

# Forecast Tables: Introduction and Glossary

**Forecasts (or simulation results) from International Futures (IFs) are dynamic calculations of the full modeling system, not extrapolations of series, results of isolated multiple regressions, or representations of the forecasts of others. To understand more about the forecasts of IFs and the specific formulations for the variables shown in output tables, see the text of the volume, especially Chapter 3, and the documentation of the model available at <http://www.ifs.du.edu>.**

Base case forecasts for 183 individual countries over a long period of time appear in the tables at the back of each volume in the Patterns of Potential Human Progress (PPHP) series. Such forecasts are seldom done, and there are good reasons for reluctance to provide them, including:

- Data in any series are seldom available for all countries, particularly for smaller ones or those that have undergone substantial socio-political transitions. IFs separately represents 183 countries and uses estimation procedures to fill data holes as necessary.
- Every country is very much unique. Formulating a large-scale dynamic model to behave reasonably in the face of such complexity is extremely challenging, and structures of the system will never be completely free of poor behavior for many countries, especially under extreme or new circumstances.
- Some variables, such as the future level of democracy, have especially weak bases for forecasting.

Most longer-term global forecasting reduces the severity of these problems in several ways, including reliance on regional aggregations

of countries and significantly limiting the forecast horizon. The accompanying tables obviously ignore those practical approaches and simply present the numbers that the model produces. This volume has repeatedly stressed that we should never treat any model results as predictions; we should instead use them for thinking about and exploring possible futures. That is the spirit behind these tables. With continuing development of the modeling system, results will change and presumably improve on average.

The forecast tables are organized by geographic, substantive, and temporal attributes. Geographically, the first of multiple sets begins with global and four continent totals (Africa, the Americas, Asia with Oceania, and Europe), followed by the UN subregional divisions within each of the continents. The subsequent six pages of each set provide IFs base case forecasts for each of the country members of the subregional divisions within the four continents. The countries appear in subregions in descending order based on our forecasts of their populations in 2060.

The multiple sets cover six substantive issue areas. The first provides a variety of population measures, land area, and an overall measure of human development. The remaining sets of forecasting variables are divided into five categories: poverty and standard economic variables, health, education, infrastructure, and governance. These categories correspond to the topics that the PPHP volume series addresses, and forecasts in each category are therefore being developed across volumes. Each of the PPHP volumes is posted online, including the forecast tables, at <http://www.ifs.du.edu>.

Temporally, each series contains values for 2010, 2035, and 2060, thereby providing a forecast horizon of 50 years. In many cases, an additional column shows the cumulative percentage change forecast from 2010 through 2060. The model is currently initialized in 2005, and it computes annual results recursively from 2005 through the simulation horizon. The model uses actual GDP data through 2008 and International Monetary Fund forecasts of GDP through 2015. Otherwise, all results in years after 2005 are IFs model computations

rather than actual values (even when data are available) or the forecasts of others.

To facilitate the reading and interpretation of the tables, the glossary that follows provides both the names of the variables as they appear in the tables and in IFs, along with brief definitional information and the sources of initial conditions. Variables are listed in the order in which they appear in the end tables. Please refer to the list of acronyms that immediately follows the glossary for the full names of organizations and data sources referred to in it.

Variables	IFs Names	Sources and Notes
<b>Population, Land Area, and Human Development Index</b>		
Population	POP	Total number of people within a country. Total initialized from WDI data; IFs also has cohort data on age/sex distribution, fertility, and mortality from UNPD.
Land area in 1,000 sq kilometers	LANDAREA	Total national land area in 1,000 square kilometers. Initialized with data from FAO via WDI. Constant over time.
Land area in 1,000 sq miles	No variable name in model; calculated by converting square kilometers	Total national land area in 1,000 square miles. Constant over time.
Population density per sq kilometer	No variable name in model; calculated from LANDAREA and POP	Population per land area measured in square kilometers.
Population density per sq mile	No variable name in model; calculated by converting density per square kilometer	Population per land area measured in square miles.
Urban population	No variable name in model; calculated from others	Percentage of population living in urban areas. Initialized with WDI data.
Population growth rate	POPR	Annual percentage change. See description of "Population" entry at beginning of glossary.
Total fertility rate	TFR	The average number of children a woman is expected to bear throughout her life. Initialized from WDI data. Forecasts initialized with cohort data on fertility from UNPD.
Population below 15 years of age	POPLE15	The total number of people in this age category, which is generally considered a period of economic dependence on others.
Population 65 years of age and older	POPGT65	The total number of people in this age category, which is generally considered a period of nonparticipation in the labor force.
Youth bulge	YTHBULGE	Although the youth bulge is always an indicator of the portion of the adult or near-adult population that is young, specific definitions vary. In IFs the definition is the population age 15–29 as a percentage of the population 15 and older. A bulge exists when this ratio is above a specified level, such as 50 percent.
Human Development Index	HDI	This corresponds very closely to the Human Development Index of the UNDP (see <a href="http://hdr.undp.org">http://hdr.undp.org</a> ), which is an average of three components: long and healthy life; knowledge (literacy and education); and standard of living (GDP/capita). Computed in IFs population model from nearly identical drivers within IFs (see Hughes 2004b for specifics).
HDI with Higher Ceilings	HDI21STFIX	An IFs-specific measure. Computed in IFs population model from driver categories within IFs corresponding to the UNDP's Human Development Index but with maximum values raised to levels that constitute better upper limits for the 21st century (notably, life expectancy of 120 years and GDP per capita of \$100,000).

Variables	IFs Names	Sources and Notes
<b>Poverty</b>		
Poverty below \$1 per day	INCOMEL1LN	Population living below \$1.08 per day at 1993 international prices (purchasing power parity). Initialized from the World Bank's PovcalNet. The forecasting formulation is based on an assumption that income in a country is subject to log-normal distribution and is also responsive to the Gini index of distribution. There are complexities in the conversion of values from 1993 dollars to contemporary currency levels; although changes in the global consumer price index suggest that \$1.08 in 1993 dollars would be \$1.98 in 2000 dollars and \$2.82 in 2005 dollars, the problems converting different countries with different market baskets and inflation patterns preclude such simple translation.
Poverty below \$2 per day	INCOMEL2LN	Population living below \$2.15 per day at 1993 international prices (purchasing power parity). Initialized from the World Bank's PovcalNet. See immediately preceding description of "Poverty below \$1 per day" for further information and interpretation.
Poverty below \$5 per day	No variable name in model; calculated from others	Population living below \$5.40 per day at 1993 international prices (purchasing power parity). See preceding description on this page of "Poverty below \$1 per day" for further information and interpretation. The forecasts of values at income poverty levels above \$2 per day do not use survey data for initial conditions, but rather use the log-normal formulation and survey data for \$2 per day to estimate initial conditions.
Poverty below \$10 per day	No variable name in model; calculated from others	Population living below \$10.80 per day at 1993 international prices (purchasing power parity). See preceding descriptions on this page of "Poverty below \$1 per day" for general interpretation and "Poverty below \$5 per day" for a note on initialization.
Poverty below \$20 per day	No variable name in model; calculated from others	Population living below \$21.60 per day at 1993 international prices (purchasing power parity). See preceding descriptions on this page of "Poverty below \$1 per day" for general interpretation and "Poverty below \$5 per day" for a note on initialization.
GDP per capita at PPP	GDPPCP	Gross domestic product at purchasing power parity (using 2000 dollars) divided by total population. GDP is explained in the variable that immediately follows ("Gross domestic product"). OECD defines purchasing power parity as "a price relative which measures the number of units of country B's currency that are needed in country B to purchase the same quantity of an individual good or service as 1 unit of country A's currency will purchase in country A" ( <a href="http://stats.oecd.org/glossary/detail.asp?ID=2204">http://stats.oecd.org/glossary/detail.asp?ID=2204</a> ). In other words, purchasing power parities eliminate price level differences between countries in order to make better comparisons of actual purchasing power.
Gross domestic product	GDP	Gross domestic product is defined as either the sum of value added across all sectors of an economy or as the sum of goods and services delivered to meet final demand of an economy. Initialized from WDI data using 2000 dollars; forecasts use much other data including series from the GTAP.

<b>Health</b>		
Life expectancy at birth	LIFEXP	The average number of years a newborn is expected to live. Initialized from WDI data.
Infant mortality rate	INFMOR	The probability an infant will die before her/his first birthday, expressed as a rate per 1,000 live births. Initialized from WDI data.
Child mortality probability	No variable name in model; calculated using IFs population model	The probability that a child will die before her/his fifth birthday, expressed as a rate per 1,000 live births. Initialized from UNPD data.
Adult mortality probability	No variable name in model; calculated using IFs population model	The probability that a 15-year-old person will die before her/his 60th birthday, expressed as a rate per 1,000 population. Initialized from UNPD data.
Calories per capita	CLPC	Estimate of available calories per day from all sources, measured in kilocalories. Initialized with data originally from the FAO.
Undernourished children	MALNCHP	As defined by WHO ( <a href="http://www.who.int/healthinfo/statistics/indchildrenstunted/en/">http://www.who.int/healthinfo/statistics/indchildrenstunted/en/</a> ), "Percentage of children underweight is the percentage of children under five years who have a weight-for-age below minus two standard deviations of the NCHS/WHO reference median." Individual countries may look at children at ages three, four, or five. Initialized from WDI data using weight-based malnutrition measure.
Adult obesity rate	HLOBESITY	The prevalence of obesity among adults 30 years of age and older, expressed as the percentage who have a body mass index (BMI) of 30 or greater. Initialized using WHO estimates (available at <a href="http://apps.who.int/bmi/index.jsp">http://apps.who.int/bmi/index.jsp</a> ) and forecast based on the historical relationship between obesity and available calories per capita.
Adult smoking rate	HLSMOKING	The prevalence of smoking, expressed as the percentage of the adult population (typically defined by countries as those 15 or 18 and older) who currently smoke tobacco. Initialized with data from WHO and WDI.
HIV Prevalence Rate	HIVRATE	The percentage of the total population infected with HIV. Initialized using data from UNAIDS.

Variables	IFs Names	Sources and Notes
Government spending on health	No variable name in model; calculated as GDSHealth divided by GDP and then multiplied by 100	Government spending on domestic health as a percentage of GDP; initialized with WDI data.
Disability-adjusted life years	HLDALYCommun HLDALYNonCom HLDALYInjuries	Total disability-adjusted life years (DALYs) across a population, expressed as years in millions. DALYs are calculated as the sum of years of life lost (YLLs), which are calculated as deviation from life expectancy, and years lived with disability (YLDs). YLDs initialized from WHO Global Burden of Disease estimates and YLLs initialized from calculations inside IFs. DALYs are shown for the three major categories of disease: communicable diseases (this category also includes all maternal and perinatal diseases); noncommunicable diseases; and injuries.
Years lived with disabilities	HLYLDCommun HLYLDNonCom HLYLDInjuries	Total years lived with disability (YLDs) across a population, expressed as years in millions. Initialized from WHO Global Burden of Disease estimates. YLDs are shown for the three major categories of disease: communicable diseases (this category also includes all maternal and perinatal diseases); noncommunicable diseases; and injuries.
Total annual deaths	DEATHS	Total number of annual deaths in millions. Initialized from UNPD mortality data.
Deaths and age-standardized death rates from communicable diseases	DEATHCAT, AIDS, Diarrhea, Malaria, RespInfec, and OthCommunDis	This variable is expressed with two measures. The first is the total number of annual deaths from communicable diseases (expressed in thousands). The second is a weighted average of age-specific mortality rates per 100,000 people, using a standard population distribution by age from WHO in order to enable comparison of death rates across countries regardless of differences in the age distribution of their populations. Initialized using WHO Global Burden of Disease cause-specific mortality rates for communicable diseases (including also all other causes of maternal and perinatal mortality, including nutritional deficiencies). Separate forecasts are shown for AIDS; diarrheal diseases; malaria; respiratory infections; and a combined category of all other communicable, maternal, and perinatal diseases.
Deaths and age-standardized death rates from noncommunicable diseases	DEATHCAT, CardioVasc, Diabetes, Digestive, MaligNeoPL, MentalHealth, Respiratory Conditions, OtherNonComm	See explanation for deaths and age-standardized mortality rates for communicable diseases. Initialized using WHO Global Burden of Disease cause-specific mortality rates for noncommunicable diseases and conditions. Separate forecasts are shown for cardiovascular diseases, diabetes, digestive diseases, malignant neoplasms, mental health, respiratory conditions, and a combined category of all other noncommunicable diseases.
Deaths and age-standardized death rates from injuries	DEATHCAT, ntInj, TrafficAcc, UnintInj	See explanation for deaths and age-standardized mortality rates for communicable diseases. Initialized using WHO Global Burden of Disease cause-specific mortality rates for injuries. Separate forecasts are shown for road traffic accidents, other unintentional injuries, and intentional injuries.

Education		
Literacy	LIT	The basic definition is the ability of adults to read and write, but different countries use very different standards. IFs uses 15 and older as the definition of adult for this variable. Initialized from WDI data.
Years of education, Adults 25+	EDYRSAG25	Average number of years of completed education, presented separately for females and males 25 years of age and older. Initialized from the Barro and Lee data set (Barro and Lee 2001).
Primary education enrollment rate, net	EDPRIENRN	The percentage of the official primary age group enrolled at the primary level. Contrast this with gross enrollment, which includes enrolled students from all age groups but maintains the base of the official age group and can therefore exceed 100 percent. Initialized with UNESCO data.
Lower secondary enrollment rate, gross	EDSECLWRENRG	All students of any age enrolled at the lower secondary level as a percentage of those of the official age to enroll at that level (see "Primary education enrollment rate, net" earlier in this section of the glossary for the distinction between gross and net enrollment rates). Lower secondary education for most countries is approximately grades 7–9. Initialized with UNESCO data.
Upper secondary enrollment rate, gross	EDSECUPPRENRG	All students of any age enrolled at the upper secondary level as a percentage of those of the official age to enroll at that level (see "Primary education enrollment rate, net" earlier in this section of the glossary for the distinction between gross and net enrollment rates). Upper secondary education for most countries is approximately grades 10–12. Initialized with UNESCO data.
Tertiary enrollment rate, gross	EDTERENRG	All students of any age enrolled at the tertiary or post-secondary degree level as a percentage of those of the official age (frequently considered to be 18–21) to enroll at the tertiary level. Initialized with UNESCO data.
Knowledge Society Index	KNOWSOC	Adapted from the technological connectivity subindex of the A. T. Kearney Globalization Index (see "Globalization Index" entry at end of this glossary). Supplemented in IFs with ties to R&D spending and tertiary graduation rate (see Hughes 2005 Part 2 for specification).

Variables	IFs Names	Sources and Notes
<b>Infrastructure: Health-Related</b>		
Water safety	WATSAFE	Percentage of population without access to piped water on premises, public taps or standpipes, tube wells or boreholes, protected dug wells, protected springs, or rainwater collection. Initialized with data from WHO and UNICEF.
Sanitation	SANITATION	Percentage of population without access to personal (as opposed to shared or public) sanitation facilities that ensure hygienic separation of human excreta from human contact. Initialized with data from WHO and UNICEF.
Household use of solid fuels	ENSOLFUEL	Percentage of population using solid fuels for household cooking and/or open heating; used in IFs as measure of indoor air pollution. Initialized with data from WHO.
Urban residential outdoor air pollution	ENVPM2PT5	Micrograms of particulate matter with a diameter of 2.5 micrometers or less per cubic centimeter; used in IFs to measure level of urban outdoor air pollution, expressed as an annual average. Initialized in IFs by converting World Bank data on PM <sub>10</sub> concentrations based on regional factors associated with the PM <sub>10</sub> concentrations.
<b>Infrastructure: Resource-Related</b>		
Water use per capita	WATUSEPC	Annual water withdrawals (all uses) divided by population. Initialized with data from FAO via Earth Trends from the WRI. Formulation in IFs is very basic and does not include feedback from water supply constraints.
Crop yield	YL	Annual agricultural crop production of all kinds divided by land area devoted to crop production, measured as metric tons per hectare. Initialized with production and land data originating with UN FAO.
Energy demand per capita	ENDEM divided by POP	The units of energy consumed per capita expressed as equivalent barrels of oil. Initialized using energy data from British Petroleum and OECD and population data from WDI. A technology parameter heavily influences forecasts.
Electricity use	INFRAELEC	Defined as kilowatt hours per capita per year. Initialized from WDI data. Formulations for this and other infrastructure variables in IFs are very simple at this stage.
Annual carbon emissions	CARANN	Releases to the atmosphere of carbon from human activity (burning fossil fuels or deforestation) in billion tons or gigatons (1,000 million). Computed in IFs without initialization from a data source.
<b>Infrastructure: Transportation</b>		
Road density	INFRAROAD	Defined as the total kilometers of road (both paved and unpaved) per 1,000 hectares. Initialized from WDI data.
Cars, Buses, and Freight Vehicles	VEHICFLPC	Total number of cars, buses, and freight vehicles per capita, expressed as a rate per 1,000 population. Does not include motor scooters or other two-wheeled vehicles. Initialized with International Road Federation World Road Statistics via WDI.
<b>Infrastructure: Communication</b>		
Mobile phone usage	ICTMOBIL	Percentage of population with access to mobile phones; can exceed 100 percent because of multiple phones per individual. Initialized from ITU data.
Internet usage	INFRANET	The percentage of the population with Internet access. Initialized from ITU data.
Broadband usage	ICTBROAD	Percentage of population with access to broadband. Initialized from ITU data.
<b>Infrastructure: Other</b>		
R&D expenditures	Not directly available in model; calculated as RANDEXP over GDP	The OECD defines research and development to cover basic research, applied research, and experimental development; expenditures can be private or public. Initialized from OECD and WDI data and expressed here as a percentage of GDP.

<b>Governance</b>		
Freedom House Index (inverted)	FREEDOM	This variable is based on, and initialized with data from, the annual surveys conducted by Freedom House and published in the Freedom in the World series. The surveys measure freedom—defined as the opportunity to act spontaneously in a variety of fields outside the control of the government and other centers of potential domination—in terms of political rights and civil liberties. The category of political rights combines three subcategories (electoral process, political pluralism and participation, and functioning of government) and the civil liberties category combines four subcategories (freedom of expression and beliefs, associational and organizational rights, rule of law, and personal autonomy and individual rights). Countries are assigned a separate score on each of the two major categories; scoring runs from 1 to 7, with 1 indicating “most free” and 7 indicating “least free” (see <a href="http://www.freedomhouse.org">www.freedomhouse.org</a> ). In IFs, the two scores are added and the valence is reversed, resulting in composite country-level freedom scores that can range from 2 to 14 with higher numbers being more free.

Variables	IFs Names	Sources and Notes
Polity Democracy Index	DEMOCPOLITY	This variable is based on, and initialized from, Polity Project data (see <a href="http://www.systemicpeace.org/polity/polity4.htm">http://www.systemicpeace.org/polity/polity4.htm</a> ). The index or "Polity Score" measures a spectrum of governance structures from fully institutionalized autocracies through mixed authority regimes ("anocracies") to fully institutionalized democracies. The Polity Project expresses polity scores on a 21-point scale ranging from -10 (hereditary monarch) to +10 (consolidated democracy). Adapted in IFs as the Polity measure of democracy minus the Polity measure of autocracy plus 10.
Economic Freedom Index	ECONFREE	This variable is based on an index developed by the Fraser Institute and initialized with data from its annual Economic Freedom of the World (EFW) series. The definition of economic freedom includes personal choice, voluntary exchange coordinated by markets, freedom to enter and compete in markets, and protection of persons and their property from aggression by others. The EFW index utilizes data from external sources (e.g., the International Monetary Fund, the World Bank, and the World Economic Forum) and includes 42 variables across the following five components: size of government; legal structure and security of property rights; access to sound money; freedom to trade internationally; and regulation of credit, labor, and business. Each component is rated on a scale from 0 to 10 based on the underlying country-level data, with higher ratings indicating greater economic freedom. The final country-level rating also ranges from 0 to 10 and is determined by averaging its component ratings (see <a href="http://www.freetheworld.com">www.freetheworld.com</a> ).
Government Corruption Perceptions Index	GOVCORRUPT	This variable is based on, and initialized with data from, Transparency International's Corruption Perceptions Index (TI-CPI). Broadly speaking, corruption is defined as the misuse of public power for private benefit. The TI-CPI's purpose is the country-level assessment of the perceived extent of public and political sector corruption as indicated by the frequency and/or the size of corrupt transactions (e.g., bribes). The TI-CPI is an aggregate indicator: it draws on 13 different sources (none of which covers all countries) that share this common purpose. Evaluative assessments are made by country experts (both residents and non-residents) and by business leaders. Individual ratings of ranks are combined through a standardization process into a country-level composite score that ranges from 1 to 10, with higher values representing less corruption (see <a href="http://www.transparency.org">www.transparency.org</a> ).
Economic Integration Index	ECONINTEG	The Economic Integration Index in IFs is adapted from the economic integration component of the FOREIGN POLICY Globalization Index (developed by the international management consulting group A. T. Kearney) and is initialized with values from the broader IFs database (primarily WDI and the United Nations Conference on Trade and Development's World Investment Report). The index combines measures of a country's trade and foreign direct investment inflows and outflows in relation to its GDP (e.g., relative to its capacity to participate rather than to the absolute size of its participation). Values run from 0 to 100, with higher values representing greater economic integration. See Hughes 2005 for IFs specification.
Globalization Index	GLOBALIZ	The Globalization Index in IFs is adapted from the FOREIGN POLICY Globalization Index developed by the international management consulting group A. T. Kearney. A. T. Kearney's index is a composite of four sub-indices: economic integration, personal contact, technological connectivity, and political engagement. In IFs, economic integration is measured by trade (exports) and foreign direct investment (inflows of capital), while personal contact is represented by telephone infrastructure and worker remittances (net) relative to GDP. Technological connectivity is represented by an electronic network infrastructure measure, and political engagement is calculated from the sum of foreign aid expenditures or receipts as a portion of GDP relative to the global average. See Hughes 2005 for expanded specification of the components of the index in IFs. The index is initialized with data from the broader IFs database.

### Data Source Organization Abbreviations

FAO: Food and Agriculture Organization of the United Nations

GTAP: Global Trade and Analysis Project

ITU: International Telecommunications Union

OECD: Organisation for Economic Co-operation and Development

NCHS: National Center for Health Statistics

UNAIDS: United Nations Program on AIDS

UNDP: United Nations Development Programme

UNESCO: United Nations Educational, Scientific and Cultural Organization

UNICEF: United Nations Children's Fund

UNPD: United Nations Population Division

WDI: World Development Indicators (World Bank)

WHO: World Health Organization

WRI: World Resource Institute