An Estimation of the Global Burden of Communicable and Noncommunicable Disease and Economic Growth

Abstract

This paper aims to analyze the global burden of disease on economic growth through the inclusion of disease within a well specified growth model. Growth is specified as the percent change of per capita GDP and years of life lost to communicable and non-communicable diseases are included as a measurement of human capital.

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Introduction

The epidemic of global disease is composed of two subsets: communicable and noncommunicable. Communicable diseases (CD's) are caused by the direct or indirect transmission of infectious agents. Major examples of this include respiratory infections such as covid-19, diarrheal disease, HIV/AIDS, tuberculosis, and malaria. In 2018, The World Health Organization found that more than half of the deaths estimated within low-income countries in the year 2016 were caused by communicable diseases, maternal causes, conditions arising during pregnancy and childbirth, and nutritional deficiencies. The rate of death measured by these same causes in high-income countries was only seven percent. This discrepancy is magnified by the impact of cyclical poverty within low income countries. In low income countries, members of society who are marginalized or poor have limited access to healthcare and the presence of communicable disease generates a cost that leads to significant economic loss.

Noncommunicable diseases (NCD's) are non-infectious and non-transmissible diseases that are predicted to be caused by genetic or behavioral factors. NCDs kill more than three in five people worldwide and are the highest cause of global death and disability. The most prevalent NCD's are cardiovascular diseases, cancer, chronic respiratory diseases, and diabetes. The World Health Organization calculated that in 2015, seventy percent of global death was caused by NCD, ranging from thirty-seven percent in low-income countries to eighty-eight percent in high-income countries (WHO, 2017). NCD's create and perpetuate poverty that hinders economic development within low-and middle-income countries to such an extent that, in January 2019 the Global Health Policy published an article stating that, at the current calculated rate, a forty-seven

trillion-dollar cumulative loss of output is estimated to take place within the calculations of 2011 to 2030 (Global Health Policy, 2019).

In terms of strategy and size of scale, the United States has implemented the greatest global health intervention for HIV and malaria (U.S. National Library of Medicine, 2017). However, as the mortality rates of both diseases have fallen in recent years, the significance of reconstructive efforts within the general populace has become stagnated. Instead attention has now shifted to the increasing issue of NCD. This escalation originates from the major risk factors of tobacco use, physical inactivity, the harmful use of alcohol, and unhealthy diets. In 2011 the U.N. General Assembly quoted the circumstance as "one of the major challenges for sustainable development in the twenty-first century" (UN Report 2012). While NCD's have always been a concern of developed countries, it is now expanding to be a hindrance upon developing countries as they make their transition from low-income to middle-income status (IHME 2013). NCD's are currently encroaching upon all regions, all age groups, and all categories of income level. "For all regions except Africa, NCDs are now the leading causes of death; it is projected that by 2030, this will also be the case in Africa" (WHO 2018). Facing the impending consequent of NCD growth, in accordance with the simultaneous challenge of combating infectious disease, will leave impoverished regions such as Africa to face a detrimental double burden of disease.

In 2013 The World Health Assembly endorsed the *WHO Global Action Plan for the Prevention and Control of NCDs, 2013–2020.* This plan targets five major actions: reducing deaths from NCD's by 25 percent by 2025, reducing the prevalence of current tobacco use in persons aged greater than fifteen years by thirty percent, reducing the harmful use of alcohol by at least a ten

percent approximate, reducing the prevalence of insufficient physical activity by ten percent, and achieving an eighty percent availability of affordable basic technologies and essential medicines (Global Action Plan for the Prevention and Control of NCDs 2013-2020). Hence, the question now presented to current global administration is whether or not to support this initiative. Some health experts advocate for early intervention within the NCD epidemic, as these diseases enhance over time and can become too costly to handle later. Others believe that, during a time of constrained budgets, efforts should prioritize existing global health programs. By analyzing the individual impact these diseases have on economic growth, this paper aims to determine: Which policy implications would be most effective, continued support for communicable disease or new action against noncommunicable disease?

Review of Literature

The foundation of modern cross-country empirical research is generated upon Gary Becker (1962)'s formulation of human capital theory. As labor quality, in the form of human capital is shown to significantly contribute to economic growth, it has become a commonality to use education as a determining factor of growth. The purpose of this would be to assess the level of cognitive skills in a given population. However, this direction of analysis narrowly restricts the estimate; adding the variable of health to the model as an additional indicator of human capital introduces a more specified approach in the development of worker productivity. Workers in good health are physically and mentally more productive and generate higher wages. This element of health has been commonly proxied indirectly in the form of life expectancy, morbidity, or mortality and generated significant positive effects on economic growth (Bloom & Canning, 2000, 2003). Nevertheless, the adverse impact of ill health on human welfare should be more completely encapsulated, as the systemic consequences of poor societal health can be substantial.

In particular, any "health 'shocks' − such as unexpected increases in health expenditure, reduced functional capacity and lost income or productivity − are often a primary risk factor for impoverishment" (Out-of-Pocket Health Payments and Catastrophic Expenditures). Educational attainment and consequent levels of future income may also be adversely impacted by poor levels of health. "At a societal level, poor population health is associated with lower savings rates, lower rates of return on capital, and lower levels of domestic and foreign investment; all of these factors can and do contribute to reductions in economic growth" (Ruger 2006). Analysis of the statistical significance of these predicted impacts, then signifies to policy

makers “which specific disease or, more generally, depleted health status disrupts or reduces production or consumption opportunities at the societal level” (WHO, 2009).

However not all of the impact analysis denotes a negative outcome (Bloom, Canning and Sevilla, 2004). The positive influence found on economic growth when implementing a specified health variable, enforces the political stance of investment; a greater monetary support for health infrastructure, health services, etc. would conceivably advance wealth overall. “Therefore, appropriate measurement and valuation of the economic benefits that accrue from the reduction or elimination of disease represents a further important, and more positive, reason for undertaking economic impact studies in health” (WHO 2009).

In order to conduct evidence and research the study, Alok Bhargava, Dean T. Jamison, Lawrence Lau, and Christopher JL Murray modeled the effects of health on economic growth. Proximate determinants of economic growth at 5 yearly intervals were modeled using a panel data on GDP series based on purchasing power comparisons in the Penn World Table, and on exchange rate conversions from the World Development Indicators. The conceptual framework implemented a causal relationship between life expectancy and income and used a Solow theoretical model commonly specified for economic growth.

In the conceptual framework of the analysis, the demographic literature relating life expectancy to income was integrated with models commonly specified for economic growth (Barro and Sala-i-Martin, 1995). This paper investigated the effects of health indicators such as adult survival rates (ASR) on economic growth rates at 5-year intervals in the period 1965-90 in developed and developing countries. Although the health of individuals in a country can only be roughly approximated in national averages, the models showed significant effects of adult

survival rate (ASR) on economic growth for low income countries. Thus, for example, for the poorest countries, a 1% change in ASR was associated with an approximate 0.05% increase in growth rate. While the magnitude of this coefficient was small, a similar increase of 1% in investment/GDP ratio was associated with a 0.014% increase in growth rate. An important finding of this study was that the economic performance of developing countries could conceivably be enhanced by improving health of the citizens. However, the study states that "it is important that future research compile more elaborate data on health indicators…Analyses based on elaborate data sets would afford sharper insights into the likely impact of health on economic growth".

Another important factor to consider is the finding that health differences are not large enough to account for much of the cross-country difference in incomes, and that the variations in political, economic, and social institutions are more central factors (Journal of the European Economic Association, Papers and Proceeding, 2003). It is argued that health does not have a direct effect on growth but serves in growth regressions as a proxy for the pattern of European settlement, which was more successful in countries with a low burden of infectious disease. This paper argues that the main impact of disease environments on the economic development of nations is not due to a direct effect of health conditions on income but rather because of the indirect effect via institutions (Acemoglu 2003).

Micro economists have identified a production function model of aggregate economic growth that includes two variables that are fundamental components of human capital: work experience and health (Bloom, Canning and Sevilla, 2004). They construct a panel of countries observed every 10 years from 1960 to 1990. The study uses real per capita GDP, labor supply, schooling,

life expectancy, work experience, capital stock, and creates a variable for institutional quality. The main result is that good health has a positive, sizable, and statistically significant effect on aggregate output even when experience of the workforce is controlled for. It suggests that a one-year improvement in a population's life expectancy contributes to an increase of 4% in output. This is a relatively large effect, indicating that increased expenditures on improving health might be justified purely on the grounds of their impact on labor productivity, quite apart from the direct effect of improved health on welfare. While this supports the case for investments in health as a form of human capital, the study is not able to distinguish in its analysis between the effects of different types of health investments that affect different groups within the population (Bloom 2004).

Over time, this line of research is followed specifically by Bloom up to the current relevance of the noncommunicable disease crisis. A dynamic production function model is calibrated to assess how noncommunicable diseases (NCDs) will affect U.S. productive capacity in 2015–2050 (Chen, Kuhn, Prettner, Bloom 2018). In this framework, aggregate output is produced according to a human capital–augmented production function that accounts for the effects of projected disease prevalence. NCDs influence the economy through the following pathways: 1) When working-age individuals die of a disease, aggregate output undergoes a direct loss because physical capital can only partially substitute for the loss of human capital in the production process. 2) If working-age individuals suffer from a disease but do not die from it, then, depending on the condition's severity, they tend to be less productive, might work less, or might retire earlier. 3) Current NCD interventions such as medical treatments and prevention require substantial resources. Part of these resources could otherwise be used for productive investments in infrastructure, education, or research and development. This implies a loss of savings across

the population and hampers economy-wide physical capital accumulation. The results indicate a total loss of 94.9 trillion United States dollars due to all NCDs. Mental health conditions and cardiovascular diseases impose the highest burdens, followed by cancer, diabetes, and chronic respiratory diseases. In per capita terms, the economic burden of all NCDs in 2015–2050 is 265,000 United States dollars. The total NCD burden roughly corresponds to an annual tax rate of 10.8% on aggregate income. (Chen, Kuhn, Prettner, Bloom 2018).

With a push from the U.N. General Assembly in 2011, more empirical research was conducted to analyze the impact of noncommunicable disease on economic growth. The current opportunities and challenges facing policy makers include “balancing the need to address a growing NCD problem with the need to finish the current infectious disease agenda; deciding how an individual country may best contribute to global NCD efforts while handling the crisis domestically; supporting further research into the risk factors and drivers behind NCDs and accelerating research into and implementation of innovative solutions that address these risk factors and strengthen the capacity of health systems to respond to NCDs; and addressing trade and intellectual property concerns in order to buttress continuing NCD research and development efforts while expanding the availability of and affordable access to NCD medicines, diagnostics, and treatments in developing countries” (Global Action Plan for the Prevention and Control of NCDs 2013-2020). In order to address the current issue presented by the UN, this study will mirror the production function model previously identified by David Bloom; however, the variables of communicable and noncommunicable disease will be used as indirect proxies for health in determining economic growth.

Theoretical Model

The neoclassical growth accounting model – the Solow-Swan's growth model is applied for the estimations in this paper. The Solow Growth Model expands upon the Cobb Douglas relationship which expresses a country's output as a function of its inputs, or factors of production, and the efficiency with which it uses these inputs. The Solow Growth Model is an exogenous model of economic growth that analyzes changes in the level of output in an economy over time as a result of changes in the population growth rate, the savings rate, and the rate of technological progress. In addition, the relationship between the aggregate of all citizen's human capital and the output of a nation was also found to be significant (Mincer, 1984). Human capital is positively connected to economic growth since investment tends to boost productivity. The process of educating a workforce is a type of investment, but instead of capital investment such as equipment, the investment is in human capital. In 1992 economists Mankiw, Romer & Weil (1992) show that a simple neoclassical model can explain up to 80% of the cross-country variation in the log of per capita GDP, especially if it incorporates differences in human capital investment across countries.

Empirical Model

The standard for development in this paper will be the level of a nation's per capita GDP. Countries with relatively high per capita GDPs are included in the more developed cohort and countries with relatively low per capita GDP are included in the less developed cohort.

$$1)\ Y = \beta_0 + \beta_1 X_t + u$$

Equation (1) is an OLS regression where Y represents the log of per capita GDP, β_0 represents an intercept term, and X_t is a matrix of explanatory variables. In the case of this study the primary variables of interest are communicable disease and noncommunicable disease. Additionally, it will be interesting to see the effects of the openness of an economy measured by trade. $\beta_1$represents vectors of the coefficients of the $X_t$explanatory variable matrix, and u represents the error term. All data for this regression is drawn from the World Bank's World Development Indicators. The total investment measure was created by adding net investments in nonfinancial assets to net investment in portfolio assets. This total investment was then divided by total GDP in order to create a measure for the share of GDP constituted in investment. This measure is referred to as $\left(\frac{INVEST}{GDP}\right)$. In addition, using the method of taking the natural log transformation of an equation creates a linear pattern in the parameters and hence an ordinary least squares regression model is used to minimize the sum of the squared residuals.

2) $lnGPPPC = \beta_0 + \beta_1 \ln\left(\frac{INVEST}{GDP}\right)_t + \beta_2\, lnLabor_t + \beta_3 lnEdu + \beta_4 lnLife + \beta_5 lnNCD + \beta_6 lnCD + \beta_7 lnTrade + u$

Where the variable "$INVEST$ " is the total investment, or net investments in nonfinancial assets added to net investment in portfolio assets. The variable "$\left(\frac{INVEST}{GDP}\right)$" is the measure for the share of GDP constituted in investment. The variable "$Labor$" is the total labor force. The variable "Edu" is the educational attainment for the population aged 15 and over. It is calculated as a percentage of the population with completed secondary schooling. The variable "$Life$" is life expectancy at birth, measured in total years. The variable "NCD" is the total number of

noncommunicable diseases and the variable "CD" is the total number of communicable diseases. The variable "$Trade$" is the measured effects of an open economy. This variable is measured as a percentage of GDP by adding the percentage of exports of goods and services with the percentage of imports of goods and services. Given previous literature, it is predicted that coefficients for all signs except for communicable and noncommunicable will be positive. In statistics, positive correlation describes the relationship between two variables that change together, while an inverse correlation describes the relationship between two variables which change in opposing directions. This relationship is measured by the correlation coefficient "r", while the square of this figure "R-squared" indicates the degree to which variation in one variable is related to the other. In the case of Beta 2, Beta 3, and Beta 4 as more people work, are educated to perform at higher capacities, and live longer life spans, gross domestic product per capita will move in a similar positive direction. In other words, positive correlation is a form of dependency, where a shift in one variable means a change is likely in the other, or that certain known variables produce specific results. Beta 1 and Beta 7 will have the same positive correlation as greater financial investments are made within a country and the amount of buying and selling of goods and services increases over time. On the other hand, disease and ill health have a negative impact on human welfare and therefore an adverse impact on economic growth. This will be found in Beta 5 and Beta 6.

Data

The neoclassical growth accounting model – the Solow-Swan's growth model is applied for the estimations in this paper. This paper uses an aggregate production function that expresses a country's output as a function of its inputs and the efficiency with which it uses these inputs. These inputs are physical capital, labor, and human capital in the dimensions of education, and health. In 1962 Gary Becker accounts for education having an impact on human capital and this variable is directly added into the model to control for this effect. To obtain measures of the relative contributions of each of the inputs on economic growth, all the parameters of this production function are estimated using a panel data set with observations from the years 2000 and 2010 and cross-sectional units of 134 countries (See APPENDIX). These parameters were limited by the available data reported for communicable and noncommunicable disease. The purpose of the regression will be to minimizing the sum of squared errors from the data. All data variables used are outlined in the Summary Statistics section of the results (TABLE 1). Given poverty found in low and middle income countries increases the risk of death and disability, this model divides the countries by income level to show if the same coefficients for the variables changed on any level and if statistically insignificant variables remained insignificant.

RESULTS

TABLE 1: SUMMARY STATISTICS					
Variable	**Description**	**Mean**	**Std Dev**	**Minimum**	**Maximum**
CD	Communicable diseases (Total)	5068.10	21191.95	1.5000000	277854.60
NCD	Noncommunicable diseases (Total)	6005.37	20196.53	12.5000000	178048.80
EDU	Educational Attainment for Population Aged 15 and Over: (Percentage) of the population with completed secondary schooling	7.3369403	6.4259377	0	30.0000000
LABOR	Labor force, total	20349450.66	76464575.77	35469.00	779956733
LIFE	Life expectancy at birth, total (years)	69.6159335	9.2842079	38.7020000	82.8426829
TRADE	EXPORT + IMPORT	81.0393447	52.7486629	0	369.6855558
GDPPC	Gross Domestic Product Per Capita	11308.68	16309.36	0	104965.31
INVEST	INVEST Net investment in nonfinancial assets (% of GDP) + Portfolio Investment, (% of GDP)	1.7247017	2.6710031	-2.9709612	23.4668536

TABLE 2: OLS				
[Parameter Estimate] **(Standard Error)** **{t Value}** **Pr > |t|**				
Variable				
	ALL	**LOWER+ LOWER MIDDLE COUNTRIES**	**UPPER MIDDLE + HIGH INCOME COUNTRIES**	**HIGH INCOME COUNTRIES**
Intercept	7.37845 3.37885 2.18 0.0301	7.87016 5.24165 1.50 0.1382	-0.22032 4.88680 -0.05 0.9641	-35.58971 11.75485 -3.03 0.0033
lnLIFE	-0.18871 0.65002 -0.29 0.7719	0.02339 1.02385 0.02 0.9818	0.46420 0.73301 0.63 0.5276	0.35408 0.78155 0.45 0.6517
lnLABOR	0.00684 0.04694 0.15 0.8843	0.01830 0.40544 0.05 0.9641	1.57898 0.75084 2.10 0.0372	9.43906 2.57039 3.67 0.0004
lnEDU	0.13389 0.07868 1.70 0.0903	-0.25732 0.27536 -0.93 0.3536	-0.14818 0.20253 -0.73 0.4656	0.82126 0.29835 2.75 0.0073
lnNCDD	0.63230 0.34047 1.86 0.0647	-0.06063 0.07489 -0.81 0.4212	0.00232 0.05313 0.04 0.9653	0.00429 0.05713 0.08 0.9403
lnCDD	-0.59496 0.14743 -4.04 <.0001	0.00226 0.13015 0.02 0.9862	0.15014 0.08693 1.73 0.0863	0.15409 0.10356 1.49 0.1406
lnINVEST	0.09471 0.02812 3.37 0.0009	0.06054 0.03378 1.79 0.0779	0.13573 0.03797 3.57 0.0005	0.08107 0.06708 1.21 0.2303
lnTRADE	0.12902 0.15222 0.85 0.3976	0.22743 0.28979 0.78 0.4355	0.14184 0.16070 0.88 0.3789	-0.00516 0.18417 -0.03 0.9777
R-Squared	0.4563	0.1725	0.3031	0.2627
Adj R-Squared	0.4385	0.0805	0.2690	0.1998
RMSE	1.12468	0.94164	1.05087	0.94141

Number of Observations	222	71	151	90

The number of observations is for all countries is 222, with countries grouped as 71 lower and lower middle-income countries, 151 upper middle- and higher-income countries, and 90 high-income countries. When consulting the results of the model, we find that the best R-Squared value is with all countries combined (0.4563). The adjusted R-squared has been adjusted for the number of predictors in each model signifying that approximately 44 percent of the variance for the dependent variable GDPPC is explained by the independent variables. The root mean square error of the estimator (1.12468) measures a high average of the squares of the errors, or a larger than desired average squared difference between the estimated values and the actual value. That means that the average error for the predicted dependent variable was incorrect by 1.12468.

All of the coefficients predicted were correct expect for life expectancy and noncommunicable disease. The variable for life expectancy was found to have a contradictory negative coefficient, however it was found to be statistically insignificant in all models and can be disregarded. Although communicable disease shows a negative impact on GDP per capita(-0.59496), GDP per capita also shows a positive change in the response associated with a one-unit change of the predictor non communicable disease (0.63230). This could be due to a two-way casual relationship between the two variables as a higher growth rate leads to more prevalence of noncommunicable disease. This could be an undesired effect from modeling the relationship as linear when it may in fact be nonlinear. Although it is interesting to note that the one time the variable of noncommunicable disease appears negative is when it is estimated in lower and lower middle-income countries. High rates of NCDs in low- and middle-income countries perpetuate poverty, strain economic development, and burden fragile health systems, making these countries

less resilient when emergencies like infectious disease outbreaks or natural disasters occur. Even though this model contains an issue with reverse causality it is interesting that this section of the results still appears as the predicted value of negative.

Trade, Investment, Education, and Labor all carry the predicted positive correlation and observe the positive effects that the openness of an economy has on GDP per capita within a Solow framework by adding the trade variable. The variables for communicable disease and investment are of particular interest as has these two variables are of the highest statistical significance and correlate best as explanatory variables for GDPPC. The t value for communicable disease is -4.04 and the t value for investment is 3.37 which measures the size of the difference relative to the variation in the sample data used. The greater the magnitude of the t value, the greater the evidence against the null hypothesis that that there is no significant difference between specified populations, any observed difference being due to sampling or experimental error. Communicable disease has a t value that is less than negative 2 and investment has a t value that is greater than positive 2 which indicate greater confidence in the coefficient as an accurate predictor.

CONCLUSION

In this paper, a regression model was estimated to see if noncommunicable and communicable disease had a negative impact on economic growth, and if so, which disease had the greater impact. The purpose of this study was to guide political action in expenditure for global disease prevention. This model focused on physical capital, labor, and human capital in the dimensions of education, and health as explanatory factors for economic growth. The results showed that communicable disease had the greatest negative impact on a country's economic output per person. Although there may be limitations to this study that prevented the most accurate results from being presented. In this case, not only did the key regressor of GDPPC have a causal effect on the dependent variable of noncommunicable disease, but a casual effect runs in the other direction from the dependent variable to the same regressor too. This can be avoided in future studies by running a more advanced regression that accounts for reverse causation between the two variables.

Although these limitations skewed certain aspects of the study, it can be concluded that investment has a significant and positive correlation to economic growth. Indicating that overall, the global burden of disease can to some extent be avoided through investing in evidence informed health promotion or disease prevention interventions within and beyond the health system. There is a substantial evidence base suggesting that many health promotion and disease prevention interventions, delivered within the health system as well as in partnership with other sectors, are highly cost-effective. Despite this evidence, the level of investment in health promotion and disease activities remains stubbornly low in many countries (McDaid). Ministries

of health as well as ministries of finance can play pivotal roles in increasing investment within and outside the health system; More evidence should be generated on the economic benefits of interventions with short, as well as mid and long-term returns on investment. Return on investment models can be used, alongside conventional economic evaluation methods, to communicate economic costs and benefits to different sectors over different time scales. And as the limitations of this study are overcome in future studies, the impact of communicable disease and noncommunicable disease on economic growth can be used as determining factors in the investment process.

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APPENDIX A: COUNTRIES

CODE	NAME	INCOME GROUP	REGION
1. ALB	Republic of Albania	Upper middle income	Europe & Central Asia
2. DZA	People's Democratic Republic of Algeria	Upper middle income	Middle East & North Africa
3. ARG	Argentine Republic	Upper middle income	Latin America & Caribbean
4. ARM	Republic of Armenia	Upper middle income	Europe & Central Asia
5. AUS	Commonwealth of Australia	High income	East Asia & Pacific
6. AUT	Republic of Austria	High income	Europe & Central Asia
7. BHR	Kingdom of Bahrain	High income	Middle East & North Africa
8. BGD	People's Republic of Bangladesh	Lower middle income	South Asia
9. BRB	Barbados	High income	Latin America & Caribbean
10. BEL	Kingdom of Belgium	High income	Europe & Central Asia
11. BLZ	Belize	Upper middle income	Latin America & Caribbean
12. BEN	Republic of Benin	Low income	Sub-Saharan Africa
13. BTN	Kingdom of Bhutan	Lower middle income	South Asia
14. BRA	Federative Republic of Brazil	Upper middle income	Latin America & Caribbean
15. BRN	Brunei Darussalam	High income	East Asia & Pacific
16. BGR	Republic of Bulgaria	Upper middle income	Europe & Central Asia
17. KHM	Kingdom of Cambodia	Lower middle income	East Asia & Pacific
18. CAN	Canada	High income	North America
19. CAF	Central African Republic	Low income	Sub-Saharan Africa
20. CMR	Republic of Cameroon	Lower middle income	Sub-Saharan Africa
21. CHL	Republic of Chile	High income	Latin America & Caribbean
22. CHN	People's Republic of China	Upper middle income	East Asia & Pacific
23. COL	Republic of Colombia	Upper middle income	Latin America & Caribbean
24. COG	Republic of Congo	Lower middle income	Sub-Saharan Africa
25. CRI	Republic of Costa Rica	Upper middle income	Latin America & Caribbean
26. CIV	Republic of Côte d'Ivoire	Lower middle income	Sub-Saharan Africa
27. HRV	Republic of Croatia	High income	Europe & Central Asia
28. CYP	Republic of Cyprus	High income	Europe & Central Asia
29. CZE	Czech Republic	High income	Europe & Central Asia
30. DNK	Kingdom of Denmark	High income	Europe & Central Asia
31. DOM	Dominican Republic	Upper middle income	Latin America & Caribbean
32. ECU	Republic of Ecuador	Upper middle income	Latin America & Caribbean
33. EGY	Arab Republic of Egypt	Lower middle income	Middle East & North Africa
34. SLV	Republic of El Salvador	Lower middle income	Latin America & Caribbean
35. EST	Republic of Estonia	High income	Europe & Central Asia
36. FJI	Republic of Fiji	Upper middle income	East Asia & Pacific
37. FIN	Republic of Finland	High income	Europe & Central Asia
38. FRA	French Republic	High income	Europe & Central Asia

39. GAB	Gabonese Republic	Upper middle income	Sub-Saharan Africa
40. GMB	Republic of The Gambia	Low income	Sub-Saharan Africa
41. DEU	Federal Republic of Germany	High income	Europe & Central Asia
42. GRC	Hellenic Republic	High income	Europe & Central Asia
43. GTM	Republic of Guatemala	Upper middle income	Latin America & Caribbean
44. GUY	Co-operative Republic of Guyana	Upper middle income	Latin America & Caribbean
45. HTI	Republic of Haiti	Low income	Latin America & Caribbean
46. HND	Republic of Honduras	Lower middle income	Latin America & Caribbean
47. HUN	Hungary	High income	Europe & Central Asia
48. ISL	Republic of Iceland	High income	Europe & Central Asia
49. IND	Republic of India	Lower middle income	South Asia
50. IDN	Republic of Indonesia	Lower middle income	East Asia & Pacific
51. IRN	Islamic Republic of Iran	Upper middle income	Middle East & North Africa
52. IRQ	Republic of Iraq	Upper middle income	Middle East & North Africa
53. IRL	Ireland	High income	Europe & Central Asia
54. ISR	State of Israel	High income	Middle East & North Africa
55. ITA	Italian Republic	High income	Europe & Central Asia
56. JAM	Jamaica	Upper middle income	Latin America & Caribbean
57. JPN	Japan	High income	East Asia & Pacific
58. JOR	Hashemite Kingdom of Jordan	Upper middle income	Middle East & North Africa
59. KAZ	Republic of Kazakhstan	Upper middle income	Europe & Central Asia
60. KEN	Republic of Kenya	Lower middle income	Sub-Saharan Africa
61. KOR	Republic of Korea	High income	East Asia & Pacific
62. KWT	State of Kuwait	High income	Middle East & North Africa
63. KGZ	Kyrgyz Republic	Lower middle income	Europe & Central Asia
64. LAO	Lao People's Democratic Republic	Lower middle income	East Asia & Pacific
65. LVA	Republic of Latvia	High income	Europe & Central Asia
66. LSO	Kingdom of Lesotho	Lower middle income	Sub-Saharan Africa
67. LBR	Republic of Liberia	Low income	Sub-Saharan Africa
68. LBY	Socialist People's Libyan Arab Jamahiriya	Upper middle income	Middle East & North Africa
69. LTU	Republic of Lithuania	High income	Europe & Central Asia
70. LUX	Grand Duchy of Luxembourg	High income	Europe & Central Asia
71. MWI	Republic of Malawi	Low income	Sub-Saharan Africa
72. MYS	Malaysia	Upper middle income	East Asia & Pacific
73. MDV	Republic of Maldives	Upper middle income	South Asia
74. MLI	Republic of Mali	Low income	Sub-Saharan Africa
75. MRT	Islamic Republic of Mauritania	Lower middle income	Sub-Saharan Africa
76. MEX	United Mexican States	Upper middle income	Latin America & Caribbean
77. MDA	Republic of Moldova	Lower middle income	Europe & Central Asia
78. MNG	Mongolia	Lower middle income	East Asia & Pacific
79. MAR	Kingdom of Morocco	Lower middle income	Middle East & North Africa
80. MOZ	Republic of Mozambique	Low income	Sub-Saharan Africa
81. MMR	Republic of the Union of Myanmar	Lower middle income	East Asia & Pacific

82. MUS	Republic of Mauritius	Upper middle income	Sub-Saharan Africa
83. MLT	Republic of Malta	High income	Middle East & North Africa
84. NAM	Republic of Namibia	Upper middle income	Sub-Saharan Africa
85. NPL	Nepal	Low income	South Asia
86. NLD	Kingdom of the Netherlands	High income	Europe & Central Asia
87. NZL	New Zealand	High income	East Asia & Pacific
88. NIC	Republic of Nicaragua	Lower middle income	Latin America & Caribbean
89. NER	Republic of Niger	Low income	Sub-Saharan Africa
90. NOR	Kingdom of Norway	High income	Europe & Central Asia
91. PAK	Islamic Republic of Pakistan	Lower middle income	South Asia
92. PAN	Republic of Panama	High income	Latin America & Caribbean
93. PNG	The Independent State of Papua New Guinea	Lower middle income	East Asia & Pacific
94. PRY	Republic of Paraguay	Upper middle income	Latin America & Caribbean
95. PER	Republic of Peru	Upper middle income	Latin America & Caribbean
96. PHL	Republic of the Philippines	Lower middle income	East Asia & Pacific
97. POL	Republic of Poland	High income	Europe & Central Asia
98. PRT	Portuguese Republic	High income	Europe & Central Asia
99. QAT	State of Qatar	High income	Middle East & North Africa
100. ROU	Romania	Upper middle income	Europe & Central Asia
101. RUS	Russian Federation	Upper middle income	Europe & Central Asia
102. RWA	Republic of Rwanda	Low income	Sub-Saharan Africa
103. SAU	Kingdom of Saudi Arabia	High income	Middle East & North Africa
104. SEN	Republic of Senegal	Lower middle income	Sub-Saharan Africa
105. SRB	Republic of Serbia	Upper middle income	Europe & Central Asia
106. SLE	Republic of Sierra Leone	Low income	Sub-Saharan Africa
107. SGP	Republic of Singapore	High income	East Asia & Pacific
108. SVN	Republic of Slovenia	High income	Europe & Central Asia
109. ZAF	Republic of South Africa	Upper middle income	Sub-Saharan Africa
110. ESP	Kingdom of Spain	High income	Europe & Central Asia
111. LKA	Democratic Socialist Republic of Sri Lanka	Upper middle income	South Asia
112. SDN	Republic of the Sudan	Lower middle income	Sub-Saharan Africa
113. SWE	Kingdom of Sweden	High income	Europe & Central Asia
114. CHE	Switzerland	High income	Europe & Central Asia
115. SYR	Syrian Arab Republic	Low income	Middle East & North Africa
116. TJK	Republic of Tajikistan	Low income	Europe & Central Asia
117. TZA	United Republic of Tanzania	Low income	Sub-Saharan Africa
118. THA	Kingdom of Thailand	Upper middle income	East Asia & Pacific
119. TGO	Republic of Togo	Low income	Sub-Saharan Africa
120. TON	Kingdom of Tonga	Upper middle income	East Asia & Pacific
121. TTO	Republic of Trinidad and Tobago	High income	Latin America & Caribbean
122. TUN	Republic of Tunisia	Lower middle income	Middle East & North Africa
123. TUR	Republic of Turkey	Upper middle income	Europe & Central Asia
124. UGA	Republic of Uganda	Low income	Sub-Saharan Africa

125. UKR	Ukraine	Lower middle income	Europe & Central Asia
126. ARE	United Arab Emirates	High income	Middle East & North Africa
127. GBR	United Kingdom of Great Britain and Northern Ireland	High income	Europe & Central Asia
128. USA	United States of America	High income	North America
129. URY	Oriental Republic of Uruguay	High income	Latin America & Caribbean
130. VEN	República Bolivariana de Venezuela	Upper middle income	Latin America & Caribbean
131. VNM	Socialist Republic of Vietnam	Lower middle income	East Asia & Pacific
132. YEM	Republic of Yemen	Low income	Middle East & North Africa
133. ZMB	Republic of Zambia	Lower middle income	Sub-Saharan Africa
134. ZWE	Republic of Zimbabwe	Lower middle income	Sub-Saharan Africa