy and life expectancy of this country
log(100 – CPRX)	Logarithm of the difference between maximum of

	the civil and political rights index and the civil and political rights index of this country
GIN1	Gini coefficient of income inequality before taxes and transfers
log(GPCPPP)	Logarithm of GDP per capita at purchasing power parities
log(ELCONS)	Logarithm of consumption of electricity per capita
log(INFMRT)	Logarithm of infant mortality
SCINTX	The societal integration index
FPX	Freedom of the press index
HDX	Human development index
Number of observations	485
Correlation coefficient	0.9212

Definition of Emissions of Carbon Dioxide Per Square Kilometer

Определение выбросов углекислого газа и на квадратный километр

The emissions of carbon dioxide per square kilometer are obtained by dividing of the total emission of carbon dioxide by the area.

Data about the total emissions of carbon dioxide for the vast majority of countries are taken from WB.

In cases where data about the emissions of carbon dioxide per capita were missing, they were obtained by proxies.

In cases where data about the emissions of carbon dioxide per square kilometer were missing, they were obtained by multiplying data about the emissions of carbon dioxide per capita by population density.

There were no missing values, but we calculated the following regression:

log(CO2DEN) = REG(log(max(LIFEXP) – LIFEXP), log(POPDEN), GIN1, log(GPCPPP), log(ELCONS), SCINTX, HDX)

where

log(CO2DEN)	Logarithm of carbon dioxide emissions per sq km
log(max(LIFEXP) – LIFEXP)	Logarithm of the difference between maximum life expectancy and life expectancy of this country
log(POPDEN)	Logarithm of population density
GIN1	Gini coefficient of income inequality before taxes and transfers
log(GPCPPP)	Logarithm of GDP per capita at purchasing power

	parities
log(ELCONS)	Logarithm of consumption of electricity per capita
SCINTX	The societal integration index
HDX	Human development index
Number of observations	485
Correlation coefficient	0.9571

Definition of People Using Drinking Water

Определение использования питьевой воды

It is defined as a percent of total population using at least basic drinking water services.
When the sources give the number 100, we assume it to be 99.999.
There were no missing values, but we calculated the following regression:

log(100 – DRNK) = REG(FRST, log(GPC), log(max(LIFEXP) – LIFEXP), log(100 – CPRX), SCINTX, FPX)

where

log(100 – DRNK)	Logarithm of the difference between maximum percent of people using basic drinking water services and percent of people using basic drinking water services
FRST	Forest cover
log(GPC)	Logarithm of GDP per capita at market exchange rates
log(max(LIFEXP) – LIFEXP)	Logarithm of the difference between maximum life expectancy and life expectancy of this country
log(100 – CPRX)	Logarithm of the difference between maximum of the civil and political rights index and the civil and political rights index of this country
SCINTX	The societal integration index
FPX	Freedom of the press index
Number of observations	485
Correlation coefficient	0.7964

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Definition of People Using Improved Sanitation Facilities

Определение использования улучшенных туалетов

Access to improved sanitation facilities refers to the percentage of the population using improved sanitation facilities. Improved sanitation facilities are likely to ensure hygienic separation of human excreta from human contact. They include flush/pour flush (to piped sewer system, septic tank, pit latrine), ventilated improved pit (VIP) latrine, pit latrine with slab, and composting toilet.

When the sources give the number 100, we assume it to be 99.99.

There were no missing values, but we calculated the following regression:

log(100 – SNTN) = REG(log(100 – DRNK), log(CO2PC), FRST, log(max(LIFEXP) – LIFEXP), GIN2, GINWLTH, log(INFRMT))

where

log(100 – SNTN)	Logarithm of the difference between maximum percent of people using basic sanitation facilities and percent of people using basic sanitation facilities
log(100 – DRNK)	Logarithm of the difference between maximum percent of people using basic drinking water services and percent of people using basic drinking water services
log(CO2PC)	Logarithm of carbon dioxide emissions per capita
FRST	Forest cover
log(max(LIFEXP) – LIFEXP)	Logarithm of the difference between maximum life expectancy and life expectancy of this country
GIN2	Gini coefficient of income inequality after taxes and transfers
GINWLTH	Gini coefficient of wealth inequality
log(INFMRT)	Logarithm of infant mortality
Number of observations	485
Correlation coefficient	0.8307

Definition of Area, Population, and Population Density

Определение территории, населения и плотности населения

We provide the area and population for all countries and dependencies in the world as of the boundaries of de-facto control.

By population we mean the de-facto definition, which counts all residents of a country regardless

of legal status or citizenship — except for refugees not permanently settled in the country of asylum, who are generally considered part of the population of their country of origin. The values shown are midyear estimates.[7]

The area and population numbers of countries are shown with two numbers: total country and (where applicable) country without autonomous and separatist regions.

The prime source for the data about area is CIA; where this was unavailable, I used data from Wikipedia; in rare cases I used my own calculations.

The prime source for population data was the World Bank. Where the World Bank population data is not available, I used the EUROSTAT, CIA, DBEARTH, and WIKI as the main sources.

In cases when I had to compute GDP per capita (at market exchange rates or purchasing power parities) and electricity consumption per capita from the total numbers of GDP and electricity consumption from the CIA World Factbook, I used population figures for the corresponding years also from the World Factbook.

The population density is obtained by dividing numbers for population by area.

There were no missing values, but we calculated the following regression:

log(POPDEN) = REG(log(CO2DEN), FRST, log(WATR), log(CO2PC), log(100 – CPRX), GIN1, HDX)

where

log(POPDEN)	Logarithm of population density
log(CO2DEN)	Logarithm of carbon dioxide emissions per sq km
FRST	Forest cover
log(WATR)	Logarithm of freshwater per capita
log(CO2PC)	Logarithm of carbon dioxide emissions per capita
log(100 – CPRX)	Logarithm of the difference between maximum of the civil and political rights index and the civil and political rights index of this country
GIN1	Gini coefficient of income inequality before taxes and transfers
HDX	Human development index
Number of observations	485
Correlation coefficient	0.9937

Definition of the Murder Rate

Определение коэффициента убийств

[7] Economics: The World Bank (1).

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When there were missing values, but we calculated the following regression:

log(MRDR) = REG(log(CO2PC), log(WATR), log(max(LIFEXP) – LIFEXP), log(100 – CPRX), GIN2, GINWLTH, log(ELCONS), SCINTX)

where

log(MRDR)	Logarithm of the murder rate
log(CO2PC)	Logarithm of carbon dioxide emissions per capita
log(WATR)	Logarithm of freshwater per capita
log(max(LIFEXP) – LIFEXP)	Logarithm of the difference between maximum life expectancy and life expectancy of this country
log(100 – CPRX)	Logarithm of the difference between maximum of the civil and political rights index and the civil and political rights index of this country
GIN2	Gini coefficient of income inequality after taxes and transfers
GINWLTH	Gini coefficient of wealth inequality
log(ELCONS)	Logarithm of consumption of electricity per capita
SCINTX	The societal integration index
Number of observations	367
Correlation coefficient	0.7015

Definition of the Fertility Rate

Определение коэффициента фертильности

There were no missing values, but we calculated the following regression:

log(FERTIL) = REG(log(POPDEN), log(WATR), log(100 – SNTN), log(GPC), GIN1, GIN2, log(GPCPPP), log(ELCONS), log(INFMRT), HDX)

where

log(FERTIL)	Logarithm of the fertility rate
log(POPDEN)	Logarithm of population density
log(WATR)	Logarithm of freshwater per capita
log(100 – SNTN)	Logarithm of the difference between maximum percent of people using basic sanitation facilities and percent of people using basic sanitation

	facilities
log(GPC)	Logarithm of GDP per capita at market exchange rates
GIN1	Gini coefficient of income inequality before taxes and transfers
GIN2	Gini coefficient of income inequality after taxes and transfers
log(GPCPPP)	Logarithm of GDP per capita at purchasing power parities
log(ELCONS)	Logarithm of consumption of electricity per capita
log(INFMRT)	Logarithm of infant mortality
HDX	Human development index
Number of observations	485
Correlation coefficient	0.8657

Definition of Female Participation Rate

Определение коэффициента участия женщин в экономике

There were no missing values, but we calculated the following regression:

log(PARFEM) = REG(log(GPC), log(max(LIFEXP) – LIFEXP), log(GPCPPP), HDX)

where

log(PARFEM)	Logarithm of female participation rate
log(GPC)	Logarithm of GDP per capita at market exchange rates
log(max(LIFEXP) – LIFEXP)	Logarithm of the difference between maximum life expectancy and life expectancy of this country
log(GPCPPP)	Logarithm of GDP per capita at purchasing power parities
HDX	Human development index
Number of observations	377
Correlation coefficient	0.3816

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Definition of the Suicide Rate

Определение Коэффициента самоубийств

Suicide is a public health issue, but also an indication of how unhappy people feel. To estimate suicide rate where the data is missing, we used a regression:

log(SUIC) = REG(log(PARFEM), log(POPDEN), SCINTX)

where

log(SUIC)	Logarithm of suicide rate
log(PARFEM)	Logarithm of female participation rate
log(POPDEN)	Logarithm of population density
SCINTX	The societal integration index
Number of observations	339
Correlation coefficient	0.3342

Definition of Armed Forces Personnel

Определение численности вооруженных сил

Armed forces personnel[8] are active duty military personnel, including paramilitary forces if the training, organization, equipment, and control suggest they may be used to support or replace regular military forces.[9]

Definition of Military Expenditures

Определение военных расходов

Military expenditures data are primarily based on World Bank data. They are taken from Stockholm International Peace Research Institute (SIPRI) and are derived from the NATO definition, which includes all current and capital expenditures on the armed forces, including peacekeeping forces; defense ministries and other government agencies engaged in defense projects; paramilitary forces, if these are judged to be trained and equipped for military operations; and military space activities. Such expenditures include military and civil personnel and social services for personnel; operation and maintenance; procurement; military aid (in the military expenditures of the donor country). Excluded are civil defense and current expenditures for previous military activities, such as veterans' benefits,

[8] Called "ARMY" in the table.
[9] Economics: The World Bank (1).

demobilization, conversion, and destruction of weapons.[10]

The exaggeration of Russian and Chinese military expenditures by the CIA and IISS deserves special commentary.

The contemporaneous estimates of the CIA and IISS of Russian and Chinese military expenditures diverge significantly from the historically adjusted World Bank estimates (based on SIPRI estimates).

In the beginning of the 1990s, after the collapse of the Soviet Union, when Russia had slashed its military budget to very meager numbers, the CIA and IISS overestimated Russian military expenditures on an order of 5 to 6 times. This exaggeration by reputable Anglo-American intelligence organizations had been so big and so persistent that it smacked of fulfilling the wishes of their political masters with the purpose of protecting Western military careers and budgets and sustaining lucrative military-industrial businesses.

The extreme exaggeration of Russian military expenditures had continued until 2001 in the case of the IISS, when it leveled off with the purchasing power parities estimated of the World Bank. In 2005, the IISS switched to market exchange rate estimates, which seems to be a welcome development because international comparisons of military expenditures are usually done in market exchange rates as better reflecting the comparative quality of armaments. But the numbers of the IISS now look like they have gone to the other extreme, underestimating Russian military expenditures in comparison with the World Bank numbers.

The estimates of Russian military expenditures by the CIA leveled off with the numbers of the World Bank at purchasing power parities in 2005. That is some semblance of sanity in comparison with the 1990s. But if we take into account that the international comparison tables should clearly use either market exchange rates or purchasing power parities, the problem of substantial overestimation of Russian military expenditures in the case of the CIA persists. Thus, by the virtue of continuing the use of purchasing power parities, while using market exchange rates for other countries, the CIA still overestimates Russian military expenditures by an order of 2.

As far as China is concerned, the IISS had made estimates of that country's military expenditures from the beginning of 1990s until 2006 generally in line with the purchasing power parities numbers of the Word Bank. After 2006, the IISS has switched to providing numbers for China at market exchange rates and, as with Russia, these numbers seem to underestimate Chinese military expenditures when compared the numbers of the World Bank at market exchange rates.

In the case of China, the CIA had outlandish overestimates of that country's military expenditures from the beginning of the 1990s until 1999. From 2000 to 2005, the CIA numbers had been generally in line with the numbers of the World Bank if calculated at purchasing power parities. This had at least some logic, though again had a built-in overestimate of an order of 2 relative to the more proper market exchange rate way of calculation. In 2006, the CIA gave a fantastically high percentage for Chinese military expenditures in GDP, which lead to the numbers of military expenditures at purchasing power parities exceeding the World Bank numbers even at purchasing power parities by an order of 2. In recent years the CIA in their estimates of the percent of Chinese military expenditures in GDP has moved somewhat closer to the more sound estimates of the World Bank, but the CIA estimates still exceed the more proper World Bank estimates at purchasing power parities by a considerable margin of 10-20 percent.

Here are some numbers to support these observations.

[10] Economics: The World Bank (1).

3. Appendices

Years	U.S. military expenditures as percent of GDP (WB)	U.S. GDP, Bil. Doll. (WB)	Military Expenditures, Bil. Doll.		
			U.S. (WB)	NATO (SIPRI)	World (SIPRI)
1992	4.9705	6,520.330	324.1		
1993	4.6044	6,858.560	315.8	485.0 (IISS)	821.6 (IISS)
1994	4.2153	7,287.240	307.2		
1995	3.8602	7,639.750	294.9	470.9 (IISS)	827.7 (IISS)
1996	3.5550	8,073.120	287.0		
1997	3.4056	8,577.550	292.1	454.1 (IISS)	803.7 (IISS)
1998	3.2016	9,062.820	290.2		
1999	3.0857	9,631.170	297.2	469.2 (IISS)	808.7 (IISS)
2000	3.1122	10,251.000	319.0	471	756
2001	3.1238	10,581.900	330.6	472	772
2002	3.4476	10,929.100	376.8	507	784
2003	3.8272	11,456.500	438.5	592	879
2004	4.0163	12,217.200	490.7	722	1,035
2005	4.0892	13,039.200	533.2	779	1,118
2006	4.0413	13,815.600	558.3	825	1,204
2007	4.0734	14,474.200	589.6	894	1,339
2008	4.4466	14,769.900	656.8	950	1,464
2009	4.8758	14,478.100	705.9	1,059 (NATO)	1,531
2010	4.9040	15,049.000	738.0	1,014 (NATO)	1,630
2011	4.8224	15,599.700	752.3	1,044 (NATO)	1,738
2012	4.4617	16,254.000	725.2	997 (NATO)	1,756
2013	4.0237	16,880.700	679.2	969 (NATO)	1,747
2014	3.6789	17,608.100	647.8	942 (NATO)	1,776

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Years	U.S. military expenditures as percent of GDP (WB)	U.S. GDP, Bil. Doll. (WB)	Military Expenditures, Bil. Doll.		
			U.S. (WB)	NATO (SIPRI)	World (SIPRI)
2015	3.4645	18,295.000	633.8	895 (NATO)	1,682
2016	3.4026	18,804.900	639.9	918 (NATO)	1,674
2017	3.2977	19,612.100	646.7	957 (NATO)	1,739
2018	3.3040	20,656.500	682.5		1,822
2019	3.4122	21,540.000	735.0		1,917
2020	3.6505	21,354.100	779.5		1,981
2021	3.4171	23,681.200	809.2		2,113

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Year	Russian military expenditures as percent to GDP (WB)	Russian GDP, Bil. Doll. (WB)		Russian military expenditures, Bil. Doll.				
		At market exchange rates	At purchasing power parities	At market exchange rates (WB)	At purchasing power parities (WB)	At market exchange rates (IISS)	At purchasing power parities (Percent to GDP) (IISS)	At purchasing power parities (Percent to GDP) (CIA)
1992	**4.4270**	**460.291**	**1,019.330**	**20.4**	**45.1**		140.0	142.3
1993	**4.1813**	**435.084**	**953.037**	**18.2**	**39.8**		107.9	113.8
1994	**4.5237**	**395.077**	**851.034**	**17.9**	**38.5**		109.6	93.0
1995	**3.7844**	**395.537**	**832.875**	**15.0**	**31.5**		98.0	76.0
1996	**3.7566**	**391.725**	**817.527**	**14.7**	**30.7**		74.0	
1997	**4.0398**	**404.929**	**843.110**	**16.4**	**34.1**		64.0	41.7
1998	**2.7326**	**270.955**	**807.029**	**7.4**	**22.1**		57.1	
1999	**3.0733**	**195.907**	**870.676**	**6.0**	**26.8**		56.8	35.0

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Year	Russian military expenditures as percent to GDP (WB)	Russian GDP, Bil. Doll. (WB)		Russian military expenditures, Bil. Doll.				
		At market exchange rates	At purchasing power parities	At market exchange rates (WB)	At purchasing power parities (WB)	At market exchange rates (IISS)	At purchasing power parities (Percent to GDP) (IISS)	At purchasing power parities (Percent to GDP) (CIA)
2000	**3.3070**	**259.710**	**1,000.580**	**8.6**	**33.1**		52.0	60.0
2001	**3.5463**	**306.602**	**1,074.590**	**10.9**	**38.1**		46.1	65.0
2002	**3.7563**	**345.470**	**1,167.900**	**13.0**	**43.9**		50.8	
2003	**3.6708**	**430.347**	**1,338.660**	**15.8**	**49.1**	10.6	65.2	
2004	**3.3004**	**591.017**	**1,473.340**	**19.5**	**48.6**	14.9	59.6	
2005	**3.3312**	**764.016**	**1,696.730**	**25.5**	**56.5**	18.8	59.1	66.2 (3.9)
2006	**3.2464**	**989.932**	**2,133.190**	**32.1**	**69.3**	24.6	70.0	
2007	**3.1185**	**1,299.700**	**2,377.450**	**40.5**	**74.1**	32.2	81.5	

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Year	Russian military expenditures as percent to GDP (WB)	Russian GDP, Bil. Doll. (WB)		Russian military expenditures, Bil. Doll.				
		At market exchange rates	At purchasing power parities	At market exchange rates (WB)	At purchasing power parities (WB)	At market exchange rates (IISS)	At purchasing power parities (Percent to GDP) (IISS)	At purchasing power parities (Percent to GDP) (CIA)
2008	**3.1495**	**1,660.850**	**2,878.200**	**52.3**	**90.6**	40.5	86.0	
2009	**3.9241**	**1,222.650**	**2,768.600**	**48.0**	**108.6**	38.3	97.9	
2010	**3.5851**	**1,524.920**	**2,927.000**	**54.7**	**104.9**	41.9	98.5	
2011	**3.4330**	**2,045.920**	**3,259.320**	**70.2**	**111.9**	51.6	86.7	134.6 (4.13)
2012	**3.6892**	**2,208.290**	**3,480.300**	**81.5**	**128.4**	58.8	73.0	130.5 (3.75)
2013	**3.8540**	**2,292.470**	**3,741.780**	**88.4**	**144.2**	66.1	110.0	148.2 (3.96)
2014	**4.1130**	**2,059.240**	**3,763.530**	**84.7**	**154.8**	64.5	155.4 (4.13)	154.3 (4.1)

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Year	Russian military expenditures as percent to GDP (WB)	Russian GDP, Bil. Doll. (WB)		Russian military expenditures, Bil. Doll.				
		At market exchange rates	At purchasing power parities	At market exchange rates (WB)	At purchasing power parities (WB)	At market exchange rates (IISS)	At purchasing power parities (Percent to GDP) (IISS)	At purchasing power parities (Percent to GDP) (CIA)
2015	**4.8715**	**1,363.480**	**3,526.240**	**66.4**	**171.8**	51.9	134.7 (3.82)	171.4 (4.86)
2016	**5.4251**	**1,276.790**	**3,538.980**	**69.3**	**192.0**	46.6	122.8 (3.47)	191.1 (5.4)
2017	**4.2490**	**1,574.200**	**3,807.100**	**66.9**	**161.8**	45.7	118.0 (3.10)	161.4 (4.24)
2018	**3.7198**	**1,657.330**	**4,231.840**	**61.6**	**157.4**	45.3	121.9 (2.88)	166.3 (3.93)
2019	**3.8603**	**1,693.120**	**4,579.550**	**65.4**	**176.8**	46.4	125.5 (2.74)	178.6 (3.9)
2020	**4.1715**	**1,493.080**	**4,651.430**	**62.3**	**194.0**	42.7	133.5 (2.87)	186.1 (4.0)
2021	**3.6117**	**1,843.390**	**5,732.440**	**66.6**	**207.0**	48.5	151.3 (2.64)	229.3 (4.0)

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Year	Chinese military expenditures as percent to GDP (WB)	Chinese GDP, Bil. Doll. (WB)		Chinese military expenditures, Bil. Doll.				
		At market exchange rates	At purchasing power parities	At market exchange rates (WB)	At purchasing power parities (WB)	At market exchange rates (IISS)	At purchasing power parities (Percent to GDP) (IISS)	At purchasing power parities (Percent to GDP) (CIA)
1992	**2.4495**	**426.916**	**1,470.360**	**10.5**	**36.0**		24.3	53.7
1993	**1.9281**	**444.731**	**1,714.190**	**8.6**	**33.1**		27.4	56.2
1994	**1.6935**	**564.322**	**1,979.040**	**9.6**	**33.5**		28.9	57.0
1995	**1.6862**	**734.485**	**2,241.860**	**12.4**	**37.8**		32.9	63.5
1996	**1.6527**	**863.749**	**2,509.420**	**14.3**	**41.5**		36.2	
1997	**1.6327**	**961.602**	**2,788.480**	**15.7**	**45.5**		36.6	74.9
1998	**1.6551**	**1,029.060**	**3,041.070**	**17.0**	**50.3**		38.2	
1999	**1.8715**	**1,094.000**	**3,320.390**	**20.5**	**62.1**			

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Year	Chinese military expenditures as percent to GDP (WB)	Chinese GDP, Bil. Doll. (WB)		Chinese military expenditures, Bil. Doll.				
		At market exchange rates	At purchasing power parities	At market exchange rates (WB)	At purchasing power parities (WB)	At market exchange rates (IISS)	At purchasing power parities (Percent to GDP) (IISS)	At purchasing power parities (Percent to GDP) (CIA)
							39.9	88.9
2000	**1.8358**	**1,211.330**	**3,683.900**	**22.2**	**67.6**		42.0	42.0
2001	**1.9831**	**1,339.400**	**4,080.840**	**26.6**	**80.9**		43.6	47.0
2002	**2.0594**	**1,470.560**	**4,522.780**	**30.3**	**93.1**		69.0	45.0-65.0
2003	**1.9963**	**1,660.280**	**5,075.030**	**33.1**	**101.3**	22.3	75.5	60.0
2004	**1.9385**	**1,955.350**	**5,738.580**	**37.9**	**111.2**	25.0	87.2	67.5
2005	**1.8719**	**2,285.960**	**6,592.900**	**42.8**	**123.4**	29.5	103.4	81.5
2006	**1.8696**	**2,752.120**	**7,660.750**	**51.5**	**143.2**	35.2	128.1	329.4 (4.3)
2007	**1.7502**	**3,550.330**	**8,988.030**	**62.1**	**157.3**			

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Year	Chinese military expenditures as percent to GDP (WB)	Chinese GDP, Bil. Doll. (WB)		Chinese military expenditures, Bil. Doll.				
		At market exchange rates	At purchasing power parities	At market exchange rates (WB)	At purchasing power parities (WB)	At market exchange rates (IISS)	At purchasing power parities (Percent to GDP) (IISS)	At purchasing power parities (Percent to GDP) (CIA)
						46.2	122.2 (1.36)	
2008	**1.7160**	**4,594.340**	**10,045.300**	**78.8**	**172.4**	60.2	114.1	
2009	**1.8935**	**5,101.690**	**11,057.200**	**96.6**	**209.4**	70.4	166.2	
2010	**1.7335**	**6,087.190**	**12,381.900**	**105.5**	**214.6**	76.4	178.0	246.4 (1.99)
2011	**1.6591**	**7,551.550**	**13,844.400**	**125.3**	**229.7**	90.2	198.0	276.9 (2.00)
2012	**1.7009**	**8,532.190**	**15,212.900**	**145.1**	**258.8**	102.6	221.0	279.9 (1.84)
2013	**1.7143**	**9,570.470**	**16,374.800**	**164.1**	**280.7**	115.8	277.0	302.9 (1.85)
2014	**1.7384**	**10,475.600**	**17,423.200**	**182.1**	**302.9**	131.1	314.0	331.0 (1.9)

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Year	Chinese military expenditures as percent to GDP (WB)	Chinese GDP, Bil. Doll. (WB)		Chinese military expenditures, Bil. Doll.				
		At market exchange rates	At purchasing power parities	At market exchange rates (WB)	At purchasing power parities (WB)	At market exchange rates (IISS)	At purchasing power parities (Percent to GDP) (IISS)	At purchasing power parities (Percent to GDP) (CIA)
2015	**1.7768**	**11,061.600**	**18,216.500**	**196.5**	**323.7**	142.4	231.3 (1.27)	355.2 (1.95)
2016	**1.7689**	**11,233.300**	**19,265.300**	**198.7**	**340.8**	145.0	246.6 (1.28)	366.0 (1.9)
2017	**1.7112**	**12,310.500**	**20,594.700**	**210.7**	**352.4**	151.5	259.5 (1.26)	411.9 (2.0)
2018	**1.6736**	**13,894.900**	**22,453.900**	**232.5**	**375.8**	168.2	280.7 (1.25)	419.9 (1.87)
2019	**1.6829**	**14,280.000**	**24,300.700**	**240.3**	**409.0**	177.1	298.9 (1.23)	461.7 (1.9)
2020	**1.7567**	**14,687.700**	**25,246.700**	**258.0**	**443.5**	187.2	318.1 (1.26)	429.2 (1.7)
2021	**1.6053**	**17,820.500**	**28,821.600**	**286.1**	**462.7**	213.9	345.9 (1.20)	432.3 (1.5)

3. Appendices

Definition of Operational Offensive Nuclear Delivery Systems

Определение действующих наступательных систем доставки ядерного оружия

I follow the definition of the International Institute for Strategic Studies and the Bulletin of the Atomic Scientists.

Definition of Operational Nuclear Warheads

Определение действующих ядерных боеголовок

Includes strategic and sub-strategic operational warheads aligned to an in-service delivery system, excluding artillery shells and mini-nukes.[11]

Definition of States Possessing, Pursuing or Capable of Acquiring Weapons of Mass Destruction

Определение государств, обладающих, преследующих или способных к созданию оружия массового поражения

The main part of this data is taken from the Bulletin of the Atomic Scientists.[12]

I concluded that all countries which have nuclear power plants should be considered to some degree capable of acquiring nuclear weapons. The list of such countries is available from the Encyclopedia Britannica[13] and the CIA.[14]

I also made the assumption that such highly developed economic powers as the United Kingdom, France, Japan, and Germany must be capable of acquiring the whole range of WMD. In the case of Japan and Germany, which have nuclear power plants, it is reasonable to believe that they have the capability also for biological, chemical, and missile technology. In the case of the United Kingdom and France, which are acknowledged by the Bulletin of the Atomic Scientists as nuclear, chemical and missile powers, I think they are also capable of obtaining biological weapons. Based on information about satellite launches by Japan and Brazil, I consider these two countries as actually possessing missile technology.

[11] Military: International Institute for Strategic Studies.

[12] Military: Bulletin of the Atomic Scientists.

[13] Economics: Encyclopedia Britannica.

[14] Economics: Central Intelligence Agency.

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Definition of Fissile Materials

Определение расщепляющихся материалов

Materials that can sustain an explosive fission chain reaction are essential for all types of nuclear explosives, from first-generation fission weapons to advanced thermo-nuclear weapons. The most common of these fissile materials are highly enriched uranium (HEU) and plutonium of almost any isotopic composition.

The production of both HEU and plutonium starts with natural uranium. Natural uranium consists almost entirely of the non-chain-reacting isotope U-238, with about 0.7 percent U-235, but the concentration of U-235 can be increased through enrichment — typically using gas centrifuges. Uranium that has been enriched to less than 20 percent U-235 (typically, 3–5 percent) — known as low-enriched uranium is suitable for use in power reactors. Uranium that has been enriched to contain at least 20 percent U-235 — known as HEU — is generally taken to be the lowest concentration practicable for use in weapons. However, in order to minimize the mass of the nuclear explosive, weapon-grade uranium is usually enriched to over 90 percent U-235. Plutonium is produced in nuclear reactors through the exposure of U-238 to neutrons and is subsequently chemically separated from spent fuel in a reprocessing operation. Plutonium comes in a variety of isotopic mixtures, most of which are weapon-usable. Weapon designers prefer to work with a mixture that predominantly consists of Pu-239 because of its relatively low rate of spontaneous emission of neutrons and gamma rays and the low generation of heat through this radioactive decay. Weapon-grade plutonium typically contains more than 90 percent of the isotope Pu-239. The plutonium in typical spent fuel from power reactors (reactor-grade plutonium) contains 50–60 percent Pu-239 but is weapon-usable, even in a first-generation weapon design.[15]

[15] Military: Stockholm International Peace Research Institute.

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