Life Expectancy and its Socioeconomic Determinants – A Discriminant Analysis of National Level Data

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Abstract

Although studies in recent years have shown that life expectancy at birth (LEB) has been rising in almost all societies, significant differentials in mortality, and hence, in LEB, exist within, as well as, between societies. This disparity in LEB is believed to have its roots in differential socioeconomic backgrounds of different social groups. The underlying rationale is that the socioeconomic, and environmental factors do exert independent, as well as, interactive influence on the LEB level.

The aim of this paper is to identify the effects of different socioeconomic factors on life expectancy at birth across a number of countries by analyzing national level data. The source of data in this analysis is the World Population Data Sheet, 2011. Data on LEB and all other nine variables used in this analysis are available only for 106 countries in the World Population Data Sheet, 2011. The values of LEB have been collapsed and the countries have been classified to yield three groups: group 1 - countries with low values of LEB; group 2 - countries with medium values of LEB; and group 3 - countries with high values of LEB. The technique called 'Canonical Discriminant Analysis' is employed to uncover variables that discriminate among the groups most. Standardized coefficients as well as structure coefficients have been examined to identify these variables. A number of measures such as Wilk's lambda, canonical correlation, plot of group centroids etc., have been used to assess the appropriateness of the technique, and efficiency of the variables to discriminate among the groups.

The analysis shows that the infant mortality rate is the most influential variable in discriminating among the three groups, while poverty is the second most influential variable. The other important discriminators are also identified.

Policy implications are discussed.

Key Words: Life Expectancy at Birth; Socioeconomic Factors; Discriminant Analysis

Introduction

One of the principal goals of every government is to lengthen the life expectancy of its population by reducing its mortality rate to its minimum possible level. Although studies in recent years have shown that life expectancy at birth (LEB) has been rising in almost all societies (Dowd et al., 2010), significant mortality differentials exist within, as well as, between societies. This disparity in mortality is believed to have its roots in differential socioeconomic backgrounds of different social groups since socioeconomic factors do influence the biological processes that eventually lead to illness and death. To this end, World Bank, World Health Organization, other international organizations, and donors of development assistance have been attempting to reduce health inequalities by socioeconomic status (Wagstaff, 2000), and thereby to reduce the mortality rates among the disadvantaged. However, not much attention has been paid so far to identify changes over time in health status, and hence in mortality, due to changes in the levels of broader social and economic trends (Sastry, 2004). The phenomenon gained momentum particularly in the wake of the perception that the linkage between socioeconomic development and life expectancy is direct, and has aroused concerns among the researchers to identify socioeconomic factors that influence life expectancy. The underlying rationale is that the socio economic and environmental factors do exert independent, as well as, interactive influence on the mortality level.

The intent in this paper is to discern the pattern of relationship between socioeconomic factors and the life expectancy across a number of countries by analyzing aggregate level data using a multivariate technique of analysis. The study derives its importance from the policy point of view since the identification of these factors is necessary to enable the governments to make proper changes in their policies in respect of distribution of resources that will help reduce the mortality rates with consequent increase in the length of life.

Data and Methods

Variables and Their Measures

The source of data in this analysis is the World Population Data Sheet, 2011 (Population reference Bureau, 2011). The main variable of interest is the life expectancy at birth (Y:LEB), and is defined as the average number of years to be lived by a cohort subjected to the whole series of mortality rates for all ages combined in a given society. This single index of mortality is a synthetic measure that summarizes the mortality levels (Pollard, 1988), and shows the average number of years a newborn infant can expect to live under current mortality schedule. The values of this variable vary from lows of 48 in Guinea-Bissau, 49 in Zambia to highs of 79 in Costa Rica, and 80 in Slovenia among the countries used in this analysis. These values have been collapsed and the countries have been classified to yield three groups: group 1 (43 countries with low values of life expectancy < 65 years: LEB = L); group 2 (33 countries with medium values of life expectancy from 66-73 years: LEB = M); and group 3 (30 countries with high values of life expectancy >73 years: LEB = H).

This paper attempts to identify those variables that contribute most in discriminating among the three groups of countries. It is possible that the groups do not differ equally on all variables – some variables may contribute more in differentiating the three groups than others. In such a case, the variables with higher contributions should be of greater concern to the governments seeking to improve the levels of LEB in their respective countries.

The discriminating variables are URBAN (X_1): percentage of population living in urban areas; CMW (X_2): percentage of currently married or in-union women of reproductive age who are currently using modern methods of contraception; GNIPPP (X_3): gross national income converted to 'International' dollars using a purchasing power parity conversion factor where the 'International' dollars indicate the amount of goods and services one could buy in the United States with a given amount of money; DENSITY (X_4): population per square kilometer; RWS (X_5): percentage of rural population with access to improved water supply; IMR (X_6): infant mortality rate measured as the number of deaths of infants under age 1 per thousand live births; TFR (X_7): total fertility rate defined as the number of children a woman would have if she survived to the end of her reproductive period and experienced a given set of age-specific birth rates; DEPPOP (X_8); percentage of the dependent population defined as the sum of the percentages of population aged less than 15 years and more than 65 years; and POVERTY (X_9): percentage of population living on less than $2 per day. This paper analyzed data on the above 10 variables which were available only for 106 countries. Details of these variables and their measures can be found in the World Population Data Sheet, 2011. The list of these countries along with the values of these 10 variables are given in the appendix.

Theoretical reasoning and the availability of data guided the choice of the discriminating variables. For example, a number of researches have shown that urbanites run a lower risk of mortality than their rural counterparts (Ortega and Rincon, 1975; World Health Organization, 1976). With all resources concentrated in urban areas, the urban dwellers are more exposed to improved medical facilities, as well as, to more sources to earn better incomes compared to the ruralites. As a consequence, people in urban areas are generally economically better off than their rural counterparts, and hence are more likely to have, on the average, longer life. Carvalho (1977) found that life expectancy in Brazil is about 12 years less for the lower income group than for the higher income group. Income differentials and mortality differentials have also been found to be negatively correlated in many other researches (Duleep, 1986; Araki and Murata, 1986; Jain, 1984). When the income of the people is below poverty level it is likely to exert even a more powerful negative influence on life expectancy. Understandably, poverty plays a very significant role in determining the length of life in a society. It has been found that although the per capita income of the developing countries increased, on an average, by 3 percent annually since 1990, so also did the number of people living in extreme poverty by more than 100 million people in some regions, and income inequality in many poor countries increased concomitantly along with the increasing poverty (Documents, 2005).

In a high-fertility society, a family is more likely to use a given income on a larger number of members than in a low-fertility society. This may cause economic strains on low-income families that may eventually lead to poverty which is negatively related to LEB. A similar argument might show that the variable – dependent population – may also influence LEB. Another factor that may influence income, and hence, LEB, is the population density. For example, in China, people living in areas with the highest density (the coastal region) have much higher income than those living in the western region which is the least densely populated area (Johnson, 2001). It is possible that people can earn better by running businesses with less investment in areas with high density since the potential consumers usually outnumber those in the least densely populated areas.

Based on similar arguments, we hypothesize that URBAN, CMW, GNIPPP, DENSITY, and RWS will have positive relationships with LEB, while IMR, TFR, DEPPOP, and POVERTY are expected to have negative relationships with LEB.

Analytical Technique

The 'canonical discriminant analysis' technique is used in this paper to discriminate among the groups (Bennett and Bowers, 1976; Klecka, 1980; Nie et al., 1975). It is based on the assumption that the discriminating variables follow the multivariate normal distribution, given by

$$f(X,\mu,\Sigma) = \frac{1}{(2\pi)^{p/2}|\Sigma|^{1/2}} e^{-\frac{1}{2}(X-\mu)'\Sigma^{-1}(X-\mu)}$$

where X' = vector of discriminating variables (X_1, X_2, …..,X_9)

μ' = mean vector of the discriminating variables (X_1, X_2, …..,X_9)

Σ = common covariance matrix

p = number of discriminating variables

The technique is very appropriate since this paper aims at identifying the variables that discriminate among the three groups most (Nie et al., 1975; Bennett and Bowers, 1976; Klecka, 1980).

The canonical discriminant functions to be derived are of the form

$$D = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots\dots\dots + \beta_9 X_9 \quad \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots..(1)$$

where Xs are the discriminating variables, and βs are the unstandardized coefficients. The standardized coefficients are given by

$$\gamma_i = \beta_i \sqrt{\frac{w_{ii}}{n-g}}$$

where w_{ii} = within sum of squares of the variable X_i

g = number of groups

n = total number of cases over all the groups.

The maximum number of unique discriminant functions that can be derived is min{g-1,p}. The coefficients in the first function are derived by maximizing the difference of the group means on the function. The second function is derived such that the difference among the group means is maximum, and at the same time, the values on the first and second discriminant functions are uncorrelated. The principle of maximum group differences is also used to derive the third function on condition that the values of this function are uncorrelated with the values of the previous two functions, and so on. Since in this analysis we have three groups and nine discriminating variables, only two discriminant functions can be derived.

Findings

Table 1 shows the mean values of the discriminating variables for the three groups of countries.

Table 1. Mean values of the nine discriminating variables for the three groups of countries

Variable	**Group 1** Low LEB	**Group 2** Medium LEB	**Group 3** High LEB
Percent Urban (X_1)	36.442	51.939	61.633
Currently Married Women Using Modern Contraception (X_2)	19.884	50.636	48.600
Gross National Income (X_3)	2198.605	5715.758	1180.333
Population Density (X_4)	93.884	151.000	83.367
Percent of Rural Population with Access to Improved Water (X_5)	56.814	80.455	89.867
Infant Mortality Rate (X_6)	73.186	26.018	13.247
Total Fertility Rate (X_7)	4.874	2.588	1.987
Dependent Population (X_8)	45.116	35.667	32.900
Poverty Level (X_9)	67.395	28.576	12.067

The table shows that the three groups differ in mean values for all the discriminating variables, in some cases, quite markedly, and hence can be expected to considerably discriminate among the groups. However, these univariate statistics are unlikely to provide multivariate group differences. In order to know the relative importance of a variable as a discriminator among the groups, the standardized coefficients are examined. These coefficients are presented in table 2.

Table 2. Standardized canonical coefficients

Variables	First discriminant function	Second discriminant function
Percent Urban (X_1)	-0.031	-0.064
Currently Married Women Using Modern Contraception (X_2)	-0.229	-0.603
Gross National Income (X_3)	0.256	1.030
Population Density (X_4)	0.057	-0.353
Percent of Rural Population with Access to Improved Water (X_5)	-0.067	0.203
Infant Mortality Rate (X_6)	0.609	-0.044
Total Fertility Rate (X_7)	0.258	-0.191
Dependent Population (X_8)	0.068	0.279
Poverty Level (X_9)	0.280	0.329

The associated discriminant functions are

$$Y_1 = -0.031Z_1 - 0.229Z_2 + 0.256Z_3 + 0.057Z_4 - 0.067\,Z_5 + 0.609\,Z_6 + 0.258\,Z_7 + 0.068\,Z_8 + 0.280\,Z_9$$

$$Y_2 = -0.064Z_1 - 0.603\,Z_2 + 1.030Z_3 - 0.353\,Z_4 + 0.203\,Z_5 - 0.\,044Z_6 - 0.191\,Z_7 + 0.279Z_8 + 0.329\,Z_9$$

where Zs are Xs expressed in standardized forms.

Judging the Adequacy of the Discriminant Functions

The multivariate measure of group differences, Wilk's lambda, is given by

$$\Lambda = \prod_{i=r+1}^{q} \frac{1}{1+\lambda_i}$$

where r is the number of discriminant functions already derived, q is the maximum number of discriminant functions, and λ_i is the eigenvalue associated with the ith discriminant function. The function with the largest eigenvalue is the most powerful discriminator. To measure the group differences the value of the Wilk's lambda has been calculated before any functions have been derived, that is, when r = 0. This value, 0.1635, of Λ , which is an inverse measure of group differences, is small enough to suggest that the selected variables will discriminate among the groups quite effectively. The eigenvalues, as well as, the canonical correlations are presented in table 3. The sum of the two eigenvalues, 4.080 (=$\lambda_1 + \lambda_2$), gives the total discriminable variance. The table 3 shows that the two discriminant functions, Y_1, and Y_2, account for 93.3% and 6.7% respectively of the total discriminating power. The implication is that Y_1 is highly efficient in discriminating among the groups. An examination of the canonical correlations lends support to this contention - Y_1 is strongly related to the groups ($R_1 = 0.890$), while Y_2 has a much weaker relationship ($R_2 = 0.463$) with the groups.

Table 3. Eigen values and canonical correlations

Discriminant function	Eigen value	Relative percentage	Canonical correlation
i	λ_i		R_i
1	3.808	93.3	0.890
2	0.272	6.7	0.463

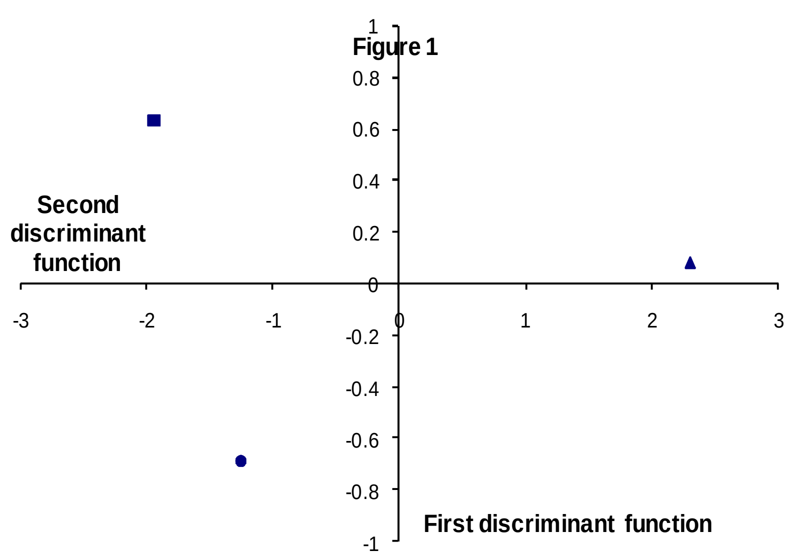
We note here that the p-dimensional space of the discriminating variables is transformed into q-dimensional space of the discriminant functions by equation (1). How effective the variables are in discriminating among the groups can be seen from the plot of the group centroids in figure 1 that represents their (centroids') relative positions in the 2 (= q) dimensional space. A centroid is a point which has coordinates that are a group's mean score on each of the discriminant functions. Table 4 presents the mean discriminant function scores.

Table 4. Mean discriminant function scores

Functions	Group 1 (low)	Group 2 (medium)	Group 3 (high)
First discriminant function	2.306	-1.245	-1.936
Second discriminant function	0.086	-0.689	0.634

The plot shows a wide separation among the three groups implying that the variables have been selected quite appropriately for discriminating among the groups.

Figure 1 (group 1- upper right quadrant; group 2- lower left quadrant; group 3-upper left quadrant)



Interpretation of the Discriminant Function Coefficients

Once the technique has been judged to be appropriate, and the variables to be efficient in discriminating the groups, the interpretation of the coefficients of the discriminant functions is in order. We will use the standardized coefficients to identify variables that contribute most in determining the scores on the functions. The absolute values of the standardized coefficients for a given function represent the magnitudes of the relative contributions of the associated variables to the function score. The contribution of a variable to a function score is positive if the associated coefficient for that variable is positive, while a negative sign of a coefficient for a function indicates that the corresponding variable contributes negatively to the score of that function. Table 2 shows that the coefficient associated with infant mortality rate is the largest (0.609) for the first function implying that the infant mortality rate is the most influential variable in discriminating among the three groups. The positive sign of the coefficient indicates that as the infant mortality rate increases the first discriminant function score also increases, and hence the likelihood that the corresponding country will belong to group 1 which is the group of low LEB countries increases, as is evident from Figure 1.

Poverty level is the second most influential variable in discriminating among the groups (0.280). This indicates that with the increase in the poverty level the tendency for the corresponding country to belong to low LEB group increases. An increase in total fertility rate also increases (0.258) the likelihood of a country to belong to group 1. The negative sign of percentage of currently married or in-union women using modern contraceptives implies (-0.229) that as this percentage increases the value of the discriminant function score decreases, and the likelihood for the country to belong to group 2 or group 3 increases. This variable is followed by RWS, DEPPOP, DENSITY, and URBAN in that order. The positive sign of GNIPPP (0.256) implies that as the GNIPPP increases the country's likelihood to belong to the low LEB group increases which is not in consonance with our expectation.

For the second discriminant function GNIPPP is the most influential variable (1.030). Again the positive sign is counter to our expectation. However, since the second discriminant function is left to account for only 6.7 percent of the total discriminating power, our interest lies mainly in the first discriminant function.

Total Structure Coefficients

When two discriminating variables are highly correlated, they are actually carrying the same discriminating information in which case they also share their contributions to the score. In such a situation their standardized coefficients, which measure their contributions, may be smaller than when only one of the variables is used, or may be larger but with opposite signs so that the balance of the contributions is retained. A structure coefficient is simply a bivariate product-moment correlation between a single variable and discriminant function, and hence is unaffected by its relationships with other variables. As such, a structure coefficient does not suffer from the same limitations as standardized coefficients. The total structure coefficients are presented in table 5.

Table 5. Total canonical structure coefficients

Variables	First discriminant function	Second discriminant function
Percent Urban (X_1)	-0.305	0.258
Currently Married Women Using Modern Contraception (X_2)	-0.440	-0.320
Gross National Income (X_3)	-0.395	0.755
Population Density (X_4)	-0.028	-0.335
Percent of Rural Population with Access to Improved Water (X_5)	-0.469	0.208
Infant Mortality Rate (X_6)	0.890	-0.157
Total Fertility Rate (X_7)	0.760	-0.121
Dependent Population (X_8)	0.653	-0.147
Poverty Level (X_9)	0.639	-0.317

As can be seen from the table, all variables except DENSITY (X_4) have high structure coefficients for the first discriminant function. While the standardized coefficients for URBAN (X_1), RWS (X_5), and DEPPOP (X_8) are small (-0.031, -0.067, and 0.068 respectively), their structure coefficients are quite large (-0.305, -0.469, and 0.653). This may be due to their correlations with other discriminating variables, so that the net effects represent true effects upon the discriminant score (correlation table not shown). What is important to note is the negative sign, as well as, the magnitude of the structure coefficient of GNIPPP (-0.395). This is in sharp contrast with the positive sign of the standardized coefficient which was counter to our expectation. The negative sign indicates that as the GNIPPP increases, the first discriminant function score decreases, and as such, the corresponding country moves away from the territory of the low LEB group, and approaches the medium LEB or high LEB groups (see figure 1). This influence of GNIPPP was not manifested by the corresponding standardized coefficient. The infant mortality rate still remains the most influential discriminator, followed by total fertility rate. Also the large structure coefficient of RWS (-0.469) compared to its small standardized coefficient (-0.067) is noteworthy. Structure coefficients on the second discriminant function can similarly be interpreted.

Summary and Conclusions

The life expectancy at birth (LEB) has been used to classify 106 countries of the world into three groups: group 1 (low LEB), group 2 (medium LEB), and group 3 (high LEB). The goal is to identify variables that discriminate among the groups most. The discriminating variables used in the analysis are: URBAN (X_1): percentage of population living in urban areas; CMW (X_2): percentage of currently married or in-union women of reproductive age who are currently using modern methods of contraception; GNIPPP (X_3): gross national income; DENSITY (X_4): population per square kilometer; RWS (X_5): percentage of rural population with access to improved water supply; IMR (X_6): infant mortality rate; TFR (X_7): total fertility rate; DEPPOP (X_8); percentage of the dependent population; and POVERTY (X_9): percentage of population living on less than $2 per day. Data for all the above 10 variables were available only for 106 countries in the World Population Data Sheet, 2011 (Population reference Bureau, 2011). The 'discriminant analysis technique' has been employed as the technique for analyzing data in this paper.

The first of the two possible discriminant functions, Y_1, accounts for 93.3% of the total discriminable variance which shows that Y_1 is highly effective in discriminating among the three groups. This is also demonstrated by the large value of the associated canonical correlation (R_1=0.890). The second discriminant function, Y_2, which accounts for only 6.7% of the total discriminable variance, has a weak relationship with the groups (R_2 = 0.463). Moreover, the wide separation of the group centroids in figure 1, also indicates the appropriateness of the technique employed, and the selection of the discriminating variables.

The analysis shows that the infant mortality rate is the most influential variable in discriminating among the three groups, while poverty is the second most influential variable. The other important discriminators are total fertility rate, percentage of currently married or in-union women of reproductive age who are using modern methods of contraception, percentage of rural population with access to improved water supply, population density, and percentage of urban population. Since the standardized coefficient of gross national income on the first discriminant function has an unexpected positive sign, its structure coefficient is examined. The structure coefficient on the first discriminant function is quite large and has the expected negative sign. This indicates that the contribution of gross national income to the discriminant function score measured by the standardized coefficient was heavily shared by other correlated variables. Indeed, the structure coefficients of all the discriminating variables except population density are quite high. Since both standardized coefficient and structure coefficient for the population density are low, we may conclude that the contribution of this variable to the discriminant function score is small.

Although the LEB values provide sufficient grounds for broadly differentiating the three groups, the element of arbitrariness that dominated the formation of the groups is one of the main limitations of this study. However, this problem is inherent in all such classification procedures. The second limitation of this study is that education which is known to have a depressant effect on LEB (Amin, 1988; Gajanayake, 1988) has not been included in the study since this variable does not appear in the World Population Data Sheet, 2011. The third limitation is that the assumption that the discriminating variables follow the multivariate normality has not been checked. However, the technique is very robust and a strong adherence to the assumptions is not necessary (Nie et al., 1975; Lachenbruch, 1975).

The study has a number of policy implications. The infant mortality rate is the most important discriminator among the three groups – a higher value of infant mortality rate pushes the relevant country towards the group of low LEB countries. Any attempt to improve the level of LEB must focus on the reduction of IMR which in turn requires massive socioeconomic changes since this subgroup of the population is very vulnerable to environmental conditions. The second most influential variable is the poverty level. An increase in the poverty level contributes positively to the discriminant score, thereby increasing the likelihood of a country to belong to the group of low LEB countries. In fact, income level has been consistently found to negatively influence LEB. The third most influential variable in discriminating among the groups is the total fertility rate. As mentioned before, a high fertility may cause economic strains on low-income families that is likely to contribute in lowering LEB.

As the structure coefficients indicate, the URBAN, CMW, and RWS variables negatively contribute to discriminant score - the higher the values of these variables the lower the discriminant score and hence, higher the likelihood of a country to belong to group 2 or group 3 which is in consonance with our expectation. The variable 'percentage of dependent population' contributes positively – its higher values push a country rightward, that is, towards the territory of the low LEB group. The analysis has gone beyond simple univariate description and uncovered multivariate differences among the three groups of countries with low, medium, and high levels of life expectancy at birth. It appears that any attempt to lessen the discrimination among the three groups of countries would demand an egalitarian distribution of the benefits of economic development.

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Appendix

Country	Level	Y	X1	X2	X3	X4	X5	X6	X7	X8	X9
Jordan	M	73	83	41	5,730	74	91	23	3.8	40	4
Syria	H	74	54	43	4,620	122	84	17	3.2	41	17
Yemen	L	65	29	19	2,330	45	57	51	5.3	48	47
Bangladesh	M	69	25	48	1,550	1,046	78	45	2.4	36	81
Bhutan	M	69	33	65	5,290	15	88	47	2.6	36	50
India	L	64	29	47	3,280	378	84	50	2.6	38	76
Kazakhstan	M	69	54	49	10,320	6	90	18	2.7	31	1
Kyrgyzstan	M	69	35	46	2,200	28	85	25	3.0	34	29
Maldives	M	73	35	27	5,250	1,091	86	11	2.4	33	12
Nepal	M	68	17	44	1,180	207	87	53	2.9	41	78
Pakistan	L	65	35	19	2,680	222	87	64	3.6	40	61
Sri Lanka	H	74	15	53	4,720	318	88	15	2.3	32	29
Tajikistan	M	72	26	32	1,950	53	61	56	3.4	42	51
Uzbekistan	M	67	36	59	2,910	64	81	47	2.7	34	77
Cambodia	L	62	20	35	1,820	81	56	58	3.0	37	57
Indonesia	M	71	43	57	3,720	125	71	30	2.3	34	51
Laos	L	65	27	29	2,200	26	51	59	3.9	45	66
Philippines	M	68	63	34	3,540	319	87	22	3.2	40	49
Thailand	H	74	31	77	7,640	135	98	12	1.6	30	27
Timor-Leste	L	62	22	21	4,730	80	63	64	5.7	48	73
Vietnam	M	73	30	68	2,790	265	92	16	2.0	32	38
China	H	74	50	84	6,890	141	82	17	1.5	26	36
Mongolia	M	67	61	61	3,330	2	49	39	2.6	32	39
Estonia	H	75	68	56	19,120	30	97	3.3	1.6	32	1
Latvia	M	73	68	56	17,610	34	96	5.7	1.3	31	1
Lesotho	L	49	23	46	1,800	72	81	91	3.1	41	62
South Africa	L	53	62	60	10,050	41	78	48	2.4	35	43
Swaziland	L	49	22	48	4,790	69	61	67	3.5	41	81
Belize	H	74	44	31	5,990	14	100	17	2.9	40	24
Costa Rica	H	79	65	72	10,930	92	91	8.8	1.9	31	5
El Salvador	M	72	65	66	6,420	296	76	20	2.3	40	15
Guatemala	M	71	50	44	4,570	135	90	30	3.6	45	26
Honduras	M	73	52	56	3,710	69	77	24	3.1	40	36
Mexico	H	77	78	66	14,020	59	87	14	2.3	35	9
Nicaragua	H	74	58	69	2,540	45	68	19	2.6	39	32
Dominican Republic	M	73	66	70	8,110	207	84	23	2.6	37	14
Jamaica	M	73	52	57	7,230	246	89	24	2.3	36	6
Argentina	H	76	93	64	14,090	15	80	12.1	2.4	36	1
Bolivia	H	67	67	34	4,250	9	67	42	3.3	41	25
Brazil	H	74	87	77	10,160	23	84	20	1.9	32	10
Colombia	M	73	75	73	8,600	41	73	16	2.1	35	28
Ecuador	H	76	68	59	8,100	52	88	19	2.5	36	13
Guyana	M	70	29	40	3,270	4	93	38	2.7	37	17
Paraguay	M	73	58	70	4,430	16	66	28	2.9	38	13
Peru	H	74	77	51	8,120	23	61	17	2.5	37	15
Suriname	M	71	70	45	6,730	3	81	20	2.3	35	27
Uruguay	H	76	93	75	12,900	19	100	10.6	2.0	36	1
Armenia	M	72	64	27	5,410	105	93	13	1.7	30	12
Azerbaijan	H	74	54	13	9,020	106	71	11	2.3	29	8
Georgia	H	74	53	27	4,700	62	96	28	1.9	31	33
Iraq	M	69	67	33	3,330	75	55	34	4.7	46	25
Algeria	M	73	67	52	8,110	15	79	22	2.3	32	24
Egypt	M	73	43	58	5,680	83	98	23	2.9	36	19
Morocco	M	72	56	52	4,400	72	60	30	2.2	34	14
Tunisia	H	75	68	52	7,810	65	84	18	2.1	31	13

Benin	L	56	43	6	1,510	81	69	78	5.4	47	75
Burkina Faso	L	56	24	13	1,170	62	72	73	5.8	47	81
Cape Verde	H	74	62	57	3,530	123	82	19	2.5	38	40
Cote d'lvoire	L	52	51	8	1,640	70	68	97	4.9	45	46
Gambia	L	59	59	13	1,330	157	86	68	5.0	46	57
Ghana	L	64	52	17	1,530	105	74	45	4.1	42	54
Guinea	L	54	28	6	940	42	61	86	5.3	46	70
Guinea-Bissau	L	48	30	14	1,060	45	51	103	5.1	44	78
Liberia	L	57	47	10	290	37	51	78	5.8	46	95
Mali	L	52	33	6	1,190	12	44	116	6.4	51	77
Mauritania	L	59	42	8	1,940	3	47	71	4.4	43	44
Niger	L	55	17	5	680	13	39	88	7.0	51	76
Nigeria	L	52	51	10	2,070	176	42	89	5.7	46	84
Senegal	L	59	43	10	1,810	65	52	51	4.7	46	60
Sierra Leone	L	53	39	7	790	75	26	89	5.0	46	76
Togo	L	62	37	11	850	103	41	55	4.7	46	69
Burundi	L	57	11	18	390	367	71	66	6.4	49	94
Comoros	L	61	28	19	1,180	337	97	65	4.8	46	65
Djibouti	L	58	76	17	2,480	39	52	76	3.7	38	41
Ethiopia	L	56	17	14	930	79	26	77	5.3	47	78
Kenya	L	57	18	39	1,570	72	52	59	4.7	45	40
Madagascar	M	67	31	29	990	36	29	42	4.6	46	90
Malawi	L	54	14	42	780	134	77	84	5.7	48	91
Mozambique	L	52	31	12	880	29	29	86	5.6	48	82
Rwanda	L	55	19	45	1,130	415	62	50	4.6	45	90
Tanzania	L	57	27	26	1,360	49	45	51	5.4	48	88
Uganda	L	54	15	18	1,190	143	64	74	6.4	51	65
Zambia	L	49	36	27	1,280	18	46	84	6.3	49	82
Angola	L	50	59	5	5,190	16	38	102	5.7	50	70
Cameroon	L	51	59	12	2,190	42	51	91	4.8	45	31
Central African Republic	L	50	39	9	750	8	51	102	4.7	45	82
Chad	L	50	28	2	1,160	9	44	125	6.0	48	83
Congo	L	58	63	13	3,040	12	34	68	4.7	44	74
Gabon	L	63	86	12	12,450	6	41	45	3.4	39	20
Sao Tome & Principe	L	62	63	33	1,850	187	89	45	4.6	47	57
Belarus	M	71	75	56	12,740	46	99	4.7	1.5	29	1
Bulgaria	H	74	73	40	13,260	67	100	9.4	1.5	32	7
Czech Republic	H	78	74	63	23,940	134	100	2.7	1.5	29	1
Hungary	H	74	68	71	19,090	107	100	5.3	1.3	31	1
Moldova	M	69	42	43	3,010	121	85	12.0	1.3	27	13
Poland	H	76	61	28	18,290	122	100	5.0	1.4	29	1
Russia	M	69	74	65	18,330	8	89	8.1	1.6	28	1
Slovakia	H	75	55	66	22,110	111	100	5.7	1.4	27	1
Ukraine	M	69	69	48	6,180	76	97	9.1	1.4	30	1
Albania	H	75	50	10	8,640	111	98	18.0	1.4	32	4
Bosnia-Herzegovina	H	76	46	11	8,770	75	98	6.0	1.3	29	1
Macedonia	H	74	65	10	10,880	80	99	7.0	1.6	30	4
Montenegro	H	74	64	17	13,110	46	96	9.3	1.9	32	1
Serbia	H	74	58	19	11,700	94	98	6.7	1.4	32	1
Slovenia	H	80	50	63	26,470	101	99	2.5	1.6	31	1
Papua New Guinea	L	62	13	24	2,260	15	33	58	4.4	43	57