Normal and Abnormal Country Growth Behavior: Country Classification and Ranking

William R. DiPietro[*]

It is common to classify human behavior as normal or abnormal, but, what about economic behavior? What is a normal growth path for an economy over time? What is an erratic or eccentric growth path? In order to address these basic or primordial questions, eight possible growth states are defined. The countries in the world are classified into these growth states in each of six five-year periods beginning in 1967 and ending in 1996. Provided all the data is available, the results yield a growth path for every country with a total of five transitions from state to state. Employing the data further, conditional relative frequencies of going from one state to another are computed. The conditional relative frequencies are then used to rate the chances of a country walking down its own particular observed state growth path. Countries growth paths are then ranked from normal to abnormal for the entire thirty years based on these ratings.

I. Introduction

What is meant by normal economic growth for a country? Is there such a thing as a normal growth path? From the very beginnings of economics, economists have been acutely interested in economic growth and in the reasons for variations in economic growth both within and across countries. The Classical economists, Smith, Malthus, and Ricardo were interested in economic growth. The literature on economic growth is comprehensive and extensive and would probably take several lifetimes of readings to even begin to adequately do it any kind of justice. Some believe in convergence, others do not. Some believe in endogenous growth theory, others firmly adhere to the standard neoclassical growth model. Some economists theorize that differences in growth rates are due to differences in technology and in the quantity and quality of the factors of production. Others assign greater weight to institutional and cultural factors. Econometrics has been extensively employed in attempting to assess the relative importance of the various factors once other important dimensions have been taken into account.

It is not uncommon for scientists to approach problems from out of the box. This means to look at a problem anew from a completely different angle. This is the approach taken within this paper. The idea was to start cold and to see what could be said about economic growth across countries.

The first thing that came to mind was to focus the analysis on recent growth data. For the first time in history, thirty consecutive years of growth data are available for a large

* Daemen College, 4380 Main St, Amherst, NY 14226-3592, U.S.A.

number of countries across the world. What could be said about economic growth by looking solely at this data?

The second was to consider growth as an evolutionary process. An evolutionary process is something that occurs in time.

Finally, the third was to consider country behavior as one does other forms of behavior. In medicine, one can speak of a normal progression of a disease. In human behavior, one can readily identify normal from abnormal behavior. The stars in the heavens go through normal stages. What about an economy? What do we mean by a typical growth path for an economy?

Out of all this came the goal of trying to classify country behavior from normal to abnormal. The fundamental purpose of this paper is to rate and rank the growth behavior of countries from normal to abnormal for the thirty-year period from 1967 to 1996. As already stated, this represents a span of time for which growth data is widely available for a large number of countries across the world.

The article is split into five sections. Section II defines eight growth states and classifies the individual countries of the world into one of the states for each consecutive five-year period running from 1967 through 1996. Section III discusses the relative frequency or relative occurrence of the observed growth states for the countries. This provides an overall picture of which growth states are more prevalent, of which growth states are more rare. The third section, Section IV, starts to get into the meat of the matter with regard to growth behavior. Section IV computes the average conditional relative frequency of moving from one state to another. Using these conditionals, likely and unlikely state sequences for five state transitions are discussed. Section V shows the primary outcome of the analysis. For each country it shows its growth state sequence, its growth normality rating, and its growth normality ranking. The normality ratings are based on the conditionals of Section IV. The normality rankings are a straightforward application of the normality ratings. Lastly, Section VI ends with some concluding remarks.

II. The Growth State Classification

The analysis begins by collecting data on real per capita growth for the thirty-year period from 1967 through 1996. The source of this growth data is World Development Indicators on CD-ROM of the Development Data Group of the World Bank. It is their series entitled GNP per capita growth and is defined as the annual growth of GNP per capita based on constant 1987 local currency. If and when it exists, The World Bank reports growth data for its list of two hundred and eleven countries throughout the world. Everyone who has ever worked with international data knows well that missing data is an ever-present problem. The year 1967 is chosen as a staring point strictly for primordial data reasons. This happens to be the year when data on real per capita growth becomes widely available for a substantial number of countries.

The thirty years of international growth data are split into six five year periods, 1967-1971, 1972-1976, 1977-1981, 1982-1986, 1987-1991, and 1992-1996. For each of the five-year periods the average and the standard deviations of real per capital growth are computed for each country. Using these computations, every country is classified into eight possible growth states for every one of the six time periods. Table 1 shows the eight potential

growth states.

Table 1   Growth States

(A) High Positive Growth, Low Standard Deviation of Growth
(B) High Positive Growth, High Standard Deviation of Growth
(C) Low Positive Growth, Low Standard Deviation of Growth
(D) Low Positive Growth, High Standard Deviation of Growth
(E) Low Negative Growth, Low Standard Deviation of Growth
(F) Low Negative Growth, High Standard Deviation of Growth
(G) High Negative Growth, Low Standard Deviation of Growth
(H) High Negative Growth, High Standard Deviation of Growth

The threshold numbers for classifying the countries into growth states are positive three, zero, and negative three for the growth rates, and approximately seven and three tenths for the standard deviation of the growth rate.[1] There is nothing really sacrosanct about these numbers. The growth rate cut-off values were selected after looking over the yearly growth rates for all the countries for the entire thirty-year period to see what seemed reasonable. As growth rates can be and are often times both positive and negative the split at zero seemed natural. Once three percent was selected on the positive side, negative three percent was selected on the negative side in order to make the classification symmetric around zero. Similarly, the growth rate standard deviation cut-off of approximately seven and three tenths was selected after computing the standard deviation of growth for the two hundred and ten countries in the World Bank data set for which data was available over the entire thirty year period and picking a number which seemed fairly reasonable.

A country will be in State A, high positive growth and low standard deviation of growth, for a period, if its average growth in per capita income during the period is greater than or equal to three percent and its standard deviation of growth in per capita income during the period is less than seven and three tenths. State B, high positive growth and high standard deviation of growth, exists when a country's average per capita growth for the period is greater than or equal to three percent and its standard deviation is greater than or equal to seven and three tenths. State C, low positive growth and low standard deviation of growth, occurs if a nation's growth in per capita income for a five year period is less than three but greater than or equal to zero percent and its standard deviation is below seven and three tenths. State D is identical to State C except that its standard deviation is greater than or equal to seven and three tenths. State E, low negative growth and low standard deviation of growth, is present when a country's per capital growth rate is less than zero, but greater than negative three percent, and its standard deviation is less than the benchmark level of seven and three tenths. State F is State E's counterpart with its standard deviation greater than or equal to seven and three tenths. State G, high negative growth and low standard deviation of growth, prevails when a country's growth rate is less than or equal to negative three percent and its standard deviation is less than seven and three tenths. Finally, State H, high negative

---

1. The exact number used for the standard deviation of growth is 7.284.

growth and high standard deviation of growth, exists when a nation's per capita income growth is equal to or less than negative three percent and its standard deviation of per capita income growth is greater than or equal to seven and three tenths.

III. The Relative Frequency of Growth State

Table 2 shows the relative frequency of the various states for the entire thirty years. Since there are six five-year periods between 1967 and 1996, there are six potential observations per country if data is available for a country for the entire thirty years. There are two hundred and ten countries listed in the World Bank data set. This yields a total of eight hundred and sixty possible observations. However, data limitations are prevalent. The data is so incomplete for some countries that not a single growth state can be computed for these countries. In the end, we are left with a total of seven-hundred eighty-eight observations of different countries in different states in the six five year periods between 1967 and 1996.[2]

Table 2   Relative Frequency of States

State	Relative Frequency
A	.2538 (200/788)
B	.0546 (43/788)
C	.3629 (286/788)
D	.0393 (31/788)
E	.1536 (121/788)
F	.0419 (23/788)
G	.0508 (40/788)
H	.0432 (34/788)

Looking at the table, the most common state was State C, followed by State A, and State E. The chances of a country being in state C, experiencing low positive growth and low standard deviation of growth, in one of the six five year periods was over thirty six percent, that of being in State A, of high positive growth and low standard deviation of growth, was over twenty five percent, and that of State E, of low negative growth and low standard deviation of growth, was a little over fifteen percent. In all, there was around a seventy seven percent chance of a country falling in one of the three most popular states in one of the six five year periods.

Except for the commonly occurring states, state A, state C, and State E, all of the other states are almost equally rare. The rarest of the rare states were States D and H. The chances of a country falling into State D of low positive growth and high standard deviation of growth was a little less than four percent, while that of a country falling into State H with high negative growth and a high standard deviation of growth was a bit over four percent.

---

2. The number of observations (states) for any given country from a minimum of zero to a maximum of six can be obtained by perusing columns one and two of Table 5. For instance, there are no observations for Afghanistan, one for Azerbaijan, and three for Bahrain.

The combined total for a country falling into one of these two least likely states during the thirty years was somewhat over eight percent.

As a rule, low variance states tended to dominate high variance states. The cumulative relative frequency of low variance states was a little over eighty two percent, while the cumulative relative frequency for high variance states was a bit less than eighteen percent.

In general, one can say that positive growth states were much more prevalent than negative growth states. Regardless of the standard deviation of growth, the cumulative relative frequency of a country falling into any of the four positive growth states was a bit over seventy one percent, while, in comparison, the cumulative relative frequency of a country falling into one of the four negative growth states was a bit less than twenty nine percent.

IV. The Average Conditional Relative Frequencies

Table 3 shows the average one step conditional relative frequencies. For the six five year periods the conditional relative frequency for every one of the states given every one of the other states moving from one period to the next were obtained. For any given particular state transition from one period to another there will be five conditional relative frequencies for the six five year periods. It is the average of these conditionals that is reported in Table 3. For example, the conditional relative frequency of moving from State A for the first five year period, 1967 to 1971, to State A for the second five year period, 1972 to 1976, was 21 out of 42. The conditional relative frequency of moving from State A for the second five-year period, 1972 to 1976, to State A for the third five year period, 1977 to 1981, was 18 out of 40. Similarly, the conditional relative frequency of moving from State A to State A for the third five year period to the fourth, for the fourth to the fifth, for the fifth to the sixth were respectively 14 out of 36, 13 out of 25, and 14 out of 26. This gives an average one step relative frequency of moving from State A to State A for the entire thirty years of .4734 [=(21+18+14+13+14)/(42+40+35+25+26)].

Table 3   Average One Step Conditional Relative Frequencies

	F(A)	F(B)	F(C)	F(D)	F(E)	F(F)	F(G)	F(H)
A	.4734	.0296	.2959	.0178	.1065	.0178	.0473	.0118
B	.2564	.1529	.2821	.0513	.0256	.1282	.0256	.0769
C	.1652	.0179	.5536	.0223	.1607	.0134	.0357	.0313
D	.1667	.0883	.1250	.0833	.3333	.0833	.0833	.0417
E	.0745	.0532	.3830	.0106	.2553	.0851	.0745	.0638
F	.1786	.0357	.2857	.0714	.1786	.1429	.0714	.0357
G	.0357	.0714	.2857	.2143	.1429	.0357	.1071	.1071
H	.1000	.1500	.0500	.0500	.2000	.1000	.1000	.2500

Now, what are we going to define as a normal growth path for a country? A country follows a normal growth path when a country grows through a sequence of most likely transitions. On the other hand, a country that moves through a sequence of least likely transitions follows an abnormal growth path.

What are the most likely growth paths taken by economies from different starting

states according to the empirical average one step relative frequencies of Table 3? Starting at State A, for five transitions, the most likely path is AAAAAA. Similarly, consecutively using the remaining states alphabetically as starting points, the most likely five step paths are BCCCCC, CCCCCC, DECCCC, ECCCCC, FCCCCC, GCCCCC, and HHHHHH. Countries following these paths are engaging in typical or normal growth behavior. States A, C, and H tend to go to themselves, while the other states are more prone to switch states. Six of the eight potential starting states end up in State C, the state with low positive growth and low standard deviation of growth, when following a path of normal economic development, that is, when following the most likely growth path. One might say that normal growth generally leads an economy to the most common Growth State (State C). While most of the most well trodden growth paths lead to the most normal state of State C, sometimes very likely behavior can lead to superior performance, the AAAAAA case, while in other cases it can lead to very poor performance, the HHHHHH case. Thus, normal growth can be average, very healthy, or very unhealthy. When a country is in a normal growth path such as AAAAAA resulting in superior performance, then everything should be done to maintain this path and nothing should be done to upset the status quo, while, on the other hand, when a country is in what might be called a normal growth path rut such as the growth path HHHHHHH some sort of policy or institutional change is needed to jar the economy onto a new growth trajectory.

In contrast, eight of the least likely paths taken by economies (there typically is more than one least likely path for any given starting state because of ties in the conditional relative frequencies) are AHCFHC, BEDHCF, CFBGAH, DHCFBG, EDHCFH, FBEDHC, GAHCFB, and HCFHCF. Any real world economy traversing one of these unlikely growth paths must be considered highly abnormal. They deserve close scrutiny and investigation to uncover what forces, whether institutional, structural, cultural, political, or some other, are behind the economy's unusual behavior.

Table 3 readily identifies where an economy is most likely to go in the next period given its current state, and, at the same time, where it is least likely to go in the next period given its current state. From State A an economy is most likely to move to State A in the next period, followed by State C, State E, State G, State B, State D or State F, and State H. Similarly, the outcomes, from most likely to least likely starting from State B would be State C, State A, State B, State F, State H, State D, and State E or State G. The results for all the states are summarized in Table 4.

Table 4   Most Likely to Least Likely Next State from Initial State for One Period Transition

Initial State	Next State							
A	A	C	E	G	B	D or	F	H
B	C	A	B	F	H	D	E or	G
C	C	A	E	G	H	D	B	F
D	E	A	C	B or	D or	F or	G	H
E	C	E	F	A or	G	H	B	D
F	C	A or	E	F	D or	G	B or	H
G	C	D	E	G or	H	B	F or	A
H	H	E	B	A or	F or	G	C or	D

Looking at Table 4 reveals that State C is the first most likely one step destination for five of the eight possible initial starting states. It occurs seven times as a destination in the four most likely next states. This is very impressive especially given the fact that the cumulative relative frequency for the four most likely next states from any given initial state is generally very high. For instance, the cumulative relative frequency for the four most likely next states beginning at State A is just a little less than eighty one percent and that beginning at State B is a little over seventy four percent. State A and State E are also very likely one step destinations. State A occurs as the first most likely next state once, the second most likely next step four times, and occurs as a next step destination for the four most likely next states seven times. State E, although it never appears as the first most likely next step, occurs as one of the four most likely next states starting from different initial states six times.

State H, on the other hand, appears to be one of the least likely destinations from any state except its own. It appears as one of the four least likely states six times and is the least likely one step destination when starting from four of the eight possible initial states. State D also appears to be an unlikely one step destination. It appears as a one step destination five times in the four least likely next states and as the least likely next state in two instances.

The other three states, State B, State D, and State G appear to be somewhere mixed. These states appear sometimes as a one step destination in the four most likely next states and other times appear in the four least likely groups.

V. Growth State Sequences, Normality Ratings, and Normality Rankings

The conditional relative frequencies of Table 3 are used to calculate normality ratings for each country for the thirty-year period from 1967 through 1996. The normality ratings in turn are used to generate normality rankings for the countries for the same period. A normality rating is an attempt to assess how common, typical, or normal the growth behavior of a country has been over the thirty-year period. It is computed simply by multiplying the conditional relative frequencies associated with a country's growth path. For instance, Algeria has the growth path DACCEE. It's normality rating is computed by multiplying F(A│D) times F(C│A) times F(C│C) times F(E│C) times F(E│E). Performing the required multiplication using the appropriate values from Table 3 one obtains a normality rating for Algeria of .00112. In general, the higher the normality rating for a country the more normal the country's growth path has been over the observed thirty year period, while the lower the country's normality rating the more abnormal has been a country's growth behavior over the thirty year period.

The normality ratings are computed only if the country has data available for at least four sequential states yielding at least three transitions for the thirty-year period. Otherwise it is not. In the case that a state does not have the full complement of five transitions, then the average of the existing conditional relative frequencies are used as the multiplication factor for the missing conditional relative frequencies in obtaining the normality ratings.

The normality ratings and rankings for all the countries are shown in Table 5. Column (1) lists the countries in alphabetical order. Column (2) shows a country's actual growth path for the six five-year periods for the thirty years from 1967 through 1996. Column (3) gives the normality rating and column (4) the normality rankings.

The normality ranking ranks countries on the basis of their normality ratings. The country with the highest normality rating (following the most normal growth path of all the countries) is ranked number one and countries with lower normality ratings are ranked accordingly with higher rank numbers. Therefore, the lower the rank number of a country the more normal it is behaving while the higher the rank number the more abnormal its growth behavior. Ties in country ranks occur when country ratings are equal.

Table 6, which follows Table 5, contains the same information as Table 5 but in a compressed and rearranged fashion. It excludes countries for which normality ratings have not been computed and lists countries in order of their normality ratings from highest to lowest.

Table 5   Country State Sequences, Normality Ratings, and Normality Rankings in Alphabetical Order by Countries

(1) Country	(2) State Seq	(3) Nrating	(4) Nrank
Afghanistan	#N/A	#N/A	
Albania	#N/A	#N/A	
Algeria	DACCEE	0.00112	34
American Samoa	#N/A	#N/A	
Andorra	#N/A	#N/A	
Angola	#N/A	#N/A	
Antigua and Barbuda	#N/A	#N/A	
Argentina	DCEEFA	7.79E-05	78
Armenia	AAACHH	0.000519	48
Aruba	#N/A	#N/A	
Australia	ACCCCA	0.008294	10
Austria	AACCCC	0.023766	5
Azerbaijan	XXXXXH	#N/A	
Bahamas	CHBAEX	1.74E-05	92
Bahrain	XXXHGX	#N/A	
Bangladesh	EFCCCC	0.004125	19
Barbados	AFBAEX	1.81E-06	109
Belarus	XXXXXG	#N/A	
Belgium	AACCCC	0.023766	5
Belize	AAAEAC	0.000526	47
Benin	EECCGC	0.000552	46
Bermuda	AAAGEX	0.000431	51
Bhutan	XXXABC	#N/A	
Bolivia	EAEGCC	9.35E-05	74
Bosnia and Herzegovina	#N/A	#N/A	
Botswana	BBAAAX	0.003	22
Brazil	AACCEC	0.004773	18
Brunei	#N/A	#N/A	
Bulgaria	XXXAFE	#N/A	

Table 5   (Continued)

(1) Country	(2) State Seq	(3) Nrating	(4) Nrank
Burkina Faso	CACCCE	0.002407	26
Burundi	XCCCCG	0.002569	25
Cambodia	#N/A	#N/A	
Cameroon	FCAAGE	0.000151	72
Canada	CACCCC	0.008294	10
Cape Verde	XXXXXH	#N/A	
Cayman Islands	#N/A	#N/A	
Central African Republic	CCECEE	0.001398	30
Chad	EEHBDF	1.04E-05	98
Channel Islands	#N/A	#N/A	
Chile	CGAFAA	1.92E-06	108
China	BCAAAA	0.004944	16
Colombia	CCCCCC	0.051997	1
Comoros	XXXCEE	#N/A	
Congo, Dem. Rep.	CEEEGG	8.36E-05	77
Congo, Rep.	CABDEG	6.23E-06	100
Costa Rica	ACEECC	0.004816	17
Cote d' Ivoire	ACBGGC	4.15E-06	104
Croatia	#N/A	#N/A	
Cuba	#N/A	#N/A	
Cyprus	XXAAAX	#N/A	
Czech Republic	XXXXEC	#N/A	
Denmark	CCCACC	0.008294	10
Djibouti	#N/A	#N/A	
Dominica	AGBAXX	1.35E-05	95
Dominican Republic	BACECA	0.000771	42
Ecuador	CBCECC	0.000172	67
Egypt, Arab Rep.	CAAAAA	0.008297	9
El Salvador	CCHECA	0.000219	63
Equatorial Guinea	XXXXEB	#N/A	
Eritrea	#N/A	#N/A	
Estonia	XXXXXH	#N/A	
Ethiopia	XXXXEB	#N/A	
Faeroe Islands	#N/A	#N/A	
Fiji	AACECC	0.004773	18
Finland	AACCCC	0.023766	5
France	ACCCCC	0.027793	3
French Guiana	#N/A	#N/A	
French Polynesia	#N/A	#N/A	
Gabon	ABHFFE	5.81E-06	102
Gambia	DBFFCX	6.98E-05	79

Table 5   (Continued)

(1) Country	(2) State Seq	(3) Nrating	(4) Nrank
Georgia	XAACHH	0.000288	57
Germany	#N/A	#N/A	
Ghana	CHEECC	0.000339	56
Greece	AACCCC	0.023766	5
Greenland	#N/A	#N/A	
Grenada	XXXCAE	#N/A	
Guadeloupe	#N/A	#N/A	
Guam	#N/A	#N/A	
Guatemala	CACGCC	0.000276	59
Guinea	XXXXCC	#N/A	
Guinea-Bissau	XEFCCC	0.002753	23
Guyana	ACEGGB	2.71E-05	87
Haiti	CCCEEH	0.000802	41
Honduras	CCCEEC	0.004816	17
Hong Kong, China	BAAAAA	0.012877	7
Hungary	XXCCEC	0.001161	32
Iceland	DAACCC	0.007157	11
India	CCCCAA	0.013269	6
Indonesia	AAAAAA	0.023776	4
Iran, Islamic Rep.	XXGDDC	4.43E-05	85
Iraq	DBHHHX	6.61E-05	82
Ireland	ACCEAA	0.000928	40
Isle of Man	#N/A	#N/A	
Israel	XCCCCX	0.051997	1
Italy	ACCCCC	0.027793	3
Jamaica	CFEEAC	1.35E-05	96
Japan	AAACAC	0.003242	21
Jordan	XXACHA	1.88E-05	91
Kazakhstan	XXXXXH	#N/A	
Kenya	BCAECC	0.001052	35
Kiribati	XXXXDE	#N/A	
Korea, Dem. Rep.	#N/A	#N/A	
Korea, Rep.	AAAAAA	0.023776	4
Kuwait	GEHFHX	2.79E-06	106
Kyrgyz Republic	XXXXDH	#N/A	
Lao PDR	XXXXCA	#N/A	
Latvia	XACCCH	0.001018	36
Lebanon	#N/A	#N/A	
Lesotho	ABCECC	0.000285	58
Liberia	AEEGXX	4.28E-05	86
Libya	BFFGXX	1.70E-05	93

Table 5   (Continued)

(1) Country	(2) State Seq	(3) Nrating	(4) Nrank
Liechtenstein	#N/A	#N/A	
Lithuania	XXXXXF	#N/A	
Luxembourg	AACAAE	0.001167	31
Macao	#N/A	#N/A	
Macedonia, FYR	#N/A	#N/A	
Madagascar	CEFEEE	0.000159	70
Malawi	BCECCD	0.000214	65
Malaysia	CAACAA	0.00181	29
Maldives	XXXXAA	#N/A	
Mali	XAECEC	0.000648	44
Malta	AAACAX	0.003856	20
Marshall Islands	#N/A	#N/A	
Martinique	#N/A	#N/A	
Mauritania	EFCEEC	0.000382	54
Mauritius	EBEAAA	2.27E-05	89
Mayotte	#N/A	#N/A	
Mexico	AAAGDE	0.000757	43
Micronesia, Fed. States.	#N/A	#N/A	
Moldova	#N/A	#N/A	
Monaco	#N/A	#N/A	
Mongolia	XXXXEE	#N/A	
Morocco	AACACD	0.000153	71
Mozambique	XXXXAD	#N/A	
Myanmar	CCACGX	0.000254	61
Namibia	XXXHBC	#N/A	
Nepal	ECCCCC	0.035974	2
Netherlands	ACCCCC	0.027793	3
Netherlands Antilles	#N/A	#N/A	
New Caledonia	#N/A	#N/A	
New Zealand	CCCCEC	0.010442	8
Nicaragua	BHHGHD	1.03E-05	99
Niger	EHAHEE	2.15E-06	107
Nigeria	BAGECC	0.000367	55
Northern Mariana Islands	#N/A	#N/A	
Norway	AACACA	0.001131	33
Oman	BBFACX	0.000197	66
Pakistan	CCAACC	0.007092	12
Palau	#N/A	#N/A	
Panama	ACCCFA	0.000217	64
Papua New Guinea	AEECEB	8.90E-05	76
Paraguay	CAAGCE	0.00017	68

Table 5   (Continued)

(1) Country	(2) State Seq	(3) Nrating	(4) Nrank
Peru	CCCFFC	0.000168	69
Philippines	CACGCC	0.000276	60
Poland	XXXCEA	N/A	
Portugal	ADCCAC	6.02E-05	84
Puerto Rico	AECECX	0.000648	45
Qatar	XFDGDX	1.93E-05	90
Reunion	#N/A	#N/A	
Romania	XXAAGC	0.000462	50
Russian Federation	XAACEG	0.000421	53
Rwanda	ADAEEH	5.15E-06	103
Samoa	XXXXED	#N/A	
Sao Tome and Principe	XEBFDX	3.46E-06	105
Saudi Arabia	XXEHEX	N/A	
Senegal	ECGCEC	0.00024	62
Seychelles	BABCAX	6.48E-05	83
Sierra Leone	CECGEF	2.67E-05	88
Singapore	AAAAAA	0.023776	4
Slovak Republic	XXXXEC	#N/A	
Slovenia	#N/A	#N/A	
Solomon Islands	XXBBCC	0.002615	24
Somalia	CDDEXX	1.33E-05	97
South Africa	ACCECC	0.005582	13
Spain	AAECAC	0.000944	39
Sri Lanka	CCAACA	0.002116	27
St. Kitts and Nevis	XXXAAA	N/A	
St. Lucia	XXXXAX	#N/A	
St. Vincent and the Grenadines	DFAAAC	0.000987	37
Sudan	CBFEEX	1.52E-05	94
Suriname	CBBXXX	#N/A	
Swaziland	BBCCAE	0.000423	52
Sweden	ACCCCC	0.027793	3
Switzerland	AECCCE	0.002009	28
Syrian Arab Republic	BBAGDA	6.67E-05	81
Tajikistan	XXXXGH	#N/A	
Tanzania	#N/A	#N/A	
Thailand	AAAAAA	0.023776	4
Togo	CCDEEF	8.94E-05	75
Tonga	XXXXCC	#N/A	
Trinidad and Tobago	CCAEEC	0.000952	38
Tunisia	AAAECC	0.005061	15
Turkey	FCECCC	0.005389	14

Table 5   (Continued)

(1) Country	(2) State Seq	(3) Nrating	(4) Nrank
Turkmenistan	XXXXXG	#N/A	
Uganda	XXXXCA	#N/A	
Ukraine	XXXXXG	#N/A	
United Arab Emirates	XXDGFX	#N/A	
United Kingdom	CCCCCC	0.051997	1
United States	CCCCCC	0.051997	1
Uruguay	ECAHCA	6.17E-06	101
Uzbekistan	XXXXXG	#N/A	
Vanuatu	XXXXFC	#N/A	
Venezuela	CCEGDE	0.000473	49
Vietnam	#N/A	#N/A	
Virgin Islands (U.S.)	XEAEXX	#N/A	
West Bank and Gaza	#N/A	#N/A	
Yemen, Rep.	#N/A	#N/A	
Yugoslavia, FR (Serbia/Montenegro)	#N/A	#N/A	
Zambia	CEFGDE	6.97E-05	80
Zimbabwe	BCDECE	0.000129	73

Table 6   Country State Sequences, Normality Ratings, and Normality Rankings
with Countries in Ascending Order by Rank

(1) Country Name	(2) State Seq	(3) Nrating	(4) Nrank
Colombia	CCCCCC	0.051997	1
Israel	XCCCCX	0.051997	1
United Kingdom	CCCCCC	0.051997	1
United States	CCCCCC	0.051997	1
Nepal	ECCCCC	0.035974	2
France	ACCCCC	0.027793	3
Italy	ACCCCC	0.027793	3
Netherlands	ACCCCC	0.027793	3
Sweden	ACCCCC	0.027793	3
Indonesia	AAAAAA	0.023776	4
Korea, Rep.	AAAAAA	0.023776	4
Singapore	AAAAAA	0.023776	4
Thailand	AAAAAA	0.023776	4
Austria	AACCCC	0.023766	5
Belgium	AACCCC	0.023766	5
Finland	AACCCC	0.023766	5
Greece	AACCCC	0.023766	5
India	CCCCAA	0.013269	6

Table 6   (Continued)

(1) Country Name	(2) State Seq	(3) Nrating	(4) Nrank
Hong Kong, China	BAAAAA	0.012877	7
New Zealand	CCCCEC	0.010442	8
Egypt, Arab Rep.	CAAAAA	0.008297	9
Australia	ACCCCA	0.008294	10
Canada	CACCCC	0.008294	10
Denmark	CCCACC	0.008294	10
Iceland	DAACCC	0.007157	11
Pakistan	CCAACC	0.007092	12
South Africa	ACCECC	0.005582	13
Turkey	FCECCC	0.005389	14
Tunisia	AAAECC	0.005061	15
China	BCAAAA	0.004944	16
Costa Rica	ACEECC	0.004816	17
Honduras	CCCEEC	0.004816	17
Brazil	AACCEC	0.004773	18
Fiji	AACECC	0.004773	18
Bangladesh	EFCCCC	0.004125	19
Malta	AAACAX	0.003856	20
Japan	AAACAC	0.003242	21
Botswana	BBAAAX	0.003	22
Guinea-Bissau	XEFCCC	0.002753	23
Solomon Islands	XXBBCC	0.002615	24
Burundi	XCCCCG	0.002569	25
Burkina Faso	CACCCE	0.002407	26
Sri Lanka	CCAACA	0.002116	27
Switzerland	AECCCE	0.002009	28
Malaysia	CAACAA	0.00181	29
Central African Republic	CCECEE	0.001398	30
Luxembourg	AACAAE	0.001167	31
Hungary	XXCCEC	0.001161	32
Norway	AACACA	0.001131	33
Algeria	DACCEE	0.00112	34
Kenya	BCAECC	0.001052	35
Latvia	XACCCH	0.001018	36
St. Vincent and the Grenadines	DFAAAC	0.000987	37
Trinidad and Tobago	CCAEEC	0.000952	38
Spain	AAECAC	0.000944	39
Ireland	ACCEAA	0.000928	40
Haiti	CCCEEH	0.000802	41
Dominican Republic	BACECA	0.000771	42
Mexico	AAAGDE	0.000757	43

Table 6   (Continued)

(1) Country Name	(2) State Seq	(3) Nrating	(4) Nrank
Mali	XAECEC	0.000648	44
Puerto Rico	AECECX	0.000648	45
Benin	EECCGC	0.000552	46
Belize	AAAEAC	0.000526	47
Armenia	AAACHH	0.000519	48
Venezuela	CCEGDE	0.000473	49
Romania	XXAAGC	0.000462	50
Bermuda	AAAGEX	0.000431	51
Swaziland	BBCCAE	0.000423	52
Russian Federation	XAACEG	0.000421	53
Mauritania	EFCEEC	0.000382	54
Nigeria	BAGECC	0.000367	55
Ghana	CHEECC	0.000339	56
Georgia	XAACHH	0.000288	57
Lesotho	ABCECC	0.000285	58
Guatemala	CACGCC	0.000276	59
Philippines	CACGCC	0.000276	60
Myanmar	CCACGX	0.000254	61
Senegal	ECGCEC	0.00024	62
El Salvador	CCHECA	0.000219	63
Panama	ACCCFA	0.000217	64
Malawi	BCECCD	0.000214	65
Oman	BBFACX	0.000197	66
Ecuador	CBCECC	0.000172	67
Paraguay	CAAGCE	0.00017	68
Peru	CCCFFC	0.000168	69
Madagascar	CEFEEE	0.000159	70
Morocco	AACACD	0.000153	71
Cameroon	FCAAGE	0.000151	72
Zimbabwe	BCDECE	0.000129	73
Bolivia	EAEGCC	9.35E-05	74
Togo	CCDEEF	8.94E-05	75
Papua New Guinea	AEECEB	8.90E-05	76
Congo, Dem. Rep.	CEEEGG	8.36E-05	77
Argentina	DCEEFA	7.79E-05	78
Gambia	DBFFCX	6.98E-05	79
Zambia	CEFGDE	6.97E-05	80
Syrian Arab Republic	BBAGDA	6.67E-05	81
Iraq	DBHHHX	6.61E-05	82
Seychelles	BABCAX	6.48E-05	83
Portugal	ADCCAC	6.02E-05	84

Table 6   (Continued)

(1) Country Name	(2) State Seq	(3) Nrating	(4) Nrank
Iran, Islamic Rep.	XXGDDC	4.43E-05	85
Liberia	AEEGXX	4.28E-05	86
Guyana	ACEGGB	2.71E-05	87
Sierra Leone	CECGEF	2.67E-05	88
Mauritius	EBEAAA	2.27E-05	89
Qatar	XFDGDX	1.93E-05	90
Jordan	XXACHA	1.88E-05	91
Bahamas	CHBAEX	1.74E-05	92
Libya	BFFGXX	1.70E-05	93
Sudan	CBFEEX	1.52E-05	94
Dominica	AGBAXX	1.35E-05	95
Jamaica	CFEEAC	1.35E-05	96
Somalia	CDDEXX	1.33E-05	97
Chad	EEHBDF	1.04E-05	98
Nicaragua	BHHGHD	1.03E-05	99
Congo, Rep.	CABDEG	6.23E-06	100
Uruguay	ECAHCA	6.17E-06	101
Gabon	ABHFFE	5.81E-06	102
Rwanda	ADAEEH	5.15E-06	103
Cote d' Ivoire	ACBGGC	4.15E-06	104
Sao Tome and Principe	XEBFDX	3.46E-06	105
Kuwait	GEHFHX	2.79E-06	106
Niger	EHAHEE	2.15E-06	107
Chile	CGAFAA	1.92E-06	108
Barbados	AFBAEX	1.81E-06	109

One of the first things one might suspect is that more developed countries would tend to have higher normality ratings than less developed countries. That is to say, one might expect, in general, that more developed countries tend to follow more normal growth paths than less developed countries.

The United Nations classifies countries into high, medium, and low human development on the basis of their human development index. For their development classification for 1994, the United Nations fails to classify only two countries, Puerto Rico and Bermuda, of the hundred and twenty-five countries with normality rankings in Table 6. The remaining one hundred twenty-three countries with both normality rankings and United Nation development classifications were classified into three groups containing forty-one countries apiece on the basis of the normality rankings in Table 6. The three groups moving from countries with the lowest ranking normality numbers to the highest are labeled most normal growth path, less normal growth path, and least normal growth path.

The three-fold normality classification and the three-fold United Nations development classification are used to set up a contingency Table. This is shown in Table 7. Each cell in

the heart of Table 7 contains two bits of information. The top number in a cell is the observed number of occurrences, while the bottom number in parentheses is the expected number of occurrences based on the assumption of independence between the normality group and the development group. Finally, the bottom row and far right column give the total number of countries in each classification category.

Table 7   Contingency Table of Development Based on the Human Development Index and Normality Growth Based on Normality Ranking

	Low Development	Medium Development	High Development	Total Countries
Most Normal Growth Path	7 (12.67)	11 (14)	23 (14.33)	41
Less Normal Growth Path	13 (12.67)	15 (14)	13 (14.33)	41
Least Normal Growth Path	18 (12.67)	16 (14)	7 (14.33)	41
Total Countries	38	42	43	123

Just looking at the results of the table, there would certainly appear to be some sort of relationship between a country's growth path normality and its level of development. When a chi-square test is performed on the null hypothesis of independence between the development categories and the normality categories, it is rejected at the one percent level of significance.[3] While the observed frequencies and predicted frequencies are very close for the two middle categories, the cells in row two and column two of the table, the divergence for each of the four corner cells is fairly wide. The divergence for these corner cells suggests a positive relationship. The observed frequencies are lower than the expected frequencies for the northeast and southwest corner cells, that is, for countries with low levels of development and the most normal growth paths, and for countries with high levels of development and least normal growth paths. On the other hand, the observed occurrences are greater than the expected occurrences for the southeast and northwest corner cells, that is, for countries with low levels of development and least normal growth, and for countries with high levels of development and most normal growth.

One might also suspect that the degree of freedom experienced in a country might have some influence on the normality of a country's growth path. Freedom House classifies countries on the basis of freedom into three groups for 1994.[4] The three groups are not free, partly free, and free. The Freedom House ratings and the normality classification employed in the previous table, Table 7, are used to construct a contingency table between freedom and normality. This is given in Table 8.

---

3. The computed chi-square value is 14.91, while table value for chi-square at the one- percent level of significance with four degrees of freedom is 13.28.

4. Freedom House (1995), *Freedom in the World*, 678-679.

**Table 8 Contingency Table of Country Freedom Based on Gastil's Ratings
and Normality Growth Based on Normality Ranking**

	Not Free	Partly Free	Free	Total Countries
Most Normal	5	12	23	40
Growth Path	(8.60)	(14.88)	(16.53)	
Less Normal	6	20	14	40
Growth Path	(8.60)	(14.88)	(16.53)	
Least Normal	15	13	13	41
Growth Path	(8.81)	(15.25)	(16.94)	
Total Countries	26	45	50	121

Once again, just as for Table 7, a chi-square test on the null of independence between the two categorical variables of Table 8 is rejected. This time the rejection is at the five percent level of significance.[5] And, once again, inspection of the results suggest a positive relationship between the two categorical variables, thus indicating that greater freedom is associated with more normal country growth behavior. As one moves down the not free column from most normal growth to least normal growth the discrepancy between observed occurrences and predicted occurrences moves from negative to positive, but when one moves in the same direction down the free column the discrepancy between observed and predicted occurrences moves form being positive to negative.

VI. Conclusion

This paper has developed normality ratings and normality rankings for the growth paths of countries throughout the world. While these are interesting in and of themselves, where can we go from here? What are some potential future areas of research using the notion of normality, the normality ratings, and normality rankings? Although in the last section we touched on a possible relationship between normality and the stage of development and between normality and freedom, this is just the tip of the iceberg with regard to the possible applications of the growth normality ratings. In general, it would be nice to see what characteristics of a country are associated with high normality and which characteristics are associated with low normality. What is the relationship, if any, between normal economic growth and the degree of trade openness of an economy? What is the relationship between the extent of government intervention in the economy and the normality (abnormality) of a country's growth path? Do freedoms, whether political or economic, have any bearing on the degree to which an economy follows a normal growth path? What about internal political and social stirrings? Do the number of riots, coups, constitutional changes, or changes in government leadership matter? Do structural features such as the composition of production of the economy exert any influence on the type of growth path an economy is likely to travel? How about policy in all its varied forms, tax policy, monetary policy, fiscal policy, trade policy? What about debt levels and debt burdens in the economy? One often

---

5. The computed chi-square value is 13.13. It is very close to being significant even at the one-percent level.

hears in the business media that investors abhor uncertainty. Are abnormally growing countries considered more risky in the eyes of investors? These are just a few of the questions and areas of study that come to mind as potential fields of inquiry for future research.

References

Barro, R.J. (1991), "Economic Growth in a Cross-Section of Countries," *Quarterly Journal of Economics*, May, 106(2), 407-444.

_____ (1996), "Inflation and Growth," *Review*, Federal Reserve Bank of St. Louis, May/June, 133-169.

Dollar, D. (1992), "Outward-Oriented Developing Economies Really Do Grow More Rapidly: Evidence from 95 LDCs, 1976-79," *Economic Development and Cultural Change*, 40(3), 523-44.

Easterly, W., and R. Levine (1997), "Africa's Growth Tragedy: Policies and Ethnic Divisions," *Quarterly Journal of Economics*, 112(4), November, 1203-50.

Easterly, W., and S. Rebelo (1993), "Fiscal Policy and Economic Growth," *Journal of Monetary Economics*, December, 32, 417-58.

Edward, S. (1992), "Trade Orientation, Distortions, and Growth in Developing Countries," *Journal of Economic Development*, 29, 31-57.

Freedom House Survey Team (1995), *Freedom in the World*, USA: Freedom House.

Mauro, P. (1995), "Corruption and Growth," *Quarterly Journal of Economics*, 3(110), 681-712.

Olson, M. (1996), "Big Bills Left on the Sidewalk: Why Some Nations are Rich, and Others Poor," *The Journal of Economic Perspectives,* Spring, 10(2), 3-24.

Solow, R.M. (1955), "A Contribution to the Theory of Economic Growth," *Quarterly Journal of Economics*, 70(1), 65-94.

The World Bank (1993), The International Bank for Reconstruction and Development, *The East Asian Miracle, Economic Growth and Public Policy*, Oxford: Oxford University Press.

_____ (1998), Development Data Group, *World Development Indicators on CD-ROM*, USA.

United Nations, Development Programme (1994), *Human Development Report 1994*, Oxford: Oxford University Press.