International Linear Regression

What is coming? Whether it is a small business projecting the next years' worth of growth or a meteorologist forecasting the next three days' worth of weather, making predictions about the future is a skill that is used in all walks of life. For countries, this is an essential element of planning. How many people will there be? How many people will reach retirement age? Will there be finances available to start green energy initiatives? Thousands of questions like these are on the minds of policymakers every day, and when they ponder these answers they look toward mathematics to guide them.

Linear Regression is a tool that utilizes past data to make predictions about the future. By calculating and interpreting trend lines that model the data, individuals are able to make datadriven decisions and project into the future. As you will come to find out, people do not always agree on which mathematical model is most accurate.

In this assignment, you will use the data "GDP per Capita Statistics of 10 Countries" to estimate a countries economy into the future. Program the data into Lists in a TI-Graphing Calculator (let t=0 represent 1985, thus t=5 is 1990). Use your mathematical models to answer the following questions.

Country	Line of Best Fit
Brazil	
China	
Cote d'Ivoire	

1. Find linear functions that model the data for each country.

Egypt	
Equatorial Guinea	
Ireland	
Japan	
Sweden	
United Arab Emirates	
United States	

2. What is the slope of the best fit line for Ireland? What does the slope mean?

3. Using your functions, answer the following questions in complete sentences. (Justify your answers.)

a. When do you expect Egypt to have a per capita GDP of greater than \$5,000?

- b. Which country do you think will reach per capita GDP of \$50,000 first, Japan or United States? When do you predict this will happen?
- c. Which country do you think will reach per capita GDP of \$5,000 first, Brazil or China? When do you predict this will happen?
- d. What is the significance of the intersection point between Egypt and Equatorial Guinea? Explain.
- e. What is the significance of the intersection point between Japan and Sweden? Explain.
- f. Using the slopes of your lines of best fit, rank the countries in order of fastest growing per capita GDP. Justify your order.
- g. The United Arab Emirates and Cote d'Ivoire both have negative slopes, what could be a plausible explanation why a country's per capita GDP could decrease?

h. If a country aimed to increase their per capita GDP, how could they do this?

i. If the trends continued at the same rate, would Ireland's per capita GDP surpass the United States'? If so, when would this happen? Do you think this is realistic?

4. Do you believe your models would be a good predictor in the year...? Why or why not?

2015 -

2020 -

2040 -

2060 -

GDP per Capita Statistics of 10 Countries

GDP per Capita (Income per Person in \$)	1985	1990	1995	2000	2002	2004	2006	2008	2010	2015
Brazil	\$3,334	\$3,353	\$3,606	\$3,696	\$3,740	\$3,899	\$4,091	\$4,479	\$4,699	
China	\$290	\$392	\$658	\$949	\$1,106	\$1,323	\$1,641	\$2,033	\$2,425	
Cote d'Ivoire	\$746	\$663	\$608	\$628	\$598	\$580	\$572	\$575	\$591	
Egypt	\$1,053	\$1,154	\$1,249	\$1,476	\$1,508	\$1,560	\$1,679	\$1,859	\$1,976	
Equatorial Guinea	\$621	\$555	\$655	\$2,410	\$4,375	\$6,468	\$6,774	\$8,603	\$8,655	
Ireland	\$11,043	\$13,993	\$17,089	\$25,629	\$27,518	\$28,937	\$30,669	\$30,130	\$27,595	
Japan	\$27,195	\$33,595	\$35,478	\$36,789	\$36,787	\$38,236	\$39,772	\$40,254	\$39,309	
Sweden	\$21,229	\$23,492	\$23,562	\$27,869	\$28,751	\$30,434	\$32,432	\$32,799	\$32,292	
United Arab Emirates	\$43,115	\$36,598	\$33,926	\$34,395	\$33,297	\$35,316	\$31,930	\$25,574	\$21,087	
United States	\$25,317	\$28,274	\$30,025	\$35,082	\$35,428	\$36,951	\$38,369	\$38,371	\$37,491	

What is GDP? Gross Domestic Product is the monetary value of all the finished goods and services produced within a country's borders in a specific time period. It includes all of private and public consumption, government outlays, investments, and exports (less imports that occur within a defined territory). The following is the formula used to calculate GDP.

GDP = C + G + T + NX

where:

"C" is equal to all private consumption, or consumer spending, in a nation's economy

"G" is the sum of government spending

"T" is the sum of all the country's businesses spending on capital

"NX" is the nation's total net exports, calculated as total exports minus total imports. (NX = Exports - Imports)

Infant Mortality Data vs. Gross Domestic Product per Capita for 48 Countries

Country	Infant Mortality per 1000 births	GDP per Capita 2010	Country	Infant Mortality per 1000 births	GDP per Capita 2010	Country	Infant Mortality per 1000 births	GDP per Capita 2010
Argentina	10.52	10,749	Israel	4.07	22,276	Rwanda	62.51	338
Australia	4.55	25,250	Italy	3.36	18,982	Saudi Arabia	15.61	9,425
Azerbaijan	28.76	2,345	Jamaica	14.30	3,665	Senegal	55.16	562
Bangladesh	48.99	558	Japan	2.21	39,309	Singapore	2.65	32,536
Botswana	10.49	4,189	Latvia	8.24	5,011	South Africa	42.67	3,746
Brazil	20.50	4,699	Lebanon	15.32	6,747	Spain	3.37	15,462
Burkina Faso	79.84	276	Liberia	72.71	155	Sudan	55.60	524
Canada	4.85	25,575	Lithuania	6.18	5,332	Sweden	2.74	32,292
Chile	7.40	6,334	Luxembourg	4.39	52,302	Syria	15.12	1,526
China	15.62	2,425	Macedonia	8.32	2,221	Tanzania	46.50	456
Colombia	15.92	3,233	Malawi	79.02	184	Thailand	15.90	2,713
Croatia	6.06	6,338	Malaysia	14.57	5,185	Tunisia	24.98	3,165
Cuba	4.83	4,495	Mali	108.70	270	Turkey	23.07	5,349
Czech Republic	3.70	7,381	Mauritania	58.93	609	Uganda	64.20	377

Dominican Republic	21.30	4,049	Mexico	16.77	6,105	Ukraine	8.38	1,037
Ecuador	19.06	1,728	Mongolia	36.00	773	United Arab Emirates	11.59	21,087
Egypt	24.23	1,976	Morocco	26.49	1,844	United Kingdom	4.56	28,033
Ethiopia	60.90	221	Nepal	43.13	268	United States	6.00	37,491
Finland	3.40	27,111	Netherlands	3.73	26,552	Uruguay	9.44	9,106
France	3.40	22,878	Nigeria	74.36	545	Venezuela	20.18	5,528
Ghana	40.90	359	Pakistan	61.27	669	Vietnam	20.24	723
Guatemala	25.16	1,861	Papua New Guinea	42.05	744	Yemen	53.50	610
Haiti	52.44	371	Paraguay	22.24	1,621	Zambia	70.60	432
Honduras	19.85	1,392	Peru	21.50	3,180	Zimbabwe	28.23	321
India	46.07	787	Philippines	18.75	1,383			1
Indonesia	27.00	1,144	Portugal	4.60	11,745			
Iraq	40.25	736	Russia	7.30	2,923			