WHAT ARE THE DETERMINANTS OF HEALTH STATUS IN LATIN AMERICA AND THE CARIBBEAN?

By

Ms. Sunielle Stanford

and

Dr. Kevin Greenidge
Research Department
Central Bank of Barbados
P.O. Box 1016, Bridgetown, Barbados
Email: kcgreenidge@centralbank.org.bb
Tel.: 1 (246) 436-6870
Fax: 1 (246) 427-1431

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ABSTRACT

Health is one factor that improves the quality of life and well being of people and thus, researchers have investigated various aspects that influence health outcomes of a society. The conceptual literature points to several factors which influence health status and these can broadly be grouped according to economic, social, environmental and biological and endowment determinants. Using a panel consisting of 37 countries, this paper seeks to identify those variables that are statistically robust in determining health status for Latin America and the Caribbean. The study finds that increases in health expenditure as a ratio of GDP, per capita calorie availability and literacy rate add to a population's health status (as measured by life expectancy), while per capita carbon dioxide emissions reduce longevity.

JEL Codes: H5; I18; O15
Keywords: Health; Socioeconomic factors; Human development

1. Introduction

The pioneering work on human capital investment by Schultz (1961) made a significant contribution to the literature on the links between human capital investment and economic growth, in addition to the broader subject of improving human welfare. Health is one factor that improves the quality of life and well being of people and thus, economists have researched the factors that influence health outcomes of a society. In particular, governments have a vested interest in improving the population's health status. The government of Barbados, for example, articulated in its Ministry of Health Development Plan (1993 – 2000) that the right to health care is a fundamental right and a healthy people in a healthy environment forms an essential part of the wealth creation capacity of a country. These sentiments have also been acknowledged in the Caribbean region – the Caribbean Community (CARICOM) Heads of Government Nassau Declaration, 2001 state that the health of the region is the wealth of the region – and the international community, particularly in the Millennium Development Goals.

The conceptual link between health status and economic growth is articulated in the World Development Report 1993: Investing in Health. According to the report, improved health 'reduces production losses caused by worker illness; it permits the use of natural resources that had been totally or nearly inaccessible because of lack of disease; it increases the enrolment of children in school and makes them better able to learn; and it frees for alternatives uses resources that would otherwise have to be spent on treating illness' (World Development Report 1993, p.17). From this point of view, policy makers should therefore be interested in identifying the factors that are pivotal to improving health status. The conceptual and empirical literature points to several factors which influence health and these can broadly be grouped according to economic, social, environmental and biological and endowment determinants. This paper seeks to determine those variables that are statistically robust in determining health status for a selection of Latin American and Caribbean (LAC) countries.

The rest of the paper is organised as follows. Section two highlights the conceptual determinants of health status. The following section describes the data and empirical methodology. Section

four presents the results while the next section summarises and outlines some policy implications of the research.

2. Determinants of health status: Conceptual Issues

Notwithstanding the difficulty in directly measuring health status, Fayissa and Gutema (2005) and Beherman and Deolalikar (1988) suggest using life expectancy at birth as a proxy for health status. In comparison, studies which use micro level data, tend to rely on self assessed notions of health status. Respondents typically rank their own state of health, ranging from 'not healthy' to 'very healthy' (Kimhi 2003; Eyles *et al.* 2001; Birch 2000). Besides being rather costly to implement (in terms of conducting a survey large enough to adequately represent the country's population), such an approach is also quite subjective and thus, this is one reason why this study relies on macro level data.

As noted in the introduction, the group of variables considered in research on health status can be broadly categorised into: economic (income, economic stability, employment and working conditions, government health expenditure and calorie availability); social (inequality and poverty measures, education and literacy, culture and ethnicity); environmental (working and living conditions) and biological (gender and chronic noncommunicable diseases).

Economic Determinants

Cullis and West (1979), argue that expenditure on health provides mental and monetary benefits. The authors note that mental benefits are derived from the curing of illness and the relief of pain, which enhance the enjoyment of life, while monetary benefits of health care are derived since health expenditures may increase output. In some LAC countries the provision of health services is heavily subsidised by governments. Thus, government expenditure on health, as opposed to total health expenditure may be more relevant in the context of this region.

In examining the socioeconomic determinants of health for the Caribbean region, Le Franc (1989) argues that conceptually, recessions and structural adjustments can have either a direct or

indirect influence on health status. In periods of recessions or structural adjustments, governments usually seek to curtail government spending (particularly on the provision of social services), in order to correct imbalances in the economy. If government opts to reduce its expenditure on health, this may adversely impact on the health status of citizens, particularly those poorer members of society that rely on public health services. For example, in Jamaica during the recessionary period of 1981-1982 and again from 1985-1986, per capita real health expenditure declined by 33 percent. This outturn was reflected in a falloff in the public health delivery system, as evident in the declines in public hospital bed occupancy. Unfortunately mortality rates were not available for the period after 1981 in order to establish a correlation with health status (Le Franc, 1989). Evidence of the direct impact of recessions on health status occurs as a result of a decline or reduced nominal incomes, which then alters the consumption patterns of health. It is important to note however, that there need not exist a positive relationship between government health expenditure and health status. This is because the resulting relationship depends on the net effect of government health expenditure versus an individual's expenditure on preventative and curative treatments. If government health expenditure (which has to be financed from taxes or user fees) makes the individual worse off, then a resulting negative relationship may occur between health expenditure and health status (Fayissa and Gutema, 2005).

Employment, working conditions and income are also expected to influence health status. Employment can positively impact on physical, mental and social health. In particular, people with relatively stress free jobs are expected to have healthier lives since they are less susceptible to stress related illnesses. Moreover, with higher disposable incomes, people have more control over their lives and can purchase, for example, better housing and healthier foods (Population Health, 2005).

Social Determinants

The distribution of income tends to be more important than the actual level of income earned by society. Thus, the larger the inequality gap in the region, the lower the health status of the population (Population Health, 2005). Education also contributes to health status as it increases job and income security, and be extension mental and social well being.

Environmental Factors

The physical environment in which people live and work is paramount to health status both in the long-term and short-term. Exposure to water, air or land contamination can have adverse effects on health (Population Health, 2005).

Biological Factors

Some individuals are more predisposed to certain chronic diseases that can affect mortality and morbidity rates of a population. Both noncommunicable and communicable diseases have been identified as the major threats to the health of Caribbean people. In the late 1990s, cardiovascular diseases, diabetes mellitus, cancer and HIV together accounted for an estimated 54 percent of deaths in the Caribbean (Caribbean Commission on Health and Development, 2006).

3. Data and Methodology

3.1 Model Specification and Data

Based on the above discussion, we specify an empirical testable function of the responsiveness of the health status of the LAC countries to the economic, social and environmental factors, as:

$$y_{i,t} = \alpha_i + X'_{i,t}\beta_i + u_{it} \tag{1}$$

$i = 1,\ldots,N$ countries over $t = 1,\ldots,T$ time periods. This model is basically a linearised Cobb-Douglas production and is quite common to this type of research (see, for example, Grossman, 1972, Beherman and Deolalikar, 1988; and, Fayissa and Gutema, 2005). y_i is the natural log of country *i*'s health status, and here we follow the common approach in the literature and employ the country's life expectancy at birth as a proxy for its health status (see, for example, Beherman and Deolalikar, 1988; and, Fayissa and Gutema, 2005). α can be viewed as an estimate of the initial health stock and can be the same across the countries or allowed to vary. X is a vector of per capita economic, social and environmental variables in natural logarithms and β is a vector of respective elasticities.

The economic factors are estimated using health expenditure as a ratio of current GDP and calories available (kilocalories per day per capita). The health expenditure variable is the aggregate of public and private preventative and curative health expenditure and is intended to capture the provision of health services in the economy. Hadley (1982) posits that an 'expenditure' variable as opposed to 'stock' variables, such as hospital beds or physicians per 1000 people, is a better indicator of the variation in the quality and quantity of health services across countries. Fayissa and Gutema (2005) explain the difficulty in determining *a prioir*, the relationship between health expenditure and health status (measured by life expectancy). Intuitively, higher per capita spending on health care contributes to an individual's health and by extension may improve an individual's health outcome. However, the authors note that this relationship only holds if the marginal change in health expenditure does not make the individual's health status worse off. Such an outcome may occur, if the increase in health expenditure, financed by taxes or user fees, is greater than the individual's expenditure on basic preventative health care such as food, clothing and shelter. Thus, if the marginal increase in total health expenditure is insufficient to offset the individual's foregone preventative health care, then the relationship between per capita health expenditure as a ratio of current GDP and life expectancy will be negative.

The second variable used to proxy economic conditions (specifically, nutritional status) is calories available per capita. It is defined as the average nutritional energy content of the total daily per capita food supply, for a given country and is derived from food balance sheets standardised for a range of primary food commodities for human consumption. A positive sign is expected for the coefficient of per capita calorie availability since nutritious foods provide energy, which in turn is expected to impact positively on one's health status. Essential nutrients present in the diet is necessary for energy, and while energy requirements tend to decline with age, all things being the same, there is expected to be a positive impact on life expectancy.

The social factor is represented by the education variable total adult literacy rate (the percentage of people ages 15 and above who can, with understanding, read and write a short, simple statement on their everyday life). Although Wolfe and Behrman (1984) argue that education is a catalyst, studies by Grossman, 1972, Rosen and Taubau, 1982, Berger and Leigh, 1989,

Grossman, 2004 and Fuchs 2004 find evidence to suggest that education contributes to health status by equipping persons with knowledge and understanding to keep them healthy. Therefore, *a priori* the coefficient of literacy rate is positive.

The relationship between environmental factors and life expectancy is estimated using the urbanisation rate and per capita carbon dioxide emissions. The urban population is defined as the share of the total population living in areas classified as urban in each country. Thornton (2002) notes the potential positive and negative effects of urbanisation rate on health status. In urban areas, there is relatively easy access to health care facilities, however this environment is typically polluted and can thus adversely impact on physical well-being. Therefore, the resulting sign on the coefficient of the urbanisation rate depends on the net effect of the competing factors. Carbon dioxide emissions are defined as pollution from the burning of fossil fuels and the manufacture of cement. These emissions are the result of carbon dioxide produced during consumption of solid, liquid, and gas fuels and gas flaring. Exposure to pollution is expected to have an adverse effect on health and therefore one's well-being is expected to be adversely affected. Consequently, a negative relationship is expected between carbon dioxide emissions and life expectancy.

While the literature identifies several types of social, economic and biological factors in explaining health status, due to inadequate data coverage of these series for the LAC region, we could not include an extensive list of variables in the model. Two classes of variables that would have been particularly interesting to examine because of their relevance to the LAC region - *prevalence of HIV and chronic noncommunicable diseases* - were not included due to data limitations.

Data and definitions on health expenditure as a ratio of current GDP, urbanisation rate and carbon dioxide emission per capita are taken from the World Bank's *World Development Indicators 2007* online database. Observations and data descriptions for the literacy rate, per capita calorie availability and the dependent variable life expectancy are sourced from the Pan American Health Organisation's database

(http://www.paho.org/English/SHA/coredata/tabulator/newTabulator.htm). The dataset used in this research consists of observations from 37 Latin American and Caribbean countries over the period 1994 – 2005. The results in Table 1 generally show the individual significance of potential economic, social and environmental variables in explaining health status. However, because health status is obviously influenced by a combination of these variables, multiple regression analysis is employed in this paper.

3.2 Methodology

Equation (1) is estimated using panel data analysis. This approach was chosen against individual regressions based on an examination of the variation coefficient for the individual explanatory variables over time and across countries, which revealed that the variability in the individual variables across countries is larger than the variability over time. Therefore, in accordance with Barajas *et al* (1988), a panel approach is more appropriate.

To account for the differences, such as initial health status, the level of economic development, social norms and infrastructure among LAC countries, a fixed-effects model is estimated (where α is fixed but not common across the countries) and an F- Test (see Green, 1993) used to determine between the fixed-effects specification and a common intercept (or pooled) model (where the $\alpha_i's$ are fixed and common across the countries). If the fixed-effects model proves superior to the pooled model, a random-effects model is then estimated (by defining $\alpha_i = \alpha + \tau_i$, where τ_i has a zero unconditional mean) and a Hausman test employed to choose between the random-effects model and the fixed-effects model.

4. Results

The model is estimated in accordance with the procedure outlined above. The F-test yields a value of 644.489 with a p-value of [0.000], which indicates that the null hypothesis of common country-specific effects is strongly rejected in favour of the fixed-effects model. That is, there are significant country-specific effects in the data. For the choice of the random-effects versus the fixed-effects model, the Hausman-test produces a χ^2 value of 7.207 with a corresponding p-

value [0.2057]. This is distributed as a $\chi^2_{(2)}$ under the null hypothesis that there is no correlation between the regressors and the country-specific effects. Since the null cannot be rejected, the underlying assumption of the random-effects model is valid and the random-effects model is preferred. The estimates from various random-effects model are given in Tables 2 – 5.

Table 2 presents the estimates from the full sample of 37 LAC countries. All the variables are significant and correctly signed, with the urbanisation rate displaying significance at the 10 percent level. The variables calories available per capita, adult literacy rate and per capita carbon dioxide emissions are consistent with *a priori* expectations. Of these three variables, the literacy rate displays the highest level of significance and the results suggest that on average, a 1 percent increase in adult literacy would lead to a 0.4 percent increase in longevity. As discussed previously, populations with higher levels of literacy tend to improve people's awareness and understanding of health issues. This knowledge may improve decision-making as it pertains to making healthy life-style choices, for example, eating healthier foods. In addition, people with higher levels of education are more likely to be employed and have access to 'better' living conditions which in turn may impact positively on longevity. As noted in the conceptual issues of health status, the signs on the coefficient for the urbanisation rate and health as a percent of GDP could not be predetermined. However, both these variables show positive and statistically significant coefficients. With regard to the health variable, the positive relationship indicates that the level of health expenditure (even if financed by taxes or user fees) does not make individual's worse off, and consequently improves longevity. Table 2 reports that a 10 percent increase in health expenditure relative to total output of goods and services improves life expectancy by 0.10 of a percentage point. In the case of the urbanisation rate, as the percentage of the population living in urban areas rise, on average these persons have more access to modern medical care facilities, which outweighs the effect of any adverse environmental conditions and raises life expectancy.

In order to test the robustness of the results across regions two methods were employed. In the first, the sample was split and the random effects model was re-estimated for Caribbean countries (Table 3) and then with Latin American countries in the sample (Table 4). For the Caribbean sample of countries, the coefficients of health expenditure, calories available per

capita and adult literacy rate are statistically significant and positive. While an increase in per carbon dioxide emissions have a negative impact on health status, the inclusion of this variable in the random effects model is insignificant (p=0.2691). Similarly, the relationship between health status and urbanisation rate is negative but the result is statistically insignificant in the model (p=0.3095). In contrast, Table 4 reports statistically significant results for literacy rate, carbon dioxide emissions and the urbanisation rate. It is interesting to note that in the full sample (Table 2) and the spilt samples (Tables 3 and 4), the literacy rate is consistently positively related to health status, and moreover, in each case displays the strongest level of significance in the model.

The second way in which the model was tested for the robustness of the results for Caribbean countries was by introducing a dummy variable. The dummy variable was given a value of 1 for Caribbean countries and 0 otherwise and allowed to interact with each regressor. Table 5 reports the socio-economic and environmental variables as well as the interaction terms. Generally, these results are similar to the results reported for the spilt samples. For the Caribbean countries, the health expenditure and calorie available coefficients correspond to the positive and statistically significant results reported in Table 3. After controlling for Caribbean countries, the urbanisation rate that was previously insignificant in the split sample, now becomes statistically significant (p=0.0017). The findings indicate that for individuals from the Caribbean, a 1percent increase in the urbanisation rate leads to a 0.1percent reduction in life expectancy. The findings that literacy rate, per capita carbon dioxide emissions and urbanisation rate are statistically significant and correctly signed for the Latin American countries is the same as reported in the split sample (Table 4). Nevertheless, when the results for Latin America and the Caribbean are compared (Tables 3 and 4), the results for the Caribbean are more robust.

Summary and policy implications

Health is ultimately influenced by a range of inter-related social, economic, environmental and biological factors. Hence, improving the health well being of any population must investigate such factors, and this research has explored the relationship for a selection of regional economies. Due to data constraints, the methodology used panel data for 37 LAC countries over

the period 1994 – 2005. The findings suggest that increases in health as a ratio of GDP, calorie intake, literacy rate and the urbanisation rate are all statistically significant in improving health well being in the region. In contrast, higher levels of carbon dioxide emissions reduce health status. The finding for health as a ratio of GDP is a very important one. Economists generally agree that one of government's roles is the provision of social services; nevertheless our findings suggest that higher spending from both government and private sector budgets contribute positively to the population health status, as measure by longevity. In fact, the Report of the Caribbean Commission on Health and Development 2006, state that countries should aim for health expenditure of at least 6 percent of GDP. From our dataset, health expenditure as a ratio of GDP over the period 1994 - 2005, averaged 6.5percent for our sample of 37 LAC countries. While on average the LAC region has reached the target, governments and the private sector must continue to allocate resources in preventative and curative areas. Additionally, the consistent finding that literacy rate is the most robust variable in the full sample of 37 countries and the split sample indicates the importance of an educated population in determining their own healthy well-being.

Of course, there are other factors that also influence health status and thus it must be noted the preliminary nature of this work. The spread of diseases -HIV/AIDS- and the burden of noncommunicable diseases are a major problem for the LAC region. Additionally, within the context of income inequality, the greater the income gap, then this may lower the health of the population. These conceptual factors need to be investigated and thus, data permitting, this study can be extended to include more social, biological and economic variables.

Nevertheless, these results have far-reaching implications for various areas in the economy, and thus should be of interest to policy makers. By improving health status and by extension longevity, this may over time contribute to increases in national insurance schemes. Moreover, the findings have implications for enhancing overall growth and economic development in the region, since a potential increase in years of life can positively impact on economic growth.

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Appendix

The countries in the sample are: Antigua and Barbuda, Argentina, Aruba, The Bahamas, Barbados, Belize, Bolivia, Brazil, Cayman Islands, Chile, Colombia, Costa Rica, Cuba, Dominica, Dominican Republic, Ecuador, El Salvador, Grenada, Guatemala, Guyana, Haiti, Honduras, Jamaica, Mexico, Netherland Antilles, Nicaragua, Panama, Paraguay, Peru, Puerto Rico, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Suriname, Trinidad and Tobago, Uruguay, and Venezuela

Table 1:Coefficient results from potential bivariate regressions

	Dependent Variable: Life expectancy at birth, total (years)							
Health expenditure to GDP ratio	0.010 (0.005)*							
Per capita food production		-0.002 (0.005)						
Calories availability (Kcal/day per capita)			0.042 (0.015)*					
Literacy rate, adult total percent of people ages 15 and above)				0.241 (0.032)*				
Secondary education, pupils					0.014 (0.005)*			
School enrolment, tertiary (percent gross)						0.014 (0.006)*		
CO2 emissions (metric tonnes per capita)							-0.004 (0.003)	
Urban population (percent)								-0.023 (0.019)
Total pool (balanced) Observations	223	340	272	314	185	217	317	407

Notes: (1) All variables are logged
(2) * indicates significance at the 5 percent level of testing
(3) Standard errors are in parenthesis

Table 2: Random Effects Estimates of the Determinants of Health Status in LAC

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.947	0.164	11.851	0.000
Log (Health/GDP)	0.010	0.005	2.003	0.047
Log (Calories)	0.041	0.021	2.000	0.048
Log (Literacy Rate)	0.409	0.029	14.143	0.000
Log (CO2)	-0.019	0.005	-3.581	0.001
Log (Urban)	0.035	0.020	1.716	0.089
Random Effects (Cross)				
Argentina	0.002			
Bahamas, The	-0.043			
Barbados	0.031			
Belize	0.018			
Bolivia	-0.095			
Brazil	-0.019			
Chile	0.058			
Colombia	-0.009			
Costa Rica	0.062			
Dominican Republic	-0.018			
Ecuador	0.032			
El Salvador	0.036			
Grenada	-0.104			
Guatemala	0.051			
Guyana	-0.139			
Haiti	-0.105			
Honduras	0.025			
Jamaica	0.038			
Mexico	0.047			
Nicaragua	0.087			
Panama	0.041			
Paraguay	-0.035			
Peru	-0.035			
St. Kitts and Nevis	-0.035			
St. Lucia	0.074			
St. Vincent and the Grenadines	-0.022			
Suriname	-0.034			
Trinidad and Tobago	0.065			
Uruguay	-0.003			
Venezuela, RB	0.029			
R-squared	0.985			
Adjusted R-squared	0.984			
S.E. of regression	0.004			
F-statistic	1635.048			
Observations	130			

Table 3: Random Effects Estimates of the Determinants of Health Status in Caribbean

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.909	0.346	5.520	0.000
Log (Health/GDP)	0.028	0.011	2.547	0.014
Log (Calories)	0.127	0.051	2.470	0.018
Log (Literacy Rate)	0.298	0.069	4.317	0.000
Log (CO2)	-0.009	0.008	-1.119	0.269
Log (Urban)	-0.019	0.019	-1.028	0.310
Random Effects (Cross)				
Bahamas, The	0.014			
Barbados	0.054			
Belize	0.048			
Brazil	0.022			
Dominican Republic	0.028			
Grenada	-0.087			
Guyana	-0.122			
Haiti	-0.111			
Jamaica	0.062			
St. Kitts and Nevis	-0.014			
St. Lucia	0.068			
St. Vincent and the Grenadines	0.021			
Suriname	0.008			
Trinidad and Tobago	0.010			
R-squared	0.995			
Adjusted R-squared	0.994			
S.E. of regression	0.005			
F-statistic	1675.892			
Observations	50			

Table 4: Random Effects Estimates of the Determinants of Health Status in Latin America

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.882	0.175	10.773	0.000
Log (Health/GDP)	0.003	0.005	0.537	0.593
Log (Calories)	-0.003	0.016	-0.217	0.829
Log (Literacy Rate)	0.449	0.049	9.236	0.000
Log (CO2)	-0.017	0.007	-2.506	0.014
Log (Urban)	0.099	0.031	3.144	0.002
Random Effects (Cross)				
Argentina	-0.031			
Bolivia	-0.115			
Chile	0.021			
Colombia	-0.033			
Costa Rica	0.051			
Ecuador	0.017			
El Salvador	0.030			
Guatemala	0.059			
Honduras	0.035			
Mexico	0.024			
Nicaragua	0.085			
Panama	0.018			
Paraguay	-0.042			
Peru	-0.061			
Uruguay	-0.039			
Venezuela, RB	-0.021			
R-squared	0.731			
Adjusted R-squared	0.713			
S.E. of regression	0.003			
F-statistic	40.252			
Observations	80			

Table 5: Random Effects Estimates of the Determinants of Health Status in LAC (with dummy for the Caribbean)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.946	0.175	11.105	0.000
Log (Health/GDP)	0.002	0.005	0.322	0.748
Log (Calories)	-0.008	0.017	-0.485	0.629
Log (Literacy Rate)	0.461	0.049	9.443	0.000
Log (CO2)	-0.018	0.006	-2.904	0.004
Log (Urban)	0.079	0.027	2.968	0.004
Log (Health/GDP)*dumCarib	0.037	0.016	2.371	0.019
Log (Calories)*dumCarib	0.139	0.051	2.711	0.008
Log (Literacy Rate)*dumCarib	-0.171	0.094	-1.813	0.072
Log (CO2)*dumCarib	-0.114	0.035	-3.207	0.002
Log (Urban)*dumCarib	0.008	0.008	1.070	0.287
Random Effects (Cross)				
Argentina	-0.020			
Bahamas, The	0.031			
Barbados	0.062			
Belize	0.057			
Bolivia	-0.113			
Brazil	-0.034			
Chile	0.030			
Colombia	-0.028			
Costa Rica	0.052			
Dominican Republic	-0.033			
Ecuador	0.018			
El Salvador	0.033			
Grenada	-0.086			
Guatemala	0.057			
Guyana	-0.121			
Haiti	-0.115			
Honduras	0.032			
Jamaica	0.071			
Mexico	0.032			
Netherlands Antilles	0.088			
Panama	0.021			
Paraguay	-0.043			
Peru	-0.056			
St. Kitts and Nevis	-0.010			
St. Lucia	0.069			
St. Vincent and the Grenadines	0.028			
Suriname	0.018			
Trinidad and Tobago	0.000			
Uruguay	-0.029			
Venezuela, RB	-0.011			
Adjusted R-squared	0.988			
S.E. of regression	0.004			
F-statistic	1046.227			
Observations	130			