Explaining Economic Performance in the Haitian Economy

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Abstract: This paper develops a methodology to ascertain the determinants of growth in the Haitian economy. The methodology uses co-integration to identify those variables that can help explain economic activity, measured through GDP. This idea, pioneered by Hamilton and Perez-Quiros (1996), has the advantage of allowing for a smaller data set than the ones used by the National Bureau of Economic Research (NBER). The results of this paper show that external and financial variables can provide Haitian policymakers with a good signaling device of the true performance of the economy. These variables are available before GDP, allowing policymakers to take preemptive measures to improve performance of the economy.
Keywords: Granger causality, co-integration, economic growth.

Resumen: Este documento desarrolla una metodología que permite comprobar los factores de crecimiento en la economía haitiana. La metodología utiliza cointegración para identificar las variables, lo que puede ayudar a explicar la actividad económica que se mide a través del PIB. Esta idea, iniciada por Hamilton y Perez-Quiros (1996), tiene la ventaja de promover un procesamiento más pequeño que los que utiliza el National Bureau of Economic Research (NBER). Los resultados de este documento muestran que las variables externas y financieras permiten que los gobiernos haitianos tengan una buena señalización del verdadero mecanismo de la economía. Estas variables se pueden conseguir antes del PIB instando a los gobiernos haitianos a que tomen medidas preventivas para aumentar el rendimiento de la economía.
Palabras clave: causalidad de Granger, cointegración, crecimiento del PIB.

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Introduction

Modern developed economies have a long tradition of monitoring economic performance. For instance, in 1946, a United States research team at National Bureau of Economic Research (NBER), led by Burns and Mitchell, developed a methodology to help predict turning points in business cycles. The team studied a group of economic variables to see how fluctuations in these variables were related to economic activity. The best series were combined into indices, however the choice of variables, as well as the weight associated with them, was purely subjective. The Bureau of Economic Analysis (BEA) took over the construction of leading, lagging, and coincident indices of economic activity and in 1990 passed on the responsibility to the Conference Board in New York.

Stock and Watson (1989), Estrella and Mishkin (1997), and McGuckin, Ozyildirim and Zarnowitz (2001) among others have refined the methodology to overcome criticism about being a-theoretical and not based on econometric analysis. These refinements rely on a large number of economic time-series released in a timely fashion, something that renders them inapplicable in less developed economies. This need for data explains why only a handful of studies have tried to apply this methodology to developing economies; for instance, Dua and Banerji (1999, 2001) for the Indian economy. Mongardini and Saadi-Sedik (2003) have also applied Stock and Watson's principle of parsimony to their selection of variables for an index of coincident and leading indicators for the Jordanian economy.

In addition, a recent study by Rand and Tarp (2001) found that business cycles in developing economies are different from those in industrial countries. The underlined implication is that policymakers of developing economies have no true measure of the current performance or direction of economic activity. The design of stabilization policies for these economies lack the appropriate first step, understanding short-run fluctuations. Corrective measures, when they are applied, may suffer from time inconsistency.

Among others, Hamilton and Perez-Quiros (1996) have stressed the co-integrating relationship linking most economic variables as a tool to identify those variables which can help explain economic activity, measured through GDP. When a co-integrating relation exists between economic variables, it is an indication that these variables move together in the long run. Moreover, co-integration implies that the

system follows an Error-Correcting Mechanism (ECM) which expresses how one variable of the co-integrating relationship responds in the short-run to shocks initiated from the others. Therefore, an ECM with a variable proxy of economic performance can well do the job of explaining short-run fluctuations. Furthermore, co-integration and ECM have the additional advantage of allowing for smaller data sets. Therefore, this methodology is appealing to economists working on developing economies where the tradition of collecting economic data is a recent phenomenon. Simone (2001) has applied this method to the Argentine economy.

The main contribution of this paper is to find the determinants of economic growth in the Haitian economy using the co-integrating properties of economic variables.

A small, open economy in the Caribbean, Haiti has suffered balance-of-payment problems since the fixed exchange rate was overvalued in the early 1980s. At that time, as a result of the American occupation from 1915 to 1934, the official currency of Haiti, the "gourde" (gde), was pegged to the US dollar ($) at the rate of five gourdes per one US dollar. A parallel market developed and played a crucial role until 1990 when, in the face of complete depletion of foreign reserves, the economy was moved to a floating exchange rate system. Haiti has also faced political instability since 1990 which has impacted economic performance, as can be seen in Figure 1 of Real GDP from 1967 to 2000. Moreover the value-added through the agricultural sector in GDP has declined, whereas the share of services has steadily increased (Table 1).[1] The identification of potential variables that possess ex-

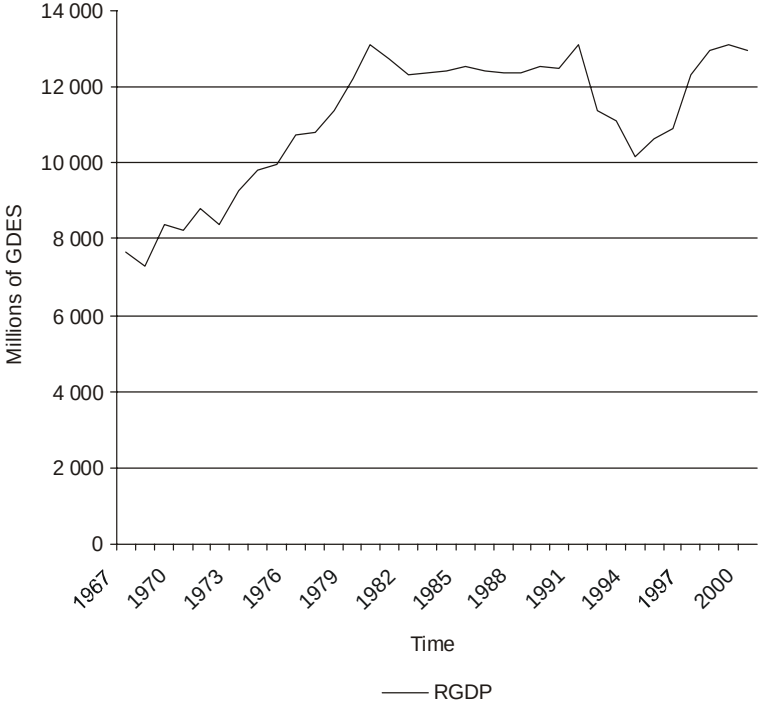
Table 1. Economic Indicators for the Haitian Economy (from 1996 to 2001)

Origin of GDP (at market prices)	*1996*	*1997*	*1998*	*1999*	*2000*	*2001*
Agriculture and mining	30.9	29.6	28.9	27.4	26.2	25.9
Manufacturing and construction	14.5	14.7	15.0	15.0	15.3	15.5
Services	48.6	49.4	49.9	50.0	50.8	51.5
Indirect and import taxes	6.0	6.3	6.2	7.6	7.8	7.1

Source: IMF Country Staff Report.
Fiscal year ending September 30.

[1] Dua and Banerji have made the same observation for the Indian economy.

Figure 1. Evolution of GDP (from 1967 to 2000)



plaining power over economic activity is an important effort to help circumcise the causes of fluctuations in the Haitian economy.

The results of this paper demonstrate that the following economic factors play a leading role in explaining economic performance of the Haitian economy: exports, net domestic borrowing, and deposits in commercial banks (including savings accounts, time deposits and deposits in foreign currency).[2] These variables have been mentioned by Edison (2000), Kaminsky and Reinhart (1999), Kamin and Babson (1999) among others in their study of indicators of early warning system. To explain how these conclusions were made, Section I will address the econometric methodology, while Section II details the empirical results and Section III provides concluding remarks.

First, let us examine how the research was arranged.

[2] In a more general study to assess the likely impacts of Economic Partnership Agreement (EPA) between Haiti and the EU, Aubourg, Cassion and Pierre, noted ACP (2004), have looked at determinants of growth for the Haitian economy. They have found domestic investment, budget deficit, inflation, and terms of trade as the important variables.

I. Econometric Methodology

As GDP is the most often quoted statistic in relation to the performance of a country, it will be used to measure Haitian economic activity. For that economy, it is available on an annual basis. This data availability restricts the analysis to annual observation for all variables.

Lack of availability of high frequency data is a common problem in less developed countries. Simone, who uses the same methodology as the current paper, resorts to quarterly data of Real GDP. Mongardini and Saadi-Sedik (2003) use a different methodology and produce monthly indexes for the Jordanian economy by doing linear interpolation for some of these variables which were available on a quarterly or yearly basis. Dua and Banerji (2001) use industrial production which is available on both quarterly and monthly basis as a proxy of GDP. These last two studies did not use the methodology of this paper. Moreover, in the Haitian economy, industrial production, available on a quarterly basis, is an I(0) variable which precludes its use for the methodology about to be described.[3]

The econometric methodology comprises the following four steps.

I.1. Step 1: Selection of Variables

The approach used in this paper is a-theoretical in the choice of the predetermined economic variables, domestic or external. The motivation is that economic performance summarizes the impetus occurring in the four sectors of the economy: real, government, financial, and external. Therefore, any variable from each of these sectors is a potential candidate of being an explanatory variable.[4] The criteria for selection were the variable's availability and frequency of publication. All selected variables are published on a monthly, quarterly, and annual basis.

[3] There is the option of estimation of missing observations (quarterly or monthly) for GDP using a Kalman filter. It has not been retained for this paper.

[4] The list of selected variables appear in Appendix A. This study departs from ACP (2004), whose choice of variables is based on prior restrictions which link the performance of the Haitian economy to demographics, trade and government spending.

I.2. Step 2: Degree of Integration

The variables selected are expected to be of the same degree of integration as GDP, that is I(1) variables. A test of unit root was conducted on all selected variables.

I.3. Step 3: Bivariate Granger Causality Test

A Granger Causality test was conducted between the past value of each of the selected variables and GDP using autoregressive representations of GDP, with each of the selected variables as regressors. A positive Granger Causality test implies that the selected variable has some explanatory power on GDP and is a potential candidate to explain economic performance. It also indicates that any shock initiated from the selected variable propagates to GDP.

I.4. Step 4: Co-integration Test

This step allowed the establishment of Error-Correcting Mechanisms (ECM) as described in Engle and Granger (1991) among groups of variables and GDP. Each ECM was used to predict GDP and its results were compared with out-of-sample values of GDP in order to choose the model(s) with the best predictive power.

II. Empirical Results

Results are provided for the variables which were successful in all four steps described in Section I. All variables are in log form and real terms. The sample size is comprised of 23 observations from 1967 to 1990.[5]

[5] The cut-off point of 1990, which reduces the sample size, has been chosen because of the deterioration of performance after that period as seen in Figure 1. This choice has been made instead of the introduction of dummies to the analysis. Moreover, some variables were not available prior to 1967 which is the justification for the starting point.

Table 2. Unit Root Test

Variable	*Sector*	*Unit Root Test*	*P-Value*	*Number of Lags*
GDP	N/A	–1.60405	0.79084	2
Coffee	Real	–2.47863	0.33873	2
Exports	External	–1.72907	0.73792	2
Real exchange rate	External	–2.10383	0.54395	2
Foreign reserves	Financial	–1.81385	0.69804	3
Net domestic borrowing	Financial	–2.43867	0.35927	2
Savings, time, & foreign accounts	Financial	–2.78094	0.20403	5
Internal revenue	Government	–2.30422	0.43162	2
Government & private consumption	Government	–2.59358	0.28286	2
Government domestic borrowing	Government	–0.95777	0.94954	2

II.1. Unit Root Test

The value of the Dickey-Fuller (ADF) test is reported in Table 2 for all variables, classified by sector as well as for GDP, with the prob value and the number of lags. The latter is based on the Akaike Information Criterion. All variables are I(1).

II.2. Bivariate Granger Causality Test

For any variable X_t, a general autoregressive representation of GDP with a lag length set to two[6] is the following:

$$\text{GDP} = c_1 + \alpha_1 \text{GDP}_{-1} + \alpha_2 \text{GDP}_{-2} + \beta_1 X_{-1} + \beta_2 X_{-2} \qquad (1)$$

This formula allows a user to statistically decide if there is any causal link between X and GDP using a χ^2 test where the null hypothesis is "X does not Granger Cause GDP" ($H_0 : \beta_1 = \beta_2 = 0$).[7]

[6] The choice of the lag length is arbitrary. Considerations have been given to the sample size.

[7] Using OLS, it is easy to set up an F-test using residuals sum of square. However, with lagged dependent variables this test is valid only asymptotically. Therefore I used an asymptotically equivalent χ^2.

Table 3. Results of the χ^2 Test

Series	χ^2 *Value*	χ^2 *Critical*
Coffee	8.8	$\chi_{5\%}{}^2 = 5.99$
Exports	2.4	$\chi_{30\%}{}^2 = 2.4$
Real exchange rate	2.64	$\chi_{30\%}{}^2 = 2.4$
Foreign reserves	5.74	$\chi_{10\%}{}^2 = 4.6$
Net domestic borrowing	3.40	$\chi_{25\%}{}^2 = 2.77$
Savings, time, & foreign accounts	12.42	$\chi_{5\%}{}^2 = 5.99$
Internal revenue	10.38	$\chi_{5\%}{}^2 = 5.99$
Government & private consumption	3.42	$\Pi_{25\%}{}^2 = 2.77$
Government domestic borrowing	10.84	$\chi_{5\%}{}^2 = 5.99$

The results of the χ^2 test with two degrees of freedom and the corresponding critical level appear in Table 3. The null hypothesis is rejected if the calculated χ^2 is greater than the critical χ^2 for the corresponding critical level. For each of these variables the critical level fluctuates from 5 to 30%. Each of these variables "Granger Causes" GDP and is a potential candidate for an explanation of economic performance.

A critical level of 30% allows this research to retain a variable like exports. In their study of stylized facts of business cycles in developing countries, Rand and Tarp (2001) pointed out the importance of shocks originating from industrialized countries. The retention of exports allows the current research to capture this fact.

II.3. Co-integrating Relationship

Testing the co-integration relationship between linear combinations of I(1) variables using the Engle-Granger co-integration test is supported by the data for twelve (12) models when co-integration rank is 2 and for ten (10) models when the co-integration rank is three.[8]

The co-integrating vector is in parentheses with the value of the test, *P*-value and number of lags.

[8] The results are reported for the model of interest. The remaining models of cointegrating rank 2 and 3 appear in Appendix B and C, respectively. They are not reported because of their low economic performance in predicting GDP out of sample data.

• Model 1:
GDP, Δ Exports, Net Domestic Borrowing, Time and Savings & Foreign Currency Account
(1, –0.16546, 0.0087833, –0.063041), –2.5388, 0.81284, 2

II.4. Error-Correcting Mechanism (ECM)

A three-step estimation method has been developed by Engle and Yoo (1987) to estimate an Error-Correcting Model (ECM). The first step of the ECM consists of finding the co-integrating vector. The second step consists of estimating an equation of the type:

$$\Delta X_t = -\alpha\gamma X_{t-1} + \text{lagged}(\Delta X_t) \qquad (2)$$

by OLS, where α is the co-integrating vector, as given from the first step. The second step provides fully efficient estimators of all parameters other than α.

The third step consists of re-estimating α, by regressing the residuals from Equation (2) on constant and lag variables of the co-integrating relation, each multiplied by estimated γ, available from the second step. The coefficients of this third step regression are corrections to the estimations of the co-integration coefficients, and the standard errors from this regression are appropriate for Gaussian Inference.

Using the above procedure, estimation of the ECM has been done for each of the co-integrating vectors described in Section III.3. It is reproduced for the model of interest, with *t*-statistics in parentheses.[9]

• Model 1:

$$\begin{aligned}\Delta\text{GDP}_t = {} & 3.31 - \underset{(3.58)}{0.06}\underset{(1.96)}{Exports_{-1}} - \underset{(3.55)}{0.38}\text{GDP}_{-1} + \underset{(1.6)}{0.187}Exports_{-1} \\ & - \underset{(2.2)}{0.05}\text{ND}Borrowing_{-1} + \underset{(2.0)}{0.1009}\text{TSF}Currency\ Account_{-1} \\ & \text{DW} = 1.57 \qquad R^2 = 0.40\end{aligned}$$

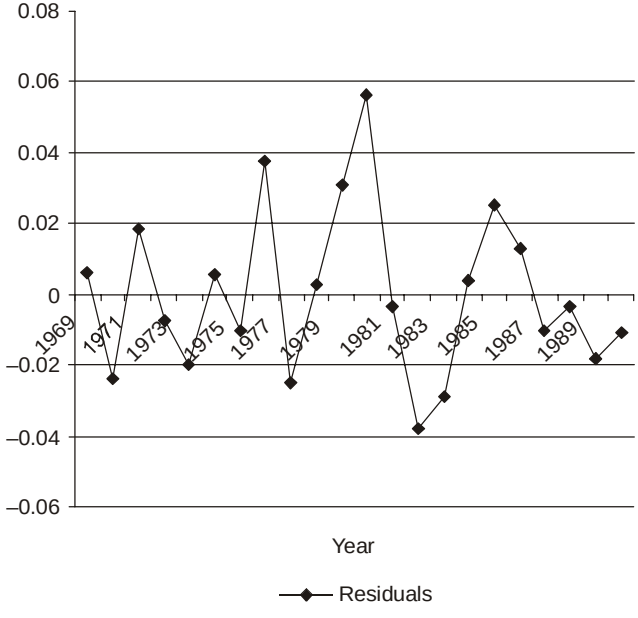
[9] All insignificant variables have been omitted.

II.5. Tests of the Residuals

A test of unit root was performed by regressing the first difference of the residuals of Model 1 on their past value. The estimated coefficient is –0.8939 with *P*-value 0.001 which confirms the I(0) nature of the residuals.

A plot of the residuals appears in Figure 2 and shows a clear pattern of autocorrelation. This autocorrelation is to be expected for a regression about performance of an economy which captures the momentum built over time. Moreover, the LM statistic is 0.012232 with *P*-value = 0.912 which translates that the residuals exhibit heteroskedasticity as well. These two problems impact on the coefficients of the regression. However, the ECM three step procedure has allowed to correct for these two problems and to produce efficient estimators.[10]

Figure 2. Plot of Residuals from Regression (for Model 1)



[10] This explains why these two problems have not been corrected.

Table 4. Likelihood Ratio Tests of Co-Integrating Coefficients

Variable	*Test Value*	*Critical Value*
Exports	10.0593	3.84
NDBorrowing	18.0232	3.84
TSFCAccounts	18.8088	3.84

II.6. Test of Linear Restrictions on the Co-integrating Coefficients

The Johansen and Juselius (1990) procedure has been used to test restrictions on each of the co-integrating coefficients, i.e.:

$$H_{0i}: \alpha_i = 0$$

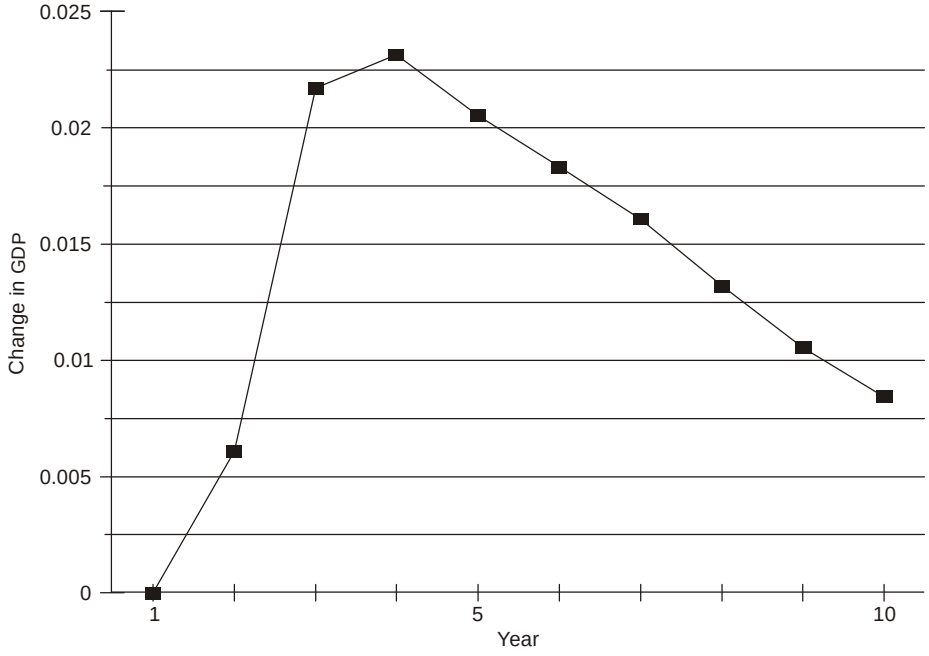
Or equivalently H_{0i} means that each of the selected variables does not contribute to economic performance of the Haitian economy.

The results of the likelihood ratio tests as well as the critical value appear in Table 4. The hypothesis of a null coefficient for any of the co-integrating variables is clearly rejected.

This model captures the effect of the financial as well as the external sector. These results are consistent with the observation about the sources of fluctuations in the Haitian economy. Indeed, since Haiti is a small open economy, external factors play an important role in determining the current state of the economy. Improvement in the terms of trade or exports are signals that there is an increase in economic activity. On the financial side, positive liabilities of the banking sector indicate potential for investment and an improvement of the state of the economy. However, fiscal discipline measured through domestic borrowing by the government, a recurrent problem, deters economic activity. These results are also consistent with the findings of the early warning system literature. Kaminsky and Reinhart (1999) mention exports as a current account indicator whereas TSFCurrency Accounts is mentioned by Ericsson (2000) as a financial indicator. These results are also consistent with the findings of Dorsainvil (2005) about the increased importance of dollarization in that economy.

In order to capture the impact of the financial and external sectors on economic activity, impulse response functions have been calculated and appear in Figures 3 thru 5. One unit shock in the financial or the terms of trade variables has maximum impact on GDP on

Figure 3. Impulse Response of GDP (to a one unit shock to exports)



the third year (2% change in GDP) and does not die out completely after ten years (0.08% change in GDP), whereas the lasting effect of one unit increase in domestic borrowing goes beyond 10 years.

II.7. Issue of Mispecification of the Model

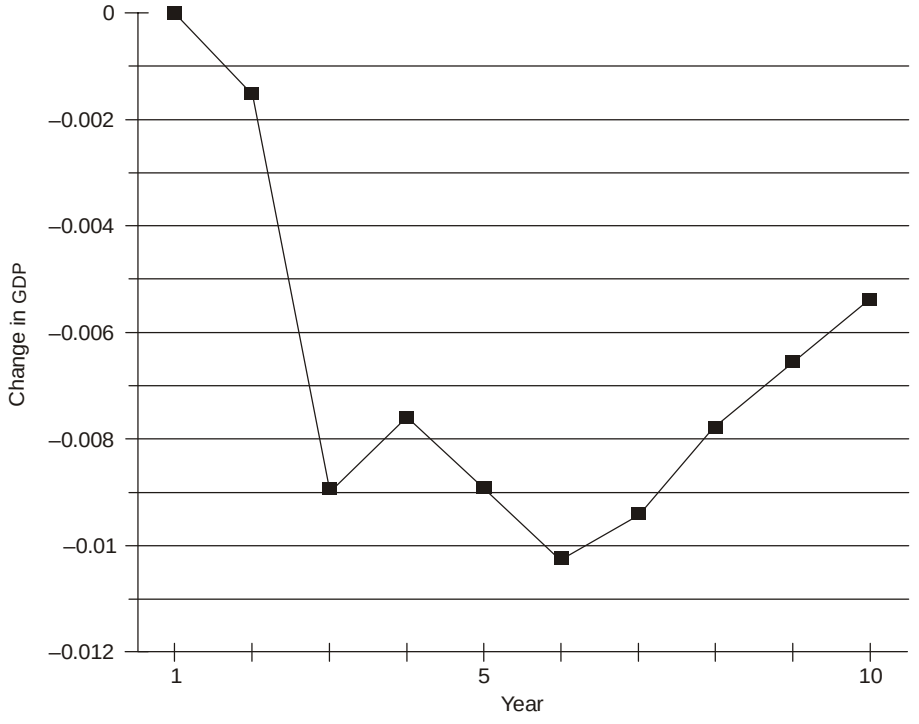
As described by Chow (1960), a Chow test was performed to test the stability of the relationship for out-of-sample data. The model passes the stability test as can be seen in Table 5.

The root mean square error which measures the standard error of the forecast has been calculated. It is 0.03, which is indicative of the

Table 5. Results of the Chow Test

Model	*Chow Test*	*P-Value*
Model 1	1.10	0.392

Figure 4. Impulse Response of GDP
(to a one unit shock to D. Borrowing)



good performance of the model,[11] something that is easily seen from the value of the forecast for out-of-sample data.

Figure 6 plots (on the same graph) the estimated and the actual value of GDP for out-of-sample data. The model overstates the value of GDP, but provides satisfactory results from an economic standpoint. In addition, the variance is relatively low (0.004 and 0.003, respectively). The actual and predicted values are reproduced in Table 6.

[11] Due to the low sample size for both subperiods (22 and 9, respectively) the skewness-kurtosis test has not been performed.

Figure 5. Impulse Response of GDP (to a one unit shock to F. Sector)

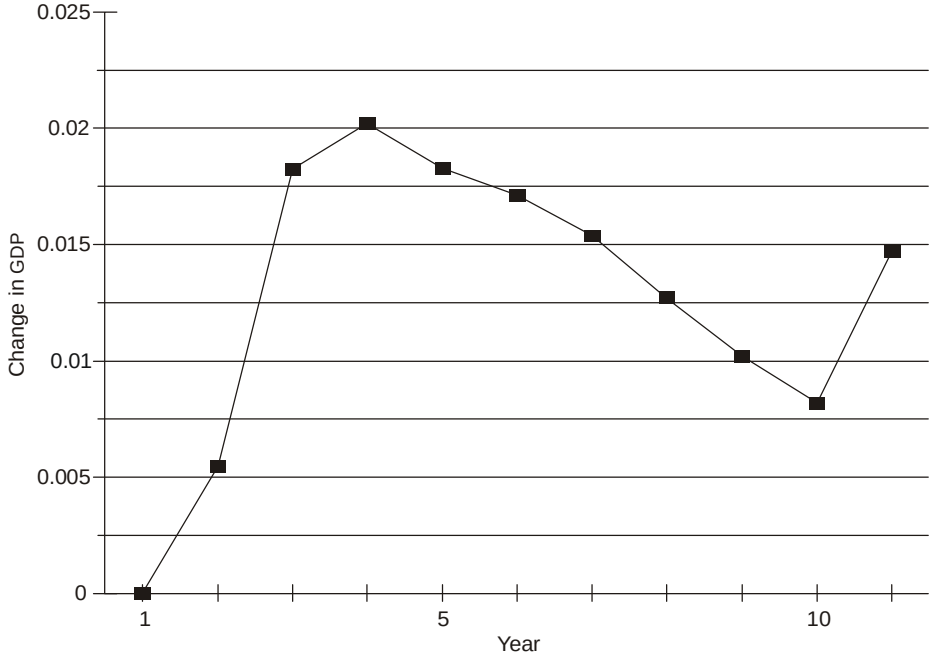
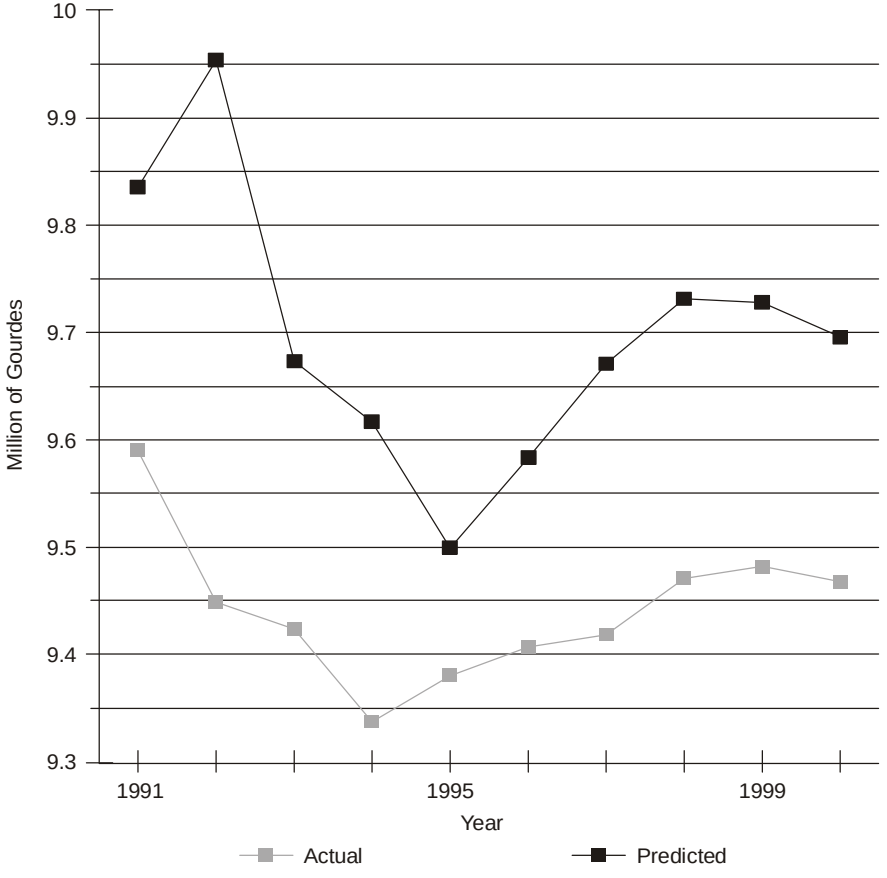


Table 6. Actual and Predicted Value of GDP in Log Form

Year	*Actual*	*Predicted*
1991	9.58967	9.8355
1992	9.44833	9.95382
1993	9.42368	9.67311
1994	9.33697	9.61653
1995	9.37983	9.49918
1996	9.40673	9.583
1997	9.41768	9.67074
1998	9.47063	9.73174
1999	9.48182	9.72841
2000	9.46715	9.69593

Figure 6. Actual and Forecast GDP (from 1991 to 2000)



III. Concluding Remarks

This paper presents and tests a methodology which enables economists to find the determinants of growth in the Haitian economy based on a smaller number of economic time-series than the NBER methodology. The results are promising. Variables such as exports, deposits, and domestic borrowing have been identified as important components of economic performance. These variables are available on a monthly and quarterly basis and can be easily followed by policymakers, more easily than GDP. These results will need to be refined to include other sources of fluctuations such as political instability.

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Appendix A. List of Selected Variables

1. Government
   Internal Revenue, Domestic Credit, Government Domestic Borrowing, Government and Private Consumption
2. Financial
   Net Domestic Borrowing, M1, M2, Foreign Reserves, Demand Deposits, Savings, Time, and Foreign Currency Deposits in Commercial Banks
3. External
   Real Exchange Rate, Exports of Agricultural Products, Exports, Imports
4. Real
   Coffee, Rice, Industrial Production

Appendix B. Eleven ECM Models with Cointegrating Rank of 2

1. Model 1

$$\Delta GDP_t = 2.01 - 0.23GDP_{-1} + 0.225Exports_{-1} + 0.0678FReserves_{-1} - 0.055\Delta Exports_{-1}$$
(3.08) (3.05) (3.9) (2.26) (1.7)

DW = 1.6 $R^2 = 0.33$

2. Model 2

$$\Delta GDP_t = 1.91 - 0.21GDP_{-1} + 0.2412Exports_{-1} - 0.0948GDBorrowing_{-1}$$
(4.12) (4.06) (2.4) (1.2)

DW = 1.96 $R^2 = 0.44$

3. Model 3

$$\Delta GDP_t = 2.10 - 0.24GDP_{-1} + 0.3844Exports_{-1} - 0.0797NDBorrowing_{-1} - 0.054\Delta Exports_{-1}$$
(2.57) (2.97) (4.39) (2.2) (1.61)

DW = 1.54 $R^2 = 0.32$

4. Model 4

$$\Delta GDP_t = -0.1428 - 0.1660GDP_{-1} + 0.5428IRevenue_{-1} - 0.0384NDBorrowing_{-1}$$
(1.96) (3.03) (3.30) (1.1)

$$- 0.0586\Delta IRevenue_{-1}$$
(1.90)

DW = 1.84 $R^2 = 0.34$

5. Model 5

$$\Delta GDP_t = 2.24 - 0.2513GDP_{-1} + 0.3427Exports_{-1} - 0.3593GPConsumption_{-1}$$
(3.0) (2.94) (4.69) (2.10)

$$- 0.0541\Delta Exports_{-1}$$
(1.6)

DW = 1.6 $R^2 = 0.31$

6. Model 6

$$\Delta GDP_t = 1.535 - 0.1675GDP_{-1} - 0.3648RER_{-1} + 0.4462IRevenue_{-1} - 0.0543\Delta IRevenue_{-1}$$
(3.66) (3.61) (1.84) (3.27) (1.91)

DW = 2.41 $R^2 = 0.17$

7. Model 7

$$\Delta GDP_t = \underset{(94.67)}{6.10} - \underset{(4.65)}{0.659}GDP_{-1} - \underset{(1.91)}{0.0973}RER_{-1} + \underset{(1.70)}{0.1545}TSFRAccounts_{-1} - \underset{(1.74)}{0.052172}\Delta TSFRAccounts_{-1}$$

$DW = 1.76 \qquad R^2 = 0.54$

8. Model 8

$$\Delta GDP_t = \underset{(3.7)}{1.54} - \underset{(3.61)}{0.1675}GDP_{-1} - \underset{(1.9)}{0.5502}RER_{-1} + \underset{(1.3)}{0.0676}FReserves_{-1} - \underset{(1.91)}{0.0543}\Delta RER_{-1}$$

$DW = 1.99 \qquad R^2 = 0.42$

9. Model 9

$$\Delta GDP_t = \underset{(2.78)}{0.8775} - \underset{(2.72)}{0.1012}GDP_{-1} - \underset{(1.6)}{0.7033}Coffee_{-1} - \underset{(1.6)}{0.5497}RER_{-1} + \underset{(2.3)}{0.0854}\Delta Coffee_{-1}$$

$DW = 1.59 \qquad R^2 = 0.41$

10. Model 10

$$\Delta GDP_t = \underset{(4.22)}{1.43} - \underset{(4.14)}{0.1463}GDP_{-1} - \underset{(1.9)}{0.5502}RER_{-1} + \underset{(1.3)}{0.0676}FReserves_{-1}$$

$DW = 2.09 \qquad R^2 = 0.09$

11. Model 11

$$\Delta GDP_t = \underset{(3.38)}{1.23} - \underset{(3.31)}{0.13}GDP_{-1} + \underset{(1.87)}{0.3551}IRevenue_{-1} + \underset{(1.4)}{0.0715}FReserves_{-1}$$

$DW = 2.0 \qquad R^2 = 0.4$

Appendix C. Nine Models with Cointegrating Rank of 3

1. Model 1

$$\Delta GDP_t = \underset{(2.85)}{1.32} - \underset{(1.83)}{0.048}\Delta GDBorrowing_{-1} - \underset{(2.80)}{0.1467}GDP_{-1} + \underset{(2.47)}{0.376}Exports_{-1} - \underset{(2.01)}{0.1337}GDBorrowing_{-1} + \underset{(1.1)}{0.0559}FReserves_{-1}$$

$DW = 2.23 \qquad R^2 = 0.39$

2. Model 2

$$\Delta GDP_t = 2.18 - 0.058\Delta Exports_{-1} - 0.242GDP_{-1} + 0.35131Exports_{-1}$$
$$(3.31)\quad (1.8)\qquad (3.28)\qquad (5.45)$$
$$- 0.418GPConsumption_{-1} + 0.071FReserves_{-1}$$
$$(2.71)\qquad (2.9)$$
$$DW = 1.62 \qquad R^2 = 0.36$$

3. Model 3

$$\Delta GDP_t = 2.24 - 0.055\Delta Exports_{-1} - 0.253GDP_{-1} + 0.4611Exports_{-1}$$
$$(3.16)\quad (1.67)\qquad (3.13)\qquad (5.32)$$
$$- 0.3177GPConsumption_{-1} - 0.0726NDBorrowing_{-1}$$
$$(2.00)\qquad (2.24)$$
$$DW = 1.57 \qquad R^2 = 0.34$$

4. Model 4

$$\Delta GDP_t = 2.24 - 0.057\Delta Exports_{-1} - 0.249GDP_{-1} + 0.2093Exports_{-1} - 0.351RER_{-1}$$
$$(3.48)\quad (1.81)\qquad (3.45)\qquad (4.4)\qquad (2.6)$$
$$+ 0.0761FReserves_{-1}$$
$$(3.1)$$
$$DW = 1.67 \qquad R^2 = 0.39$$

5. Model 5

$$\Delta GDP_t = 0.9489 + 0.0855\Delta Coffee_{-1} - 0.1109GDP_{-1} - 0.479Coffee_{-1} - 0.6606RER_{-1}$$
$$(3.48)\quad (2.49)\qquad (3.42)\qquad (1.4)\qquad (2.33)$$
$$+ 0.1348FReserves_{-1}$$
$$(2.58)$$
$$DW = 1.84 \qquad R^2 = 0.49$$

6. Model 6

$$\Delta GDP_t = 0.9761 + 0.095\Delta Coffee_{-1} - 0.135GDP_{-1} - 0.5584Coffee_{-1} - 0.6293RER_{-1}$$
$$(2.52)\quad (2.51)\qquad (2.47)\qquad (1.6)\qquad (2.12)$$
$$+ 0.3135GPConsumption_{-1}$$
$$(1.3)$$
$$DW = 1.55 \qquad R^2 = 0.38$$

7. Model 7

$$\Delta GDP_t = 1.78 + 0.095\Delta Coffee_{-1} - 0.248GDP_{-1} - 0.201Coffee_{-1} + 0.2502Exports_{-1}$$
$$(3.03)\quad (2.64)\qquad (3.00)\qquad (1.1)\qquad (4.88)$$
$$- 0.2588RER_{-1}$$
$$(1.9)$$
$$DW = 1.63 \qquad R^2 = 0.48$$

8. Model 8

$$\Delta GDP_t = 2.33 - 0.055\Delta Exports_{-1} - 0.264GDP_{-1} + 0.358Exports_{-1} - 0.2342RER_{-1}$$
$$(3.27)\quad (1.7)\qquad (3.24)\qquad (4.62)\qquad (1.8)$$
$$-0.0698NDBorrowing_{-1}$$
$$(2.2)$$
$$DW = 1.6 \qquad R^2 = 0.36$$

9. Model 9

$$\Delta GDP_t = 1.84 - 0.0434\Delta Exports_{-1} - 0.2095GDP_{-1} + 0.3273Exports_{-1}$$
$$(2.6)\quad (1.3)\qquad (2.6)\qquad (2.94)$$
$$- 0.0613NDBorrowing_{-1} + 0.0631FReserves_{-1}$$
$$(1.3)\qquad (1.7)$$
$$DW = 1.51 \qquad R^2 = 0.26$$

Data source

Except for data on the real sector, all data is derived from *International Financial Statistics,* Various Issues.

Data on coffee and rice production are derived from Food and Agricultural Organization (FAO) statistics.

Data on industrial production are derived from the Institut Haïtien de Statistique et d'Informatique (IHSI).