Technical Notes

These technical notes discuss the sources and methods used to compile the 149 indicators included in this edition of Selected World Development Indicators. The notes follow the order in which the indicators appear in the tables.

Sources

The data published in the Selected World Development Indicators are taken from *World Development Indicators 1999*. Where possible, however, revisions reported since the closing date of that edition have been incorporated. In addition, newly released estimates of population and gross national product (GNP) per capita for 1998 are included in table 1.

The World Bank draws on a variety of sources for the statistics published in the *World Development Indicators*. Data on external debt are reported directly to the World Bank by developing member countries through the Debtor Reporting System. Other data are drawn mainly from the United Nations and its specialized agencies, from the International Monetary Fund (IMF), and from country reports to the World Bank. Bank staff estimates are also used to improve currentness or consistency. For most countries, national accounts estimates are obtained from member governments through World Bank economic missions. In some instances these are adjusted by staff to ensure conformity with international definitions and concepts. Most social data from national sources are drawn from regular administrative files, special surveys, or periodic census inquiries. The Data Sources section following the Technical Notes lists the principal international sources used.

Data consistency and reliability

Considerable effort has been made to standardize the data, but full comparability cannot be assured, and care must be taken in interpreting the indicators. Many factors affect data availability, comparability, and reliability: statistical systems in many developing economies are still weak; statistical methods, coverage, practices, and definitions differ widely; and cross-country and intertemporal comparisons involve complex technical and conceptual problems that cannot be unequivocally resolved. For these reasons, although the data are drawn from the sources thought to be most authoritative, they should be construed only as indicating trends and characterizing major differences among economies rather than offering precise quantitative measures of those differences. Also, national statistical agencies tend to revise their historical data, particularly for recent years. Thus, data of different vintages may be published in different editions of World Bank publications. Readers are advised not to compile such data from different editions. Consistent time series are available on the *World Development Indicators 1999 CD-ROM*.

Ratios and growth rates

For ease of reference, the tables usually show ratios and rates of growth rather than the simple underlying values. Values in their original form are available on the *World Development Indicators 1999 CD-ROM*. Unless otherwise noted, growth rates are computed using the least-squares regression method (see "Statistical methods" below). Because this method takes into account all available observations during a period, the resulting growth rates reflect general trends that are not unduly influenced by exceptional values. To exclude the effects of inflation, constant-price economic indicators are used in calculating growth rates. Data in italics are for a year or period other than that specified in the column heading—up to two years before or after for economic indicators, and up to three years for social indicators because the latter tend to be collected less regularly and change less dramatically over short periods.

Constant-price series

An economy's growth is measured by the increase in value added produced by the individ-

uals and enterprises operating in that economy. Thus, measuring real growth requires estimates of GDP and its components valued in constant prices. The World Bank collects constant-price national accounts series in national currencies and recorded in the country's original base year. To obtain comparable series of constant-price data, it rescales GDP (and value added) by industrial origin to a common reference year, currently 1995. This process gives rise to a discrepancy between the rescaled GDP and the sum of the rescaled components. Because allocating the discrepancy would give rise to distortions in the growth rate, the discrepancy is left unallocated.

Summary measures

The summary measures for regions and income groups, presented at the end of most tables, are calculated by simple addition when they are expressed in levels. Aggregate growth rates and ratios are usually computed as weighted averages. The summary measures for social indicators are weighted by population or subgroups of population, except for infant mortality, which is weighted by the number of births. See the notes on specific indicators for more information.

For summary measures that cover many years, calculations are based on a uniform group of economies so that the composition of the aggregate does not change over time. Group measures are compiled only if the data available for a given year account for at least two-thirds of the full group, as defined for the 1987 benchmark year. As long as this criterion is met, economies for which data are missing are assumed to behave like those that provide estimates. Readers should keep in mind that the summary measures are estimates of representative aggregates for each topic and that nothing meaningful can be deduced about behavior at the country level by working back from group indicators. In addition, the weighting process may result in discrepancies between subgroup and overall totals.

Table 1. Size of the economy

Population is based on the de facto definition, which counts all residents, 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 the country of origin. The indicators shown are midyear estimates (see the technical note for table 3).

Surface area is a country's total area, including areas under inland bodies of water and coastal waterways.

Population density is midyear population divided by land area. Land area is a country's total area excluding areas under inland bodies of water and coastal waterways. Density is calculated using the most recently available data on land area.

Gross national product (GNP) is the sum of value added by all resident producers, plus any taxes (less subsidies) not included in the valuation of output, plus net receipts of primary income (employee compensation and property income) from nonresident sources. Data are converted from national currency to current U.S. dollars by the World Bank *Atlas* method (see "Statistical methods" below). **Average annual growth rate of GNP** is calculated from constant-price GNP in national currency units. **GNP per capita** is GNP divided by midyear population. It is converted into current U.S. dollars by the *Atlas* method. **Average annual growth rate of GNP per capita** is calculated from constant-price GNP per capita in national currency units. **GNP measured at PPP** is GNP converted to U.S. dollars by the purchasing power parity (PPP) exchange rate. At the PPP rate, one dollar has the same purchasing power over domestic GNP that the U.S. dollar has over U.S. GNP; dollars converted by this method are sometimes called international dollars.

GNP, the broadest measure of national income, measures total value added from domestic and foreign sources claimed by residents. GNP comprises gross domestic product (GDP) plus net receipts of primary income from nonresident sources. The World Bank uses GNP per capita in U.S. dollars to classify economies for analytical purposes and to determine borrowing eligibility. When calculating GNP in U.S. dollars from GNP reported in national currencies, the World Bank follows its *Atlas* conversion method. This involves using a three-year average of exchange rates to smooth the effects of transitory exchange rate fluctuations. (See "Statistical methods" below for further discussion of the *Atlas* method.) Note that growth rates are calculated from data in constant prices and national currency units, not from the *Atlas* estimates.

Because nominal exchange rates do not always reflect international differences in relative prices, table 1 also shows GNP converted into international dollars using PPP exchange rates. PPP rates allow a standard comparison of real price levels between countries, just as conventional price indexes allow comparison of real values over time. The PPP conversion factors used here are derived from the most recent round of price surveys conducted by the International Comparison Programme, a joint project of the World Bank and the regional economic commissions of the United Nations. This round of surveys, completed in 1996 and covering 118 countries, is based on a 1993 reference year. Estimates for countries not included in the survey are derived from statistical models using available data.

Rankings are based on 210 economies and include the 78 economies with sparse data or populations of less than 1.5 million from table 1a. Range estimates for GNP and GNP per capita have been used to rank many of these 78 economies—such as Liechtenstein and Luxembourg, which rank first and second respectively for GNP per capita.

Table 2. Quality of life

Growth of private consumption per capita is the average annual rate of change in private consumption divided by the midyear population. (See the definition of private consumption in the Technical Note to table 13.) The distribution-corrected growth rate is 1 minus the Gini index (see the Technical Note to table 5) multiplied by the annual rate of growth of private consumption. Improvements in private consumption per capita are generally associated with a reduction in poverty, but where the distribution of income or consumption is highly unequal, the poor may not share in the improvement. The relationship between the rate of poverty reduction and the distribution of income or consumption, as measured by an index such as the Gini index, is complicated. But Ravallion and Chen (1997; see Data Sources) have found that the rate of poverty reduction is, on average, proportional to the distribution-corrected rate of growth of private consumption.

Prevalence of child malnutrition is the percentage of children under age 5 whose weight for age is less than minus 2 standard deviations from the median of the reference population, which is based on children from the United States, who are assumed to be well nourished. Weight for age is a composite indicator of both weight for height (wasting) and height for age (stunting). Estimates of child malnutrition are from the WHO.

Under-5 mortality rate is the probability that a child born in the indicated year will die before reaching age 5, if the child is subject to current age-specific mortality rates. The probability is expressed as a rate per 1,000 children.

Life expectancy at birth is the number of years a newborn infant would live if patterns of mortality prevailing at its birth were to stay the same throughout its life.

Age-specific mortality data such as infant and child mortality rates, along with life expectancy at birth, are probably the best general indicators of a community's current health status and are often cited as overall measures of a population's welfare or quality of life. The main sources of mortality data are vital registration systems and direct or indirect estimates based on sample surveys or censuses. Because civil registers with relatively complete vital registration systems are fairly uncommon, estimates must be obtained from sample surveys or derived by applying indirect estimation techniques to registration, census, or survey data. Indirect estimates rely on estimated actuarial ("life") tables, which may be inappropriate for the population concerned. Life expectancy at birth and age-specific mortality rates are generally estimates based on the most recently available census or survey; see the Primary data documentation table in *World Development Indicators 1999.*

Adult illiteracy rate is the percentage of persons aged 15 and above who cannot, with understanding, read and write a short, simple statement about their everyday life. Literacy is difficult to define and to measure. The definition here is based on the concept of functional literacy: a person's ability to use reading and writing skills effectively in the context of his or her society. Measuring literacy using such a definition requires census or sample survey measurements under controlled conditions. In practice, many countries estimate the number of illiterate adults from self-reported data or from estimates of school completion rates. Because of these differences in method, comparisons across countries—and even over time within countries—should be made with caution.

Urban population is the share of the population living in areas defined as urban in each country.

Access to sanitation in urban areas is the percentage of the urban population served by connections to public sewers or household systems such as pit privies, pour-flush latrines, septic tanks, communal toilets, or other such facilities.

Table 3. Population and labor force

Total population includes all residents 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 indicators shown are midyear estimates. Population estimates are usually based on national censuses. Intercensal estimates are interpolations or extrapolations based on demographic models. Errors and undercounting occur even in high-income economies; in developing countries such errors may be substantial because of limits on transportation, communication, and the resources required to conduct a full census. Moreover, the international comparability of population indicators is limited by differences in the concepts, definitions, data collection procedures, and estimation methods used by national statistical agencies and other organizations that collect population data. The data in table 3 are provided by national statistical offices or by the United Nations Population Division.

Average annual population growth rate is the exponential rate of change for the period (see "Statistical methods" below).

Population aged 15–64 is a commonly accepted measure of the number of people who are potentially economically active. In many developing countries, however, children under age 15 work full or part time, and in some high-income economies many workers postpone retirement past age 65.

Total labor force comprises people who meet the definition established by the International Labour Organization (ILO) for the economically active population: all people who supply labor for the production of goods and services during a specified period. It includes both the employed and the unemployed. Although national practices vary, in general the labor force includes the armed forces and first-time jobseekers but excludes homemakers and other unpaid caregivers and workers in the informal sector. Data on the labor force are compiled by the ILO from census or labor force surveys. Despite the ILO's efforts to encourage the use of international standards, labor force data are not fully comparable because of differences among countries, and sometimes within countries, in definitions and methods of collection, classification, and tabulation. The labor force estimates reported in table 3 were calculated by applying activity rates from the ILO database to the World Bank's population estimates to create a labor force series consistent with those estimates. This procedure sometimes results in estimates that differ slightly from those published in the ILO's *Yearbook of Labour Statistics.*

Average annual labor force growth rate is calculated using the exponential end-point method (see "Statistical methods" below).

Females as a percentage of the labor force shows the extent to which women are active in the labor force. Estimates are from the ILO database. These estimates are not comparable internationally because in many countries large numbers of women assist on farms or in other family enterprises without pay, and countries use different criteria to determine the extent to which such workers are to be counted in the labor force.

Children aged 10–14 in the labor force is the share of that age group that is working or seeking work. Reliable estimates of child labor are difficult to obtain. In many countries child labor is illegal or officially presumed not to exist and is therefore not reported or included in surveys or recorded in official data. Data are also subject to underreporting because they do not include children engaged in agricultural or household activities with their families.

Table 4. Poverty

Survey year is the year in which the underlying data were collected.

Rural population below the national poverty line is the percentage of the rural population living below the rural poverty line determined by national authorities. **Urban population below the national poverty line** is the percentage of the urban population living below the urban poverty line determined by national authorities. **Total population below the national poverty line** is the percentage of the total population living below the national poverty line. National estimates are based on population-weighted subgroup estimates from household surveys.

Population below $1 PPP a day and **Population below $2 PPP a day** are the percentages of the population living at those levels of consumption or income at 1985 prices, adjusted for purchasing power parity.

Poverty gap at $1 PPP a day and **Poverty gap at $2 PPP a day** are calculated as the average difference between the poverty line and actual income or consumption for all poor households, expressed as a percentage of the poverty line. This measure reflects the depth of poverty as well as its prevalence.

International comparisons of poverty data entail both conceptual and practical problems. Different countries have different definitions of poverty, and consistent comparisons between countries using the same definition can be difficult. National poverty lines tend to have greater purchasing power in rich countries, where more generous standards are used than in poor countries.

International poverty lines attempt to hold the real value of the poverty line constant between countries. The standard of $1 a day, measured in 1985 international prices and adjusted to local currency using PPP conversion factors, was chosen for *World Development Report 1990: Poverty* because it is typical of poverty lines in low-income economies. PPP conversion factors are used because they take into account the local prices of goods and services that are not traded internationally. However, these factors were designed not for making international poverty comparisons but for comparing aggregates in the national accounts. As a result, there is no certainty that an international poverty line measures the same degree of need or deprivation across countries.

Problems can arise in comparing poverty measures within countries as well as between them. For example, the cost of food staples—and the cost of living generally—are typically higher in urban than in rural areas. So the nominal value of the urban poverty line should be higher than the rural poverty line. But it is not always clear that the difference between urban and rural poverty lines found in practice properly reflects the difference in the cost of living. For some countries the urban poverty line in common use has a higher real value—meaning that it allows poor people to buy more commodities for consumption—than does the rural poverty line. Sometimes the difference has been so large as to imply that the incidence of poverty is greater in urban than in rural areas, even though the reverse is found when adjustments are made only for differences in the cost of living.

Other issues arise in measuring household living standards. The choice between income and consumption as a welfare indicator is one. Incomes are generally more difficult to measure accurately, and consumption accords better with the idea of a standard of living than does income, which can vary over time even if the standard of living does not. But consumption data are not always available, and when they are not, there is little choice but to use income. There are still other problems. Household survey questionnaires can differ widely, for example in the number of distinct categories of consumer goods they identify. Survey quality varies, and even similar surveys may not be strictly comparable.

Comparisons across countries at different levels of development also pose a potential problem because of differences in the relative importance of consumption of nonmarket goods. The local market value of all consumption in kind (including consumption from a household's own production, particularly important in underdeveloped rural economies) should be included in the measure of total consumption expenditure. Similarly, the imputed profit from production of nonmarket goods should be included in income. This is not always done, although such omissions were a far bigger problem in surveys before the 1980s than today. Most survey data now include valuations for consumption or income from own production. Nonetheless, valuation methods vary: for example, some surveys use the price at the nearest market, whereas others use the average farmgate selling price.

The international poverty measures in table 4 are based on the most recent PPP estimates from the latest version of the *Penn World Tables* (National Bureau of Economic Research 1997; see Data Sources). However, any revisions in the PPP conversion factor of a country to incorporate better price indexes can produce dramatically different poverty lines in local currency.

Whenever possible, consumption has been used as the welfare indicator for deciding who is poor. When only household income is available, average income has been adjusted to accord with either a survey-based estimate of mean consumption (when available) or an estimate based on consumption data from national accounts. This procedure adjusts only the mean, however; nothing can be done to correct for the difference between the Lorenz (income distribution) curves for consumption and income.

Empirical Lorenz curves were weighted by household size, so they are based on percentiles of population, not of households. In all cases the measures of poverty have been calculated from primary data sources (tabulations or household data) rather than existing estimates. Estimates from tabulations require an interpolation method; the method chosen is Lorenz curves with flexible functional forms, which have proved reliable in past work.

Table 5. Distribution of income or consumption

Survey year is the year in which the underlying data were collected.

Gini index measures the extent to which the distribution of income (or, in some cases, consumption expenditure) among individuals or households within an economy deviates from a perfectly equal distribution. The Gini index measures the area between the Lorenz curve (described in the technical note to table 4) and a hypothetical line of absolute equality, expressed as a percentage of the maximum area under the line. As defined here, a Gini index of zero would represent perfect equality, and an index of 100 would imply perfect inequality (one person or household accounting for all income or consumption).

Percentage share of income or consumption is the share that accrues to deciles or quintiles of the population ranked by income or consumption. Percentage shares by quintiles may not add up to 100 because of rounding.

Data on personal or household income or consumption come from nationally representative household surveys. The data in the table refer to different years between 1982 and 1997. Footnotes to the survey year indicate whether the rankings are based on income or consumption. Distributions are based on percentiles of population, not of households. Where the original data from the household survey were available, they have been used to directly calculate the income or consumption shares by quintile. Otherwise, shares have been estimated from the best available grouped data.

The distribution indicators have been adjusted for household size, providing a more consistent measure of income or consumption per capita. No adjustment has been made for differences in the cost of living in different parts of the same country because the necessary data are generally unavailable. For further details on the estimation method for low- and middle-income economies, see Ravallion (1996; see Data Sources).

Because the underlying household surveys differ in method and in the type of data collected, the distribution indicators are not strictly comparable across countries. These problems are diminishing as survey methods improve and become more standardized, but strict comparability is still impossible. The income distribution and Gini indexes for the high-income economies are directly calculated from the Luxembourg Income Study database. The estimation method used here is consistent with that applied to developing countries.

The following sources of noncomparability should be noted. First, the surveys can differ in many respects, including whether they use income or consumption expenditure as the living standard indicator. Income is typically more unequally distributed than consumption. In addition, the definitions of income used in surveys are usually very different from the economic definition of income (the maximum level of consumption consistent with keeping productive capacity unchanged). Consumption is usually a much better welfare indicator, particularly in developing countries. Second, households differ in size (number of members) and in the extent of income sharing among members. Individuals differ in age and in consumption needs. Differences between countries in these respects may bias distribution comparisons.

Table 6. Education

Public expenditure on education is the percentage of GNP accounted for by public spending on public education plus subsidies to private education at the primary, secondary, and tertiary levels. It may exclude spending on religious schools, which play a significant role in many developing countries. Data for some countries and for some years refer to spending by the ministry of education of the central government only and thus exclude education expenditures by other central government ministries and departments, local authorities, and others.

Net enrollment ratio is the number of children of official school age (as defined by the education system) enrolled in primary or secondary school, expressed as a percentage of the number of children of official school age for those levels in the population. Enrollment data are based on annual enrollment surveys, typically conducted at the beginning of the school year. They do not reflect actual attendance or dropout rates during the school year. Problems affecting cross-country comparisons of enrollment data stem from inadvertent or deliberate misreporting of age and from errors in estimates of school-age populations. Age-sex structures from censuses or vital registration systems, the primary sources of data on school-age populations, are commonly subject to underenumeration, especially of young children.

Percentage of cohort reaching grade 5 is the share of students enrolled in primary school who eventually reach fifth grade. Because tracking data for individual students are not available, aggregate student flows from one grade to the next are estimated using data on average promotion, repetition, and dropout rates. Other flows, caused by new entrants, reentrants, grade skipping, migration, or school transfers during the school year, are not considered. This procedure, called the reconstructed cohort method, makes three simplifying assumptions: that dropouts never return to school; that promotion, repetition, and dropout rates remain constant over the entire period in which the cohort is enrolled; and that the same rates apply to all pupils enrolled in a given grade, regardless of whether they previously repeated a grade.

Expected years of schooling is the average number of years of formal schooling that a child is expected to receive, including university education and years spent in repetition. It may also be interpreted as an indicator of the total educational resources, measured in school years, that a child will require over the course of his or her "lifetime" in school.

Data on education are compiled by the United Nations Educational, Scientific, and Cultural Organization (UNESCO) from official responses to surveys and from reports provided by education authorities in each country. Because coverage, definitions, and data collection methods vary across countries and over time within countries, data on education should be interpreted with caution.

Table 7. Health

Public expenditure on health consists of recurrent and capital spending from government (central and local) budgets, external borrowings and grants (including donations from international agencies and nongovernmental organizations), and social (or compulsory) health insurance funds. Because few developing countries have national health accounts, compiling estimates of public health expenditure is complicated in countries where state, provincial, and local governments are involved in health care financing. Such data are not regularly reported and, when reported, are often of poor quality. In some countries health services are considered social services and so are excluded from health sector expenditures. The data on health expenditure in table 7 were collected by the World Bank as part of its health, nutrition, and population strategy. No estimates were made for countries with incomplete data.

Access to safe water is the percentage of the population with reasonable access to an adequate amount of safe water (including treated surface water and untreated but uncontaminated water, such as from springs, sanitary wells, and protected boreholes). In urban areas the source may be a public fountain or

standpipe located not more than 200 meters from the residence. In rural areas the definition implies that household members do not have to spend a disproportionate part of the day fetching water. An "adequate" amount of safe water is that needed to satisfy metabolic, hygienic, and domestic requirements, usually about 20 liters per person per day. The definition of safe water has changed over time.

Access to sanitation is the percentage of the population with disposal facilities that can effectively prevent human, animal, and insect contact with excreta. Suitable facilities range from simple but protected pit latrines to flush toilets with sewerage. To be effective, all facilities must be correctly constructed and properly maintained.

Infant mortality rate is the number of infants who die before reaching 1 year of age, expressed per 1,000 live births in a given year (see the discussion of age-specific mortality rates in the technical note to table 2).

Contraceptive prevalence rate is the percentage of women who are practicing, or whose sexual partners are practicing, any form of contraception. It is usually measured for married women aged 15–49 only. Contraceptive prevalence includes all methods: ineffective traditional methods as well as highly effective modern methods. Unmarried women are often excluded from the surveys, and this may bias the estimate. The rates are obtained mainly from demographic and health surveys and contraceptive prevalence surveys.

Total fertility rate is the number of children who would be born to a woman if she were to live to the end of her childbearing years and bear children in accordance with current age-specific fertility rates. Data are from vital registration systems or, in their absence, from censuses or sample surveys. Provided that the censuses or surveys are fairly recent, the estimated rates are considered reliable. As with other demographic data, international comparisons are limited by differences in data definition, collection, and estimation methods.

Maternal mortality ratio is the number of women who die during pregnancy or childbirth, per 100,000 live births. Maternal mortality ratios are difficult to measure because health information systems are often weak. Classifying a death as maternal requires a cause-of-death attribution by medically qualified staff, based on information available at the time of death. Even then, some doubt may remain about the diagnosis in the absence of an autopsy. In many developing countries, causes of death are assigned by nonphysicians and often attributed to "ill-defined causes." Maternal deaths in rural areas often go unreported. The data in table 7 are official estimates from administrative records, survey-based indirect estimates, or estimates derived from a demographic model developed by the United Nations Children's Fund (UNICEF) and the WHO. In all cases the standard errors of maternal mortality ratios are large, and this makes the indicator particularly unsuitable for monitoring changes over a short period.

Table 8. Land use and agricultural productivity

Land under permanent crops is land cultivated with crops that occupy the land for long periods and do not need to be replanted after each harvest, excluding trees grown for wood or timber. **Irrigated land** refers to areas purposely provided with water, including land irrigated by controlled flooding. **Arable land** includes land defined by the Food and Agriculture Organization (FAO) as land under temporary crops (double-cropped areas are counted once), temporary meadows for mowing or for pasture, land under market or kitchen gardens, and land temporarily fallow. Land abandoned as a result of shifting cultivation is not included.

The comparability of land use data from different countries is limited by variations in definitions, statistical methods, and the quality of data collection. For example, countries may define land use differently. The FAO, the primary compiler of these data, occasionally adjusts its definitions of land use categories and sometimes revises earlier data. Because the data thus reflect changes in data-reporting procedures as well as actual changes in land use, apparent trends should be interpreted with caution.

Agricultural machinery refers to wheel and crawler tractors (excluding garden tractors) in use in agriculture at the end of the calendar year specified or during the first quarter of the following year.

Agricultural productivity refers to agricultural value added per agricultural worker, measured in constant 1995 U.S. dollars. Agricultural value added includes that from forestry and fishing. Thus interpretations of land productivity should be made with caution. To smooth annual fluctuations in agricultural activity, the indicators have been averaged over three years.

Food production index covers food crops that are considered edible and that contain nutrients. Coffee and tea are excluded because, although edible, they have no nutritive value. The food production index is prepared by the FAO, which obtains data from official and semiofficial reports of crop yields, area under production, and livestock numbers. Where data are not available, the FAO makes estimates. The index is calculated using the Laspeyres formula: production quantities of each commodity are weighted by average international commodity prices in the base period and summed for each year. The FAO's index may differ from those of other sources because of differences in coverage, weights, concepts, time periods, calculation methods, and use of international prices.

Table 9. Water use, deforestation, and protected areas

Freshwater resources consists of internal renewable resources, which include flows of rivers and groundwater from rainfall in the country and river flows from other countries. Freshwater resources per capita are calculated using the World Bank's population estimates.

Data on freshwater resources are based on estimates of runoff into rivers and recharge of groundwater. These estimates are based on different sources and refer to different years, so cross-country comparisons should be made with caution. Because they are collected intermittently, the data may hide significant variations in total renewable water resources from one year to the next. These annual averages also obscure large seasonal and interannual variations in water availability within countries. Data for small countries and countries in arid and semiarid zones are less reliable than those for larger countries and countries with more rainfall.

Annual freshwater withdrawals refers to total water withdrawals, not counting evaporation losses from storage basins. It also includes water from desalination plants in countries where these are a significant source of water. Withdrawal data are for single years between 1980 and 1997 unless otherwise indicated. Caution is advised in comparing data on annual freshwater withdrawals, which are subject to variations in collection and estimation methods. Withdrawals can exceed 100 percent of renewable supplies when extraction from nonrenewable aquifers or desalination plants is considerable or when there is significant reuse of water. Withdrawals for agriculture and industry are total withdrawals for irrigation and livestock production and for direct industrial use (including withdrawals for cooling thermoelectric plants), respectively. Withdrawals for domestic uses include drinking water, municipal use or supply, and use for public services, commercial establishments, and homes. For most countries sectoral withdrawal data are estimated for 1987–95.

Access to safe water refers to the percentage of people with reasonable access to an adequate amount of safe drinking water in their dwellings or within a convenient distance of their dwellings. Information on access to safe water, although widely used, is extremely subjective, and such terms as "adequate" and "safe" may have very different meanings in different countries, despite official WHO definitions. Even in industrial countries, treated water may not always be safe to drink. Although access to safe water is equated with connection to a public supply system, this does not take account of variations in the quality and cost (broadly defined) of the service once connected. Thus cross-country comparisons must be made cautiously. Changes over time within countries may result from changes in definitions or measurements.

Annual deforestation refers to the permanent conversion of forest area (land under natural or planted stands of trees) to other uses, including shifting cultivation, permanent agriculture, ranching, settlements, and infrastructure development. Deforested areas do not include areas logged but intended for regeneration or areas degraded by fuelwood gathering, acid precipitation, or forest fires. Negative numbers indicate an increase in forest area.

Estimates of forest area are from the FAO's *State of the World's Forests 1997,* which provides information on forest cover as of 1995 and a revised estimate of forest cover in 1990. Forest cover data for developing countries are based on country assessments that were prepared at different times and that, for reporting purposes, had to be adapted to the standard reference years of 1990 and 1995. This adjustment was made with a deforestation model designed to correlate forest cover change over time with certain ancillary variables, including population change and density, initial forest cover, and ecological zone of the forest area under consideration.

Nationally protected areas refers to totally or partially protected areas of at least 1,000 hectares that are designated as national parks, natural monuments, nature reserves, wildlife sanctuaries, protected landscapes and seascapes, or scientific reserves with limited public access. The indicator is calculated as a percentage of total area. For small countries whose protected areas may be smaller than 1,000 hectares, this limit will result in an underestimate of the extent and number of protected areas. Th data do not include sites protected under local or provincial law

Data on protected areas are compiled from a variety o sources by the World Conservation Monitoring Centre, a join venture of the United Nations Environment Programme, th World Wide Fund for Nature, and the World Conservatio Union. Because of differences in definitions and reporting prac tices, cross-country comparability is limited. Compoundin these problems, the data available cover different periods. De ignating land as a protected area does not necessarily mea moreover, that protection is in force.

Table 10. Energy use and emissions

Commercial energy use refers to apparent consumption, whic is equal to indigenous production plus imports and stoc changes, minus exports and fuels supplied to ships and aircra engaged in international transportation. The International E ergy Agency (IEA) and the United Nations Statistical Divisio (UNSD) compile energy data. IEA data for nonmembers of t Organisation for Economic Co-operation and Developme (OECD) are based on national energy data that have been a justed to conform with annual questionnaires completed b OECD member governments. UNSD data are compiled pr marily from responses to questionnaires sent to national go ernments, supplemented by official national statistical public tions and by data from intergovernmental organizations. Wh official data are not available, the UNSD bases its estimat on the professional and commercial literature. The variety sources affects the cross-country comparability of data.

Commercial energy use refers to domestic primary energy u before transformation to other end-use energy sources (such electricity and refined petroleum products). It includes ener from combustible renewables and waste. All forms of comm cial energy—primary energy and primary electricity—are co verted into oil equivalents. To convert nuclear electricity into equivalents, a notional thermal efficiency of 33 percent is sumed; for hydroelectric power, 100 percent efficiency is assum

GDP per unit of energy use is the U.S. dollar estimate real gross domestic product (at 1995 prices) per kilogram of equivalent of commercial energy use.

Net energy imports is calculated as energy use less prod tion, both measured in oil equivalents. A minus sign indica that the country is a net exporter of energy.

Carbon dioxide emissions measures those emissions ste ming from the burning of fossil fuels and the manufacture cement. These include carbon dioxide produced during c sumption of solid, liquid, and gas fuels and from gas flaring.

The Carbon Dioxide Information Analysis Center (CDIA sponsored by the U.S. Department of Energy, calculates ann anthropogenic emissions of carbon dioxide. These calculati are derived from data on fossil fuel consumption, based on World Energy Data Set maintained by the UNSD, and fr data on world cement manufacturing, based on the Cem Manufacturing Data Set maintained by the U.S. Bureau Mines. Each year the CDIAC recalculates the entire time se from 1950 to the present, incorporating its most recent fi ings and the latest corrections to its database. Estimates excl fuels supplied to ships and aircraft engaged in internatio

transportation because of the difficulty of apportioning these fuels among the countries benefiting from that transport.

Table 11. Growth of the economy

Gross domestic product is gross value added, at purchasers' prices, by all resident and nonresident producers in the economy plus any taxes and minus any subsidies not included in the value of the products. It is calculated without deducting for depreciation of fabricated assets or for depletion or degradation of natural resources. Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs. The industrial origin of value added is determined by the International Standard Industrial Classification (ISIC), revision 2.

The **GDP implicit deflator** reflects changes in prices for all final demand categories, such as government consumption, capital formation, and international trade, as well as the main component, private final consumption. It is derived as the ratio of current- to constant-price GDP. The GDP deflator may also be calculated explicitly as a Laspeyres price index in which the weights are base-period quantities of output.

Agriculture value added corresponds to ISIC divisions 11–13 and includes forestry and fishing. **Industry value added** comprises the following sectors: mining (ISIC divisions 10–14), manufacturing (ISIC divisions 15–37), construction (ISIC division 45), and electricity, gas, and water supply (ISIC divisions 40 and 41). **Services value added** corresponds to ISIC divisions 50–96.

Exports of goods and services represents the value of all goods and market services provided to the rest of the world. Included is the value of merchandise, freight, insurance, travel, and other nonfactor services. Factor and property income (formerly called factor services), such as investment income, interest, and labor income, is excluded, as are transfer payments.

Gross domestic investment consists of outlays on additions to the fixed assets of the economy plus net changes in the level of inventories. Additions to fixed assets include land improvements (fences, ditches, drains, and so on); plant, machinery, and equipment purchases; and the construction of buildings, roads, railways, and the like, including commercial and industrial buildings, offices, schools, hospitals, and private dwellings. Inventories are stocks of goods held by firms to meet temporary or unexpected fluctuations in production or sales.

Growth rates are annual averages calculated using constant-price data in local currency. Growth rates for regional and income groups are calculated after converting local currencies to U.S. dollars at the average official exchange rate reported by the IMF for the year shown or, occasionally, using an alternative conversion factor determined by the World Bank's Development Data Group. Methods of computing growth rates and the alternative conversion factors are described under "Statistical methods" below. For additional information on the calculation of GDP and its sectoral components, see the technical note to table 12.

Table 12. Structure of output

Gross domestic product represents the sum of value added by all producers in the economy (see the technical note to table 11 for a more detailed definition and for definitions of **agriculture, industry, manufacturing,** and **services value added**). Since 1968 the United Nations' System of National Accounts (SNA) has called for estimates of GDP by industrial origin to be valued at either basic prices (excluding all indirect taxes on factors of production) or producer prices (including taxes on factors of production, but excluding indirect taxes on final output). Some countries, however, report such data at purchasers' prices—the prices at which final sales are made—and this may affect estimates of the distribution of output. Total GDP as shown in this table is measured at purchasers' prices. GDP components are measured at basic prices.

Among the difficulties faced by compilers of national accounts is the extent of unreported economic activity in the informal or secondary economy. In developing countries a large share of agricultural output is either not exchanged (because it is consumed within the household) or not exchanged for money. Financial transactions also may go unrecorded. Agricultural production often must be estimated indirectly, using a combination of methods involving estimates of inputs, yields, and area under cultivation.

The output of industry ideally should be measured through regular censuses and surveys of firms. But in most developing countries such surveys are infrequent and quickly go out of date, so many results must be extrapolated. The choice of sampling unit, which may be the enterprise (where responses may be based on financial records) or the establishment (where production units may be recorded separately), also affects the quality of the data. Moreover, much industrial production is organized not in firms but in unincorporated or owner-operated ventures not captured by surveys aimed at the formal sector. Even in large industries, where regular surveys are more likely, evasion of excise and other taxes lowers the estimates of value added. Such problems become more acute as countries move from state control of industry to private enterprise because new firms go into business and growing numbers of established firms fail to report. In accordance with the SNA, output should include all such unreported activity as well as the value of illegal activities and other unrecorded, informal, or small-scale operations. Data on these activities need to be collected using techniques other than conventional surveys.

In sectors dominated by large organizations and enterprises, data on output, employment, and wages are usually readily available and reasonably reliable. But in the service sector the many self-employed workers and one-person businesses are sometimes difficult to locate, and their owners have little incentive to respond to surveys, let alone report their full earnings. Compounding these problems are the many forms of economic activity that go unrecorded, including the work that women and children do for little or no pay. For further discussion of the problems encountered in using national accounts data see Srinivasan (1994) and Heston (1994) in Data Sources.

Table 13. Structure of demand

Private consumption is the market value of all goods and services, including durable products (such as cars, washing machines, and home computers), purchased or received as income in kind by households and nonprofit institutions. It excludes purchases of dwellings but includes imputed rent for owner-

occupied dwellings. In practice, it may include any statistical discrepancy in the use of resources relative to the supply of resources.

Private consumption is often estimated as a residual, by subtracting from GDP all other known expenditures. The resulting aggregate may incorporate fairly large discrepancies. When private consumption is calculated separately, the household surveys on which a large component of the estimates is based tend to be one-year studies with limited coverage. Thus the estimates quickly become outdated and must be supplemented by price- and quantity-based statistical estimating procedures. Complicating the issue, in many developing countries the distinction between cash outlays for personal business and those for household use may be blurred.

General government consumption includes all current spending for purchases of goods and services (including wages and salaries) by all levels of government, excluding most government enterprises. It also includes most expenditure on national defense and security, some of which is now considered part of investment.

Gross domestic investment consists of outlays on additions to the fixed assets of the economy plus net changes in the level of inventories. For the definitions of fixed assets and inventories see the technical note to table 11. Under the revised (1993) SNA guidelines, gross domestic investment also includes capital outlays on defense establishments that may be used by the general public, such as schools and hospitals, and on certain types of private housing for family use. All other defense expenditures are treated as current spending.

Investment data may be estimated from direct surveys of enterprises and administrative records or based on the commodity flow method, using data from trade and construction activities. The quality of public fixed investment data depends on the quality of government accounting systems, which tend to be weak in developing countries; measures of private fixed investment—particularly capital outlays by small, unincorporated enterprises—are usually very unreliable.

Estimates of changes in inventories are rarely complete but usually include the most important activities or commodities. In some countries these estimates are derived as a composite residual along with aggregate private consumption. According to national accounts conventions, adjustments should be made for appreciation of the value of inventories due to price changes, but this is not always done. In economies where inflation is high, this element can be substantial.

Gross domestic saving is the difference between GDP and total consumption.

Exports of goods and services represents the value of all goods and services (including transportation, travel, and other services such as communications, insurance, and financial services) provided to the rest of the world. Data on exports and imports are compiled from customs returns and from balance of payments data obtained from central banks. Although data on exports and imports from the payments side provide reasonably reliable records of cross-border transactions, they may not adhere strictly to the appropriate valuation and timing definitions of balance of payments accounting or, more important, correspond with the change-of-ownership criterion. (In conventional balance of payments accounting, a transaction is recorded as occurring when ownership changes hands.) This issue has assumed greater significance with the increasing globalization of international business. Neither customs nor balance of payments data capture the illegal transactions that occur in many countries. Goods carried by travelers across borders in legal but unreported shuttle trade may further distort trade statistics.

Resource balance is the difference between exports of goods and services and imports of goods and services.

Table 14. Central government finances

Current tax revenue comprises compulsory, unrequited, nonrepayable receipts collected by central governments for public purposes. It includes interest collected on tax arrears and penalties collected on nonpayment or late payment of taxes. It is shown net of refunds and other corrective transactions.

Current nontax revenue includes required, nonrepayable receipts for public purposes, such as fines, administrative fees, or entrepreneurial income from government ownership of property, and voluntary, unrequited, nonrepayable current government receipts other than from governmental sources. This category does not include grants, borrowing, repayment of previous lending, or sales of fixed capital assets or of stocks, land, or intangible assets, nor does it include gifts from nongovernmental sources for capital purposes. Together, tax and nontax revenue make up the current revenue of the government.

Current expenditure includes required payments other than for capital assets or for goods or services to be used in the production of capital assets. It also includes unrequited payments for purposes other than permitting the recipients to acquire capital assets, compensating the recipients for damage or destruction of capital assets, or increasing the financial capital of the recipients. Current expenditure does not include government lending or repayments to the government, or government acquisition of equity for public policy purposes.

Capital expenditure is spending to acquire fixed capital assets, land, intangible assets, government stocks, and nonmilitary, nonfinancial assets. Also included are capital grants.

Overall deficit/surplus is current and capital revenue and official grants received, less total expenditure and lending minus repayment.

Goods and services expenditure comprises all government payments in exchange for goods and services, including wages and salaries.

Social services expenditure comprises expenditure on health, education, housing, welfare, social security, and community amenities. It also covers compensation for loss of income to the sick and temporarily disabled; payments to the elderly, the permanently disabled, and the unemployed; family, maternity, and child allowances; and the cost of welfare services such as care of the aged, the disabled, and children. Many expenditures relevant to environmental protection, such as pollution abatement, water supply, sanitation, and refuse collection, are included indistinguishably in this category.

Data on government revenues and expenditures are collected by the IMF through questionnaires distributed to member governments, and by the OECD. In general, the definition of government excludes nonfinancial public enterprises and public financial institutions (such as the central bank). Despite the

IMF's efforts to systematize and standardize the collection of public finance data, statistics on public finance are often incomplete, untimely, and noncomparable. Inadequate statistical coverage precludes the presentation of subnational data, making cross-country comparisons potentially misleading.

Total central government expenditure as presented in the IMF's *Government Finance Statistics Yearbook* is a more limited measure of general government consumption than that shown in the national accounts because it excludes consumption expenditure by state and local governments. At the same time, the IMF's concept of central government expenditure is broader than the national accounts definition because it includes government gross domestic investment and transfer payments.

Central government finances can refer to one of two accounting concepts: consolidated or budgetary. For most countries central government finance data have been consolidated into one account, but for others only budgetary central government accounts are available. Countries reporting budgetary data are noted in the Primary data documentation table in *World Development Indicators 1999*. Because budgetary accounts do not necessarily include all central government units, the picture they provide of central government activities is usually incomplete. A key issue is the failure to include the quasi-fiscal operations of the central bank. Central bank losses arising from monetary operations and subsidized financing can result in sizable quasi-fiscal deficits. Such deficits may also result from the operations of other financial intermediaries, such as public development finance institutions. Also missing from the data are governments' contingent liabilities for unfunded pension and insurance plans.

Table 15. Balance of payments, current account, and international reserves

Goods and services exports and **goods and services imports** together comprise all transactions between residents of a country and the rest of the world involving a change in ownership of general merchandise, goods sent for processing and repairs, nonmonetary gold, and services.

Net income refers to compensation earned by workers in an economy other than the one in which they are resident, for work performed and paid for by a resident of that economy, and investment income (receipts and payments on direct investment, portfolio investment, other investment, and receipts on reserve assets). Income derived from the use of intangible assets is recorded under business services.

Net current transfers consists of transactions in which residents of an economy provide or receive goods, services, income, or financial items without a quid pro quo. All transfers not considered to be capital transfers are current transfers.

Current account balance is the sum of net exports of goods and services, income, and current transfers.

Gross international reserves comprises holdings of monetary gold, special drawing rights, reserves of IMF members held by the IMF, and holdings of foreign exchange under the control of monetary authorities. The gold component of these reserves is valued at year-end London prices ($589.50 an ounce in 1980 and $287.80 an ounce in 1998).

The balance of payments is divided into two groups of accounts. The current account records transactions in goods and services, income, and current transfers. The capital and financial account records capital transfers; the acquisition or disposal of nonproduced, nonfinancial assets (such as patents); and transactions in financial assets and liabilities. Gross international reserves are recorded in a third set of accounts, the international investment position, which records the stocks of assets and liabilities.

The balance of payments is a double-entry accounting system that shows all flows of goods and services into and out of an economy; all transfers that are the counterpart of real resources or financial claims provided to or by the rest of the world without a quid pro quo, such as donations and grants; and all changes in residents' claims on, and liabilities to, nonresidents that arise from economic transactions. All transactions are recorded twice: once as a credit and once as a debit. In principle, the net balance should be zero, but in practice the accounts often do not balance. In these cases a balancing item, called net errors and omissions, is included in the capital and financial account.

Discrepancies may arise in the balance of payments because there is no single source for balance of payments data and no way to ensure that data from different sources are fully consistent. Sources include customs data, monetary accounts of the banking system, external debt records, information provided by enterprises, surveys to estimate service transactions, and foreign exchange records. Differences in recording methods—for example, in the timing of transactions, in definitions of residence and ownership, and in the exchange rate used to value transactions—contribute to net errors and omissions. In addition, smuggling and other illegal or quasi-legal transactions may be unrecorded or misrecorded.

The concepts and definitions underlying the data in table 15 are based on the fifth edition of the IMF's *Balance of Payments Manual*. That edition redefined as capital transfers some transactions previously included in the current account, such as debt forgiveness, migrants' capital transfers, and foreign aid to acquire capital goods. Thus the current account balance now more accurately reflects net current transfer receipts in addition to transactions in goods, services (previously nonfactor services), and income (previously factor income). Many countries still maintain their data collection systems according to the concepts and definitions in the fourth edition. Where necessary, the IMF converts data reported in earlier systems to conform with the fifth edition (see the primary data documentation table in *World Development Indicators 1999*). Values are in U.S. dollars converted at market exchange rates.

Table 16. Private sector finance

Private investment covers gross outlays by the private sector (including private nonprofit agencies) on additions to its fixed domestic assets. When direct estimates of private gross domestic fixed investment are not available, such investment is estimated as the difference between total gross domestic investment and consolidated public investment. No allowance is made for the depreciation of assets. Because private investment is often estimated as the difference between two estimated quantities—domestic fixed investment and consolidated public investment—private investment may be undervalued or overvalued and subject to errors over time.

Stock market capitalization (also called market value) is the sum of the market capitalizations of all firms listed on domestic stock exchanges, where each firm's market capitalization is its share price at the end of the year times the number of shares outstanding. Market capitalization, presented as one measure used to gauge a country's level of stock market development, suffers from conceptual and statistical weaknesses such as inaccurate reporting and different accounting standards.

Number of listed domestic companies is the number of domestically incorporated companies listed on stock exchanges at the end of the year, excluding investment companies, mutual funds, and other collective investment vehicles.

Interest rate spread, also known as the intermediation margin, is the difference between the interest rate charged by banks on short- and medium-term loans to the private sector and the interest rate offered by banks to resident customers for demand, time, or savings deposits. Interest rates should reflect the responsiveness of financial institutions to competition and price incentives. However, the interest rate spread may not be a reliable measure of a banking system's efficiency, to the extent that information about interest rates is inaccurate, that banks do not monitor all bank managers, or that the government sets deposit and lending rates.

Domestic credit provided by the banking sector includes all credit to various sectors on a gross basis, with the exception of credit to the central government, which is net. The banking sector includes monetary authorities, deposit money banks, and other banking institutions for which data are available (including institutions that do not accept transferable deposits but do incur such liabilities as time and savings deposits). Examples of other banking institutions include savings and mortgage loan institutions and building and loan associations.

In general, the indicators reported here do not capture the activities of the informal sector, which remains an important source of finance in developing economies.

Table 17. Role of government in the economy

Subsidies and other current transfers includes all unrequited, nonrepayable transfers on current account to private and public enterprises and the cost to the public of covering the cash operating deficits on sales to the public by departmental enterprises.

Value added by state-owned enterprises is estimated as sales revenue minus the cost of intermediate inputs, or as the sum of these enterprises' operating surplus (balance) and their wage payments. State-owned enterprises are government-owned or -controlled economic entities that generate most of their revenue by selling goods and services. This definition encompasses commercial enterprises directly operated by a government department and those in which the government holds a majority of shares directly or indirectly through other state enterprises. It also includes enterprises in which the state holds a minority of shares, if the distribution of the remaining shares leaves the government with effective control. It excludes public sector activity—such as education, health services, and road construction and maintenance—that is financed in other ways, usually from the government's general revenue. Because financial enterprises are of a different nature, they have generally been excluded from the data.

Military expenditure for members of the North Atlantic Treaty Organization (NATO) is based on the NATO definition, which covers military-related expenditures of the defense ministry (including recruiting, training, construction, and the purchase of military supplies and equipment) and other ministries. Civilian-related expenditures of the defense ministry are excluded. Military assistance is included in the expenditure of the donor country. Purchases of military equipment on credit are recorded at the time the debt is incurred, not at the time of payment. Data for other countries generally cover expenditures of the ministry of defense; excluded are expenditures on public order and safety, which are classified separately.

Definitions of military spending differ depending on whether they include civil defense, reserves and auxiliary forces, police and paramilitary forces, dual-purpose forces such as military and civilian police, military grants-in-kind, pensions for military personnel, and social security contributions paid by one part of government to another. Official government data may omit some military spending, disguise financing through extrabudgetary accounts or unrecorded use of foreign exchange receipts, or fail to include military assistance or secret imports of military equipment. Current spending is more likely to be reported than capital spending. In some cases a more accurate estimate of military spending can be obtained by adding the value of estimated arms imports and nominal military expenditures. This method may understate or overstate spending in a particular year, however, because payments for arms may not coincide with deliveries.

The data in table 17 are from the U.S. Arms Control and Disarmament Agency (ACDA). The IMF's *Government Finance Statistics Yearbook* is a primary source for data on military spending. It uses a consistent definition of defense spending based on the United Nations' classification of the functions of government and the NATO definition. The IMF checks data on defense spending for broad consistency with other macroeconomic data reported to it, but it is not always able to verify their accuracy and completeness. Moreover, country coverage is affected by delays or failure to report data. Thus most researchers supplement the IMF's data with independent assessments of military outlays by organizations such as ACDA, the Stockholm International Peace Research Institute, and the International Institute for Strategic Studies. However, these agencies rely heavily on reporting by governments, on confidential intelligence estimates of varying quality, on sources that they do not or cannot reveal, and on one another's publications.

Composite ICRG risk rating is an overall index taken from the *International Country Risk Guide* and based on 22 components of risk. The PRS Group's *International Country Risk Guide* collects information on each component, groups these components into three major categories (political, financial, and economic), and calculates a single risk assessment index ranging from 0 to 100. Ratings below 50 indicate very high risk and those above 80 very low risk. Ratings are updated monthly.

***Institutional Investor* credit rating** ranks, from 0 to 100, the probability of a country's default. A high number indicates a low probability of default. *Institutional Investor* country credit ratings are based on information provided by leading international banks. Responses are weighted using a formula that gives

more importance to responses from banks with greater worldwide exposure and more sophisticated country analysis systems.

Risk ratings may be highly subjective, reflecting external perceptions that do not always capture a country's actual situation. But these subjective perceptions are the reality that policymakers face in the climate they create for foreign private inflows. Countries not rated favorably by credit-risk rating agencies typically do not attract registered flows of private capital. The risk ratings presented here are not endorsed by the World Bank but are included for their analytical usefulness.

Highest marginal tax rate is the highest rate shown on the schedule of tax rates applied to the taxable income of individuals and corporations. The table also presents the income threshold above which the highest marginal tax rate applies for individuals.

Tax collection systems are often complex, containing many exceptions, exemptions, penalties, and other inducements that affect the incidence of taxation and thus influence the decisions of workers, managers, entrepreneurs, investors, and consumers. A potentially important influence on both domestic and international investors is the tax system's progressivity, as reflected in the highest marginal tax rate on individual and corporate income. Marginal tax rates on individuals generally refer to employment income. For some countries the highest marginal tax rate is also the basic or flat rate, and other surtaxes, deductions, and the like may apply.

Table 18. Power and transportation

Electric power consumption per capita measures the production of power plants and combined heat and power plants less distribution losses and their own use. **Electric power transmission and distribution losses** measures losses occurring between sources of supply and points of distribution, and in distribution to consumers, including pilferage.

The IEA collects data on electric power production and consumption from national energy agencies and adjusts those data to meet international definitions, for example, to account for establishments that, in addition to their main activities, generate electricity wholly or partly for their own use. In some countries self-production by households and small entrepreneurs is substantial because of their remoteness or because public power sources are unreliable, and these adjustments may not adequately reflect actual output.

Although power plants' own consumption and transmission losses are netted out, electric power consumption includes consumption by auxiliary stations, losses in transformers that are considered integral parts of those stations, and electricity produced by pumping installations. Where data are available, consumption covers electricity generated by all primary sources of energy: coal, oil, gas, nuclear, hydroelectric, geothermal, wind, tide and wave, and combustible renewables. Neither production nor consumption data capture the reliability of supplies, including the frequency of outages, breakdowns, and load factors.

Paved roads are roads that have been sealed with asphalt or similar road-building materials. **Goods transported by road** is the volume of goods transported by road vehicles, measured in millions of metric tons times kilometers traveled. **Goods transported by rail** measures the tonnage of goods transported times kilometers traveled per million dollars of GDP measured in PPP terms. **Air passengers carried** includes passengers on both domestic and international passenger routes.

Data for most transportation industries are not internationally comparable, because unlike demographic statistics, national income accounts, and international trade data, the collection of infrastructure data has not been standardized internationally. Data on roads are collected by the International Road Federation (IRF) and data on air transportation by the International Civil Aviation Organization. National road associations are the primary source of IRF data; in countries where such an association is absent or does not respond, other agencies are contacted, such as road directorates, ministries of transportation or public works, or central statistical offices. As a result, the compiled data are of uneven quality.

Table 19. Communications, information, and science and technology

Daily newspapers is the number of copies distributed of newspapers published at least four times a week, per thousand people. **Radios** is the estimated number of radio receivers in use for broadcasts to the general public, per thousand people. Data on these two indicators are obtained from statistical surveys by the United Nations Educational, Scientific, and Cultural Organization (UNESCO). In some countries, definitions, classifications, and methods of enumeration do not entirely conform to UNESCO standards. For example, some countries report newspaper circulation as the number of copies printed rather than the number distributed. In addition, many countries impose radio license fees to help pay for public broadcasting, discouraging radio owners from declaring ownership. Because of these and other data collection problems, estimates of the number of newspapers and radios vary widely in reliability and should be interpreted with caution.

Television sets is the estimated number of sets in use, per thousand people. Data on television sets are supplied to the International Telecommunication Union (ITU) through annual questionnaires sent to national broadcasting authorities and industry associations. Some countries require that television sets be registered. To the extent that households do not register some or all of their sets, the number of registered sets may understate the true number of sets in use.

Telephone main lines counts all telephone lines that connect a customer's equipment to the public switched telephone network, per thousand people. **Mobile telephones** refers to users of portable telephones subscribing to an automatic public mobile telephone service using cellular technology that provides access to the public switched telephone network, per thousand people. The ITU compiles data on telephone main lines and mobile phones through annual questionnaires sent to telecommunications authorities and operating companies. The data are supplemented by annual reports and statistical yearbooks of telecommunications ministries, regulators, operators, and industry associations.

Personal computers is the estimated number of self-contained computers designed to be used by a single person, per thousand people. Estimates by the ITU of the number of personal computers are derived from an annual questionnaire, supplemented by

other sources. In many countries mainframe computers are used extensively, and thousands of users may be connected to a single mainframe computer; in such cases the number of personal computers understates the total use of computers.

Internet hosts are computers connected directly to the worldwide network; many computer users can access the Internet through a single host. Hosts are assigned to countries on the basis of the host's country code, though this does not necessarily indicate that the host is physically located in that country. All hosts lacking a country code identification are assigned to the United States. Because Network Wizards (the source of these data at http://www.nw.com) changed the methods used in its Internet domain survey beginning in July 1998, the data shown here are not directly comparable with those published last year. The new survey is believed to be more reliable and to avoid the problem of undercounting that occurs when organizations restrict download access to their domain data. Nevertheless, some measurement problems remain, and so the number of Internet hosts shown for each country should be considered an approximation.

Scientists and engineers in R&D is the number of people trained to work in any field of science who are engaged in professional research and development activity (including administrators), per million people. Most such jobs require completion of tertiary education.

UNESCO collects data on scientific and technical workers and R&D expenditure from its member states, mainly from official replies to UNESCO questionnaires and special surveys, as well as from official reports and publications, supplemented by information from other national and international sources. UNESCO reports either the stock of scientists and engineers or the number of economically active persons qualified to be scientists and engineers. Stock data generally come from censuses and are less timely than measures of the economically active population. UNESCO supplements these data with estimates of the number of qualified scientists and engineers by counting the number of people who have completed education at ISCED (International Standard Classification of Education) levels 6 and 7. The data on scientists and engineers, normally calculated in terms of full-time equivalent staff, cannot take into account the considerable variations in the quality of training and education.

High-technology exports consists of goods produced by industries (based on U.S. industry classifications) that rank among a country's top 10 in terms of R&D expenditure. Manufactured exports are those commodities in the Standard International Trade Classification (SITC), revision 1, sections 5–9 (chemicals and related products, basic manufactures, manufactured articles, machinery and transport equipment, and other manufactured articles and goods not elsewhere classified), excluding division 68 (nonferrous metals).

Industry rankings are based on a methodology developed by Davis (1982; see Data Sources). Using input-output techniques, Davis estimated the technology intensity of U.S. industries in terms of the R&D expenditure required to produce a certain manufactured good. This methodology takes into account direct R&D expenditure by final producers as well as indirect R&D expenditure by suppliers of intermediate goods used in producing the final good. Industries, classified on the basis of the U.S. Standard Industrial Classification (SIC), were ranked according to their R&D intensity, and the top 10 SIC groups (as classified at the three-digit level) were designated high-technology industries.

To translate Davis's industry classification into a definition of high-technology trade, Braga and Yeats (1992) used the concordance between the SIC grouping and the Standard International Trade Classification (SITC), revision 1, classification proposed by Hatter (1985). In preparing the data on high-technology trade, Braga and Yeats considered only SITC groups (classified at the four-digit level) that had a high-technology weight above 50 percent. Examples of high-technology exports include aircraft, office machinery, pharmaceuticals, and scientific instruments. This methodology rests on the somewhat unrealistic assumption that using U.S. input-output relations and trade patterns for high-technology production does not introduce a bias in the classification.

Number of patent applications filed is the number of documents, issued by a government office, that describe an invention and create a legal situation in which the patented invention can normally only be exploited (made, used, sold, imported) by, or with the authorization of, the patentee. The protection of inventions is limited in time (generally 20 years from the filing date of the application for the grant of a patent). Information on patent applications filed is shown separately for residents and nonresidents of the country. Data on patents are from the World Intellectual Property Organization, which estimates that at the end of 1996 about 3.8 million patents were in force in the world.

Table 20. Global trade

Merchandise exports shows the f.o.b. (free on board) value, in U.S. dollars, of goods provided to the rest of the world. **Merchandise imports** shows the c.i.f. (cost plus insurance and freight) value, in U.S. dollars, of goods purchased from the rest of the world. **Manufactured exports and imports** refers to commodities in SITC sections 5 (chemicals), 6 (basic manufactures), 7 (machinery), and 8 (miscellaneous manufactured goods), excluding division 68 (nonferrous metals) and group 891 (arms and ammunition). **Commercial services** comprises all trade in services, including transportation, communication, and business services, excluding government services, which comprise services associated with government sectors (such as expenditures on embassies and consulates) and with regional and international organizations.

Data on merchandise exports and imports are derived from customs records and may not fully conform to the concepts and definitions contained in the fifth edition of the IMF's *Balance of Payments Manual.* The value of exports is recorded as the cost of the goods delivered to the frontier of the exporting country for shipment—the f.o.b. value. Many countries collect and report trade data in U.S. dollars. When countries report in local currency, the value is converted at the average official exchange rate for the period. The value of imports is generally recorded at the cost of the goods when purchased by the importer plus the cost of transport and insurance to the frontier of the importing country—the c.i.f. value. Data on imports of goods are derived from the same sources as data on exports. In principle, world exports and imports should be identical. Similarly, exports from an economy should equal the sum of imports by the rest of the

world from that economy. But differences in timing and definition result in discrepancies in reported values at all levels.

The data in this table were compiled by the World Trade Organization (WTO). Data on merchandise trade come from the IMF *International Financial Statistics Yearbook*, supplemented by data from the COMTRADE database maintained by the United Nations Statistical Division and from national publications for countries that do not report to the IMF. Data on trade in manufactures come from the COMTRADE database. Where data were not available from the WTO, World Bank staff estimated the shares of manufactures using the most recent information available from the COMTRADE database. Wherever available, WTO reports merchandise trade data on the basis of the general system of trade, which includes goods imported for reexport. Two economies, Hong Kong (China) and Singapore, with substantial levels of reexports are noted in the table. Goods transported through a country en route to another are not included. Data on trade in commercial services are drawn from the IMF Balance of Payments database, supplemented by national publications from countries that do not report to the IMF.

Table 21. Aid and financial flows

Net private capital flows consists of private debt and nondebt flows. Private debt flows include commercial bank lending, bonds, and other private credits; nondebt private flows are foreign direct investment and portfolio equity investment. **Foreign direct investment** is net inflows of investment to acquire a lasting management interest (10 percent or more of voting stock) in an enterprise operating in an economy other than that of the investor. It is the sum of equity capital flows, reinvestment of earnings, other long-term capital flows, and short-term capital flows as shown in the balance of payments.

The data on foreign direct investment are based on balance of payments data reported by the IMF, supplemented by data on net foreign direct investment reported by the OECD and official national sources. The internationally accepted definition of foreign direct investment is that provided in the fifth edition of the IMF's *Balance of Payments Manual*. The OECD has also published a definition, in consultation with the IMF, Eurostat (the Statistical Office of the European Communities), and the United Nations. Because of the multiplicity of sources and differences in definitions and reporting methods, more than one estimate of foreign direct investment may exist for a country, and data may not be comparable across countries.

Foreign direct investment data do not give a complete picture of international investment in an economy. Balance of payments data on foreign direct investment do not include capital raised in the host economies, which has become an important source of financing for investment projects in some developing countries. There is also increasing awareness that foreign direct investment data are limited because they capture only cross-border investment flows involving equity participation and omit nonequity cross-border transactions such as intrafirm flows of goods and services. For a detailed discussion of the data issues see volume 1, chapter 3, of *World Debt Tables 1993–94*.

Total external debt is debt owed to nonresidents repayable in foreign currency, goods, or services. It is the sum of public, publicly guaranteed, and private nonguaranteed long-term debt, use of IMF credit, and short-term debt. Short-term debt includes all debt having an original maturity of one year or less and interest in arrears on long-term debt. **Present value of external debt** is the sum of short-term external debt plus the discounted sum of total debt service payments due on public, publicly guaranteed, and private nonguaranteed long-term external debt over the life of existing loans.

Data on the external debt of low- and middle-income economies are gathered by the World Bank through its Debtor Reporting System. World Bank staff calculate the indebtedness of developing countries using loan-by-loan reports submitted by these countries on long-term public and publicly guaranteed borrowing, along with information on short-term debt collected by the countries or from creditors through the reporting systems of the Bank for International Settlements and the OECD. These data are supplemented by information on loans and credits from major multilateral banks and loan statements from official lending agencies in major creditor countries, and by estimates from World Bank country economists and IMF desk officers. In addition, some countries provide data on private nonguaranteed debt. In 1996, 34 countries reported their private nonguaranteed debt to the World Bank; estimates were made for 28 additional countries known to have significant private debt.

The present value of external debt provides a measure of future debt service obligations that can be compared with such indicators as GNP. It is calculated by discounting debt service (interest plus amortization) due on long-term external debt over the life of existing loans. Short-term debt is included at its face value. Data on debt are in U.S. dollars converted at official exchange rates. The discount rate applied to long-term debt is determined by the currency of repayment of the loan and is based on the OECD's commercial interest reference rates. Loans from the International Bank for Reconstruction and Development and credits from the International Development Association are discounted using a reference rate for special drawing rights, as are obligations to the IMF. When the discount rate is greater than the interest rate of the loan, the present value is less than the nominal sum of future debt service obligations.

Official development assistance (ODA) consists of disbursements of loans (net of repayments of principal) and grants made on concessional terms by official agencies of the members of the Development Assistance Committee (DAC) and certain Arab countries to promote economic development and welfare in recipient economies listed by DAC as developing. Loans with a grant element of more than 25 percent are included in ODA, as are technical cooperation and assistance. Also included are aid flows (net of repayments) from official donors to the transition economies of Eastern Europe and the former Soviet Union and to certain higher-income developing countries and territories as determined by DAC. These flows are sometimes referred to as "official aid" and are provided under terms and conditions similar to those for ODA. Data for aid as a share of GNP are calculated using values in U.S. dollars converted at official exchange rates.

The data cover bilateral loans and grants from DAC countries, multilateral organizations, and certain Arab countries. They do not reflect aid given by recipient countries to other developing countries. As a result, some countries that are net donors (such as Saudi Arabia) are shown in the table as aid recipients

The data do not distinguish among different types of aid (program, project, or food aid; emergency assistance; peacekeeping assistance; or technical cooperation), each of which may have a very different effect on the economy. Technical cooperation expenditures do not always directly benefit the recipient economy to the extent that they defray costs incurred outside the country for salaries and benefits of technical experts and for overhead of firms supplying technical services.

Because the aid data in table 21 are based on information from donors, they are not consistent with information recorded by recipients in the balance of payments, which often excludes all or some technical assistance—particularly payments to expatriates made directly by the donor. Similarly, grant commodity aid may not always be recorded in trade data or in the balance of payments. Although estimates of ODA in balance of payments statistics are meant to exclude purely military aid, the distinction is sometimes blurred. The definition used by the country of origin usually prevails.

Statistical methods

This section describes the calculation of the least-squares growth rate, the exponential (end-point) growth rate, the Gini index, and the World Bank's *Atlas* methodology for calculating the conversion factor used to estimate GNP and GNP per capita in U.S. dollars.

Least-squares growth rate

Least-squares growth rates are used wherever there is a sufficiently long time series to permit a reliable calculation. No growth rate is calculated if more than half the observations in a period are missing.

The least-squares growth rate, r, is estimated by fitting a linear regression trendline to the logarithmic annual values of the variable in the relevant period. The regression equation takes the form

$$\ln X_t = a + bt,$$

which is equivalent to the logarithmic transformation of the compound growth equation,

$$X_t = X_o (1 + r)^t.$$

In this equation, X is the variable, t is time, and $a = \log X_o$ and $b = ln\ (1 + r)$ are the parameters to be estimated. If b^* is the least-squares estimate of b, the average annual growth rate, r, is obtained as $[\exp(b^*)-1]$ and is multiplied by 100 to express it as a percentage.

The calculated growth rate is an average rate that is representative of the available observations over the entire period. It does not necessarily match the actual growth rate between any two periods.

Exponential growth rate

The growth rate between two points in time for certain demographic data, notably labor force and population, is calculated from the equation

$$r = \ln (p_n/p_1)/n,$$

where p_n and p_1 are the last and first observations in the period, n is the number of years in the period, and ln is the natural logarithm operator. This growth rate is based on a model of continuous, exponential growth between two points in time. It does not take into account the intermediate values of the series. Note also that the exponential growth rate does not correspond to the annual rate of change measured at a one-year interval which is given by $(p_n - p_{n-1})/p_{n-1}$.

The Gini index

The Gini index measures the extent to which the distribution of income (or, in some cases, consumption expenditure) among individuals or households within an economy deviates from a perfectly equal distribution. A Lorenz curve plots the cumulative percentages of total income received against the cumulative percentage of recipients, starting with the poorest individual or household. The Gini index measures the area between the Lorenz curve and a hypothetical line of absolute equality, expressed as a percentage of the maximum area under the line. Thus a Gini index of zero represents perfect equality, where an index of 100 percent implies maximum inequality.

The World Bank employs a numerical analysis program, POVCAL, to estimate values of the Gini index; see Chen, Datt, and Ravallion (1993; see Data Sources).

World Bank Atlas *method*

In calculating GNP and GNP per capita in U.S. dollars for certain operational purposes, the World Bank uses a synthetic exchange rate commonly called the *Atlas* conversion factor. The purpose of the *Atlas* conversion factor is to reduce the impact of exchange rate fluctuations in the cross-country comparison of national incomes.

The *Atlas* conversion factor for any year is the average of a country's effective exchange rate with the G-5 countries (or alternative conversion factor) for that year and those for the two preceding years, after adjusting for differences in rates of inflation between the country and the G-5 countries. A country's effective exchange rate is an average of its exchange rates with a selection of other countries, usually weighted by the country's trade with those countries. The G-5 (Group of Five) countries are France, Germany, Japan, the United Kingdom, and the United States. A country's inflation rate is measured by its GNP deflator. The inflation rate for the G-5 countries is measured by changes in the SDR deflator. (Special drawing rights, or SDRs, are the IMF's unit of account.) The SDR deflator is calculated as a weighted average of the G-5 countries' GDP deflators in SDR terms. The weights are determined by the amount of each currency included in one SDR unit. Weights vary over time because the currency composition of the SDR and the relative exchange rates for each currency both change. The SDR deflator is calculated in SDR terms first and then converted to U.S. dollars using the SDR-to-dollar *Atlas* conversion factor.

This three–year averaging smooths annual fluctuations in prices and exchange rates for each country. The *Atlas* conversion factor is then applied to a country's GNP. The resulting GNP in U.S. dollars is divided by the country's midyear population for the latest of the three years to derive its GNP per capita. When official exchange rates are deemed to be unreli-

able or unrepresentative during a period, an alternative estimate of the exchange rate is used in the *Atlas* formula (see below).

The following formulas describe the computation of the *Atlas* conversion factor for year t:

$$e_t^* = \frac{1}{3}\left[e_{t-2}\left(\frac{p_t}{p_{t-2}}\Big/\frac{p_t^{S\$}}{p_{t-2}^{S\$}}\right) + e_{t-1}\left(\frac{p_t}{p_{t-1}}\Big/\frac{p_t^{S\$}}{p_{t-1}^{S\$}}\right) + e_t\right]$$

and for calculating GNP per capita in U.S. dollars for year t:

$$Y_t^{\$} = (Y_t / N_t) / e_t^*$$

where e_t^* is the *Atlas* conversion factor (units of national currency to the U.S. dollar) for year t, e_t is the average annual exchange rate (units of national currency to the U.S. dollar) for year t, p_t is the GNP deflator for year t, $p_t^{S\$}$ is the SDR deflator in U.S. dollar terms for year t, $Y_t^{\$}$ is the *Atlas* GNP in U.S. dollars in year t, Y_t is current GNP (local currency) for year t, and N_t is the midyear population for year t.

Alternative conversion factors

The World Bank systematically assesses the appropriateness of official exchange rates as conversion factors. An alternative conversion factor is used when the official exchange rate is judged to diverge by an exceptionally large margin from the rate effectively applied to domestic transactions of foreign currencies and traded products. This is the case for only a small number of countries (see the primary data documentation table in *World Development Indicators 1999*). Alternative conversion factors are used in the *Atlas* method and elsewhere in the Selected World Development Indicators as single-year conversion factors.

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