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Monetary Models of Exchange Rate in a Remittance Receiving Economy: The Case of Haiti

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by

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This paper is an attempt to examine the determinants of nominal exchange rate for the Haitian economy. Haiti changed its exchange rate regime to floating exchange rate in 1990 so we consider 1990 as date of structure break. Given the importance of the remittances in the Haitian economy, we up-date the typical monetary model of exchange rate by incorporating remittances inflow. We found strong evidence of cointegration between the exchange rate, monetary fundamentals, and the flow of remittances. We also found that the behavior of Haitian nominal exchange rate is mostly explained by the changes in real output in the long-run, but mostly explained by the changes in the level of the remittances and money supply in the short-run.

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Introduction

The monetary models of exchange rate represent an important pillar in the field of international economics. We find extensive literature, both theoretical and empirical, on this framework of nominal exchange determination. Monetary models of exchange rate deal with factors determining money demand and money supply in both home and foreign country. For example, Dornbusch (1976) examined the dynamic Mundell-Fleming model, while Engel and Frankel (1984) studied how announcements of changes in money supply impact on the nominal exchange rate. Meese and Rogoff (1983), Mark (1995), Flood and Rose (1997) as well as Mark and Sul (2001) tested those models empirically. While Meese and Rogoff (1983) found evidence regarding weak out-of-sample forecast accuracy of monetary models in the short and medium run, Mark (1995) found a better fit for monetary model in the long-run. Recently, Cerra and Saxena (2010) revisited those models and by using recent time series techniques found that there exists a long-run equilibrium relationship between nominal exchange rate and monetary fundamentals.

During six decades the Haitian domestic currency was pegged to the US dollar at the rate of five gourde for one US dollar. In 1990, this fixed exchange rate regime was ruled out due to the fact that the Haitian government was unable to give one US dollar for every five-gourde bill. Latter, the inflow of remittances became more and more important in this economy. For example, from 2% in 1991, the ratio of remittances over GDP represented more than 20% in 2011.

So far, the monetary models of exchange haven't been tested in the case of the Haitian economy. But, in the Caribbean region, Walker (2002) and Craigwell, Wright and RamjeeSingh

(2009) have studied the behavior of the Jamaican nominal exchange rate based on microstructure variables and/or monetary fundamentals. Walker (2002) used only microstructure variables while Craigwell, Wright and RamjeeSingh (2009) used a model incorporating microstructure variables and monetary fundamentals to analyze the behavior of the Jamaican exchange rate. Craigwell, Wright and RamjeeSingh (2009) found that monetary fundamentals explain the changes in the Jamaican exchange rate when they are mixed with microstructure variables. But monetary fundamentals failed to explain the behavior of the Jamaican exchange rate whenever they remove the microstructure variables. In order to fill in this void, we have decided to study the application of the monetary models in the Haiti.

We use data on monetary variables spanning from 1971 to 2009. Since the Haitian fixed exchange regime was abandoned in 1990, we consider 1990 as breakpoint in our model. We found that there exists strong evidence for cointegration between the Haitian nominal exchange rate and the monetary fundamentals. We found that real output is the most important variable that explains the behavior of exchange rate in the long-run, but the money supply and the level of remittances explain mostly the behavior of exchange rate in the short-run.

Our paper is structured as follows. In the beginning, we review the monetary models of exchange rate, we continue with a review of monetary models of Haiti and a brief economic history of Haiti. We pursue with the specification of our model, the data analysis and the empirical estimates. Finally, we discuss the results and conclude.

1 – Review of monetary models of exchange rate

The monetary models of exchange rate are theoretically and empirically very well investigated in the international economics literature. On the theoretical side, Dornbusch (1976) as well as Engel and Frankel (1984) showed that the variability of exchange rates can be explained by changes of fundamental macroeconomic variables such as money supply, real output and prices. According to Dornbusch (1976), based on the assumptions of fixed goods' prices and flexible assets' prices, an exogenous increase in the money supply will cause the exchange rate to depreciate in the short-run. The exchange rate overshoots in response to an increase in money supply. Moreover, Engel and Frankel (1984) generalized the Dornbusch (1976)'s case by showing an exogenous increase in the stock of money will cause the exchange rate to depreciate if this augmentation of the money supply is perceived as permanent by the agents; whereas if the agents perceive it as transitory, the exchange rate will appreciate.

On the empirical side, the subject is more controversial. Meese and Rogoff (1983) as well as Flood and Rose (1997) showed that the monetary models of exchange rate fail to explain and predict the values of exchange rate. However, Mark (1995), Mark and Sul (2001), as well as Cerra and Saxena (2010) showed that exchange rates are determined by macroeconomic variables and they are predictable. In fact, on one side, Meese and Rogoff (1983) demonstrated that the monetary models of exchange rate do not do better than the random walk models in forecasting nominal exchange rates. In addition, they alleged that those models can have some explanatory value but they cannot predict the levels of exchange rate because the explanatory variables in those models are themselves difficult to predict. Flood and Rose (1997) added that the monetary models of exchange rate are unlikely to be very successful. By analyzing observations for eight OECD countries from 1960 to 1991, they found the volatility of macroeconomic variables such as money and output does not appear to be significantly different during regimes of fixed and floating exchanges. They concluded that the determinants of changes in exchange rates are not macroeconomic and future researches with an aim to understand the volatility of exchange rates should concentrate on microeconomic determinants. On the other side, Mark (1995) as well as Mark and Sul (2001) demonstrated that at long-horizon macroeconomic fundamental variables explain the nominal exchange rates and they predict most the exchange rates movements. More recently, Cerra and Saxena (2010), with a large pool of observations gathered from 98 countries, using panel cointegration found strong link between monetary fundamental variables and nominal exchange rates. They also found that the monetary models outperform the random walk models in out-of-sample forecasting accuracy.

2 – Review of exchange rate models of Haiti

To the best of our knowledge, there is no published paper on the monetary models of exchange rates applied to Haiti. In order to overcome this barrier, we try to look at other countries that might reflect the same exchange rate pattern as the one of the Haitian economy. We have decided to examine the Jamaican exchange rate system due to the fact that Haiti and Jamaica are the only two countries classified into the category “managed floating with no pre-determined path for the exchange rate” by IMF in 2009.

Indeed, we found that Walker (2002) and Craigwell, Wright, and RamjeeSingh (2009) have studied the behavior of the Jamaican exchange rate. Walker (2002) tried to explain the variations of the Jamaican exchange rates by using microeconomic variables. Using daily data on spot market rates, trading volume, volatility and bid-ask spreads spanning from 1998 to

2001, the author tested the mixture distributions hypothesis on the Jamaican exchange rate. Recall that the mixture distribution hypothesis stipulates that price volatility and trading volume are both dependent on the same the information arrival rate. He found a negative relationship between trading volume and volatility and a positive relationship between spreads and volatility. Latter, Craigwell, Wright, and RamjeeSingh (2009) proposed a model that combines macroeconomic fundamental variables and microeconomic variables to scrutinize the changes in the Jamaican exchange rate. By using monthly data over the period 2000 to 2008, they found that their model presents good estimates with correct signs. But the model failed to explain the Jamaican exchange rate whenever they excluded the microstructure variables.

While Walker (2002) concentrated his work on microeconomic determinants of the Jamaican nominal exchange rate, Craigwell, Wright, and RamjeeSingh (2009) used both microeconomic and macroeconomic variables to analyze the behavior of the Jamaican nominal exchange rate. Even though the levels of the inflow of remittances are important in the Jamaican economy (11.6% of GDP in 2002 and 14.9% of GDP in 2009), the flow of remittances is not considered in those papers as part of explanatory variables of the Jamaican exchange rate.

3 – Brief economic history of Haiti (1970-2011)

In 1919, the Haitian government initiated a fixed exchange regime between the Haitian national currency, the gourde, and the US dollar. Under this fixed parity, 1 US dollar was equivalent to 5 gourdes. At the end of the year 1990, the Haitian government was unable to keep running this fixed exchange rate of 5 gourdes for $1 US. Three main factors can explain the abandonment of the fixed exchange rate regime to a floating exchange rate regime.

First, since 1974 Haiti has started a long period of current account deficit characterized by increasing government expenses and very low growth in output. While the tax revenues were decreasing, the government expenses continued to enlarge (Jaramillo and Sancak, 2007). As example, the Haitian government budget deficit rose from 10.4 million gourde in 1974 to 327.7 million gourde in 1980 and reached 577.5 million gourde in 1990 while the economy did not grow at a high rate. Second, at the end of the year 1991, the Haitian military forces overthrew the democratic elected president Aristide and controlled the political power from 1991 to 1993. In order to solve the Haitian crisis, the UN imposed a series of sanctions that will have huge consequences in the Haitian economy. As part of these sanctions, the companies in the assembly sector were prevented operating in Haiti and money transfer from the US to Haiti was restricted to $50 US per month (Swindells, 1996). Given the importance of remittances to the Haitian families, this money transfer restriction would push people toward revolting against the military power. Indeed, the Haitian economy lost lots of export revenue and the level of remittances decreased from $123 US million in 1989 to $43 US million in 1994. Finally, in the early 1990's, an unofficial foreign exchange market started operation in Haiti.

Consequently, the Haitian Central Bank, which was created in 1979, was running with fewer and fewer US dollar in reserve (Jaramillo and Sancak, 2007). The Haitian total reserves fell from 55.02 million to 3.17 million US dollar between 1979 and 1990. The Haitian government, consequently, was not able to guarantee the fixed parity anymore. Thus, in 1990, the fixed exchange rate regime between the gourde and the US dollar was abandoned in favor of a clearing market exchange rate regime.

During the period of fixed parity, the Haitian central bank (BRH) regulated the growth rate of the money supply with two main instruments: the required reserve and interest rates. During that time the required reserve rates were very high and could vary from 30% to 73%. On the interest rate side, the BRH decided on a range of interest rates that should be applied in the Haitian economy. Six years after the abandon the fixed exchange rate regime, the Haitian central bank introduced a new monetary policy instrument, the BRH 91-day bond. Actually, the 91-day bond rate is the main monetary policy instrument that the BRH uses to controle the growth of the real money balances. Moreover, the emergence of the BRH 91-day bonds coincides with the quasi complete disparition of the required reserves. (MPCE and PNUD, 2006)

Since 1996, the remittances received in the Haitian economy have increased by almost 20% per year to reach 1.5 billion US dollar in 2011. The inflow of remittances represented more 20% of the Haitian GDP in 2011. According to Arozco (2006), the remittance senders to Haiti mostly are living in the US, are young (under the age of 40), and almost eighty percent of them have a college degree or some college education. The important amount of remittances in Haiti makes this variable an important one in understanding the behavior the Haitian exchange rate. (See Appendix A1)

4 – Model

For Haiti, we anticipate that the level of remittances influences the nominal exchange rates as well as other macroeconomic variables. As a result, we add this variable to the Cerra and Saxena (2010) model. While Cerra and Saxena (2010) performed cointegration analysis on a panel data gathered from 98 countries, we will do cointegration analysis on a single-country data set. Our model is the following:

$$s_t = \alpha + \beta dm_t + \gamma dy_t + \delta b_t + \varepsilon_t$$

Where s_t is the log of the gourde/US dollar exchange rate, dm_t is the differential between log of the US money supply and the log of the Haitian money supply, dy_t is the differential between the log of the US real output and the log of the Haitian real output, b_t is the log of the remittances received in the Haitian economy, and ε_t represents the error disturbance. We anticipate the following signs for the coefficients $\beta<0$, $\gamma>0$, and $\delta<0$. In fact, if the US money supply increases relative to the Haitian money supply or the Haitian money supply decreases compared to the US money supply, the Haitian exchange rate should decreases or the gourde should appreciate, then $\beta<0$. Moreover, if the US real output increases relative to the Haitian real output or the Haitian real output falls compared to the US real output, then the Haitian currency should depreciate (s_t increases), thus $\gamma>0$. Finally, more remittances in the Haitian economy create more supply of US dollar, thus the Haitian currency should appreciate, hence $\delta<0$.

In this model, we consider the gourde as numeraire. We do not include the differentials of interest rates in our model because the Haitian treasury bonds contrary to the US T-bonds are not open to market. In fact, only commercial banks and few other institutions have access to those bonds. In addition, we use the aggregate M2 to evaluate the stock of money in both countries.

5 – Data

Most of our data come from IMF's International Financial Statistics. In fact, the observations for the real output for Haiti and the US, the values for exchange rate between the Haitian gourde and US dollar, and the aggregate M2 for the US come from the International

Financial Statistics. The Haitian money supply comes from the World Bank database. Finally, the observations on remittances received in the Haitian economy are provided by the Inter-American Development Bank. Regarding the time span, we use annual data over the period 1971 to 2009.

6 – Empirical Estimates

6.1 Stationarity test

In order to conduct cointegration analysis we have determine whether our variables in the model are unit processes or not. We cannot reject the unit root null hypothesis at 95% confidence interval. The time-series s_t, dm_t, dy_t, and b_t are nonstatitonary. (See Appendix B1).

6.2 Stability test for existing breaks (Chow Stability Test)

We use the Chow Breakpoint Test to verify whether or not there exist breaks in our data. We check the year 1990 and the year 1994. Recall, 1990 corresponds to the year when the fixed exchange rate regime was abandonned and 1994 the year the UN imposed economic sanctions on Haiti. At 95% confidence interval, the F statistic shows that 1990 is statistically significant and 1994 is not statistically significant. (See Appendix B2). As a result, we define a new variable break_1990 to take into account the change in the structure of our data. Break_1990 is a variable that takes the value zero for years before 1990 and the value 1 for years spanning from 1990 to 2009. This definition is suggested due to the fact the chart of the exchange rate reveals a long-run phenomenon that started in 1990.

6.3 Cointegration Test

Table 1: **Johansen Cointegration Test**

Sample (adjusted): 1973 2009
Included observations: 37 after adjustments

Trend assumption: Linear deterministic trend				
Series: ST DMT DYT BT BREAK_1990				
Lags interval (in first differences): 1 to 1				
Unrestricted Cointegration Rank Test (Trace)				
Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Crit. Value	Prob.**
None *	0.68	104.38	69.82	0.00
At most 1 *	0.58	62.18	47.86	0.00
At most 2 *	0.38	30.10	29.80	0.05
At most 3	0.24	12.58	15.49	0.13
At most 4	0.07	2.61	3.84	0.11
Trace test indicates 3 cointegrating eqn(s) at the 0.05 level				
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Crit. Value	Prob.**
None *	0.68	42.19	33.88	0.00
At most 1 *	0.58	32.08	27.58	0.01
At most 2	0.38	17.52	21.13	0.15
At most 3	0.24	9.97	14.26	0.21
At most 4	0.07	2.61	3.84	0.11
Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

Even though the time-series are nonstationary, we can assume there is a long-run relationship among them if there are cointegrated. In order to check if those variables are cointegrated, we apply Johansen System Cointegration Test with the structure break (year 1990). We use the Schwarz information criterion to determine the lags structure. (See Appendix B3).

The Trace test confirms the existence of 3 cointegrating equations and the Maximun Eigenvalue cointegration test confirms the existence of 2 cointegrating equations at 5% level. Therefore, we conclude that the time-series s_t, dm_t, dy_t, b_t and break_1990 are cointegrated. We, consequently, can assume there exists a long-run relationship among the log of the Haitian exchange rate (s_t), the differential between log of the US money supply and the log of the Haitian money supply (dm_t), the differential between the log of the US real output and the log of the Haitian real output (dy_t), and the log of the remittances received in the Haitian economy (b_t) with the structure break defined as break_1990.

6.4 Estimated Equation

The long-run equilibrium equation is given by the OLS method. Since the variables are cointegrated, this regression is not spurious. The estimated OLS equations is

$$s_t = -1.89 + 0.15dm_t + 0.71dy_t + 0.06b_t - 0.02break\_1990_t + \varepsilon_t$$

R^2=0.99 2.55) (19.9) (2.12) (0.8)

where (*) represents the t-statistic. In this equation, we see that the coefficients of dm_t and b_t are contrary to the economic intuition. Also, the coefficient of the break is not statistically significant. (See Appendix B4)

We don't have any economic explanation for the positive sign of the log remittance receiving in the Haitian economy. The positive sign of the coefficient of the differential between log of the US money supply and the log of the Haitian money supply (dm_t) might express the idea that in the long-run the Haitian nominal exchange rate depends on the the Haitian money supply not on differential between the US and Haitian money supply.

The short-run relationship is given by Vector Error Correction Model. The VECM equation is

$$s_{t-1} = 3.11 - 0.30dm_{t-1} - 0.24dy_{t-1} - 0.27b_{t-1} - 0.32break\_1990_{t-1} + \varepsilon_{t-1}$$

(2.49) (2.90) (4.67) (5.48)

where (*) represents the t-statistics. The VECM provides even better statistics. All the coefficients are statistically significant and the signs of dm_t and b_t are correct regards the economic intuition. In the short-run model, dm_t and b_t have the correct sign. Moreover, 1% increase the log of remittances give rise to 27% decrease in the log exchange rate. In additon, 1% increase in the differential between log of the US money supply and the log of the Haitian money supply provoke a 30% decrease in the log of the Haitian exhange rate. In other words, the log of the Haitian domestic currency appreciates by 27% (respectively 30%) if the log of the remittances go up by 1% (respectively the differential between log of the US money supply and the log of the Haitian money supply go up by 1%). (See Appendix B5)

7 – Discussions

The cointegration test shows a long-run relationship between the log of the Haitian exchange rate and macroeconomic variables such as the differential between the log of the US stock of money and the log of the Haitian stock of money, the differential between the log the US real output and the log of the Haitian real output, as well as the log of remittances received by the Haitian economy. But, in the long-run, the most important variable that explains the changes in the Haitian exchange rate is the differential between the log of the US real output and the log of the Haitian real output, dy_t. In the long-run, the depreciation of the Haitian domestic currency is explained by the very low growth rate of the Haitian real output.

In the short-run, two important variables explain the changes in the Haitian exchange rate: the differential between log of the US money supply and the log of the Haitian money supply and the log of remittances received in the Haitian economy. In the short-run model, we see that the breakpoint 1990 (break_1990) is an important variable that helps understand the behavior of the Haitian exchange rate. In fact, while the break is not statistically significant in the log-run equation, it is highly significant in the short-run model. In the short-run, a 1% increase in the log of remittances causes the log of the Haitian domestic currency to appreciate by 27% also 1% increase in the differential between the log of the US stock of money and the log of the Haitian stock of money give rise to 30% decrease in the log of the Haitian exchange rate. By analyzing, the variance decomposition, we see that, at t-1, s_t explains more than 80% of the variance of dy_t. Based on our data, the exchange rate should be an important variable of the Haitian macroeconomic policy.

8 – Conclusion

The absence of academic papers applying the monetary models of exchange in the case of Haiti motivated our curiosity to investigate the possible application of those models in understanding the behavior of the Haitian exchange rate. Inspired by Cerra and Saxena (2010), we thought that the inclusion the remittances in the original framework of the monetary models might make those models more appropriate for the Haitian economy. We specify our model where the log of the Haitian nominal exchange rate is explained by the differential of the log of the US money supply and the log of the Haitian money supply, the differential of log the US real output and the log the Haitian real output, and the log the remittances received by the Haitian economy. Further, the break date 1990 when the Haitian fixed exchange rate regime was abandoned to a floating regime was integrated in our model as a structure break variable.

Even though the variables of our model are non-stationary, the cointegration test with structure break shows that there exists a long-run equilibrium relationship between them. In the long-run equilibrium model, the differential between the log of the US real output and the log of the Haitian real output is the most important variable in that model. In fact, in the long-run, the very slow growth of the Haitian real output relative to the US real output explains mostly the depreciation of the Haitian domestic currency. However, in the short-run, the log of the remittances and the differential between the log of the US money supply and the log of the Haitian money supply are the most important variables. For example, a one percent increase in the log of remittances (respectively the differential between the log of the US money supply and the log of the Haitian money supply) gives rise to an appreciation of 27 percent (respectively 30 percent) of the log of exchange rate.

The forecasting accuracy of monetary models of exchange rate applying for the Haitian case is not tested here. One important future of this study is evaluating the out-of-sample forecasting accuracy of those models relative to the random walk models in the Haitian case.

REFERENCES

Cerra, Valerie and Saxena, Sweta C., 2010. "The monetary model strikes back: Evidence from the world." Journal of International Economics, vol. 81, no. 1, March 2010, pp. 184-196.

Craigwell Roland, Wright Allan, and RamjeeSingh Diaram. 2009. "Exchange Rate Determination in Jamaica: A Microstructure and Macroeconomic Fundamentals Approach." University of West Indies. May 2009. pp. 1-32.

Dornbusch, Rudiger. 1976. "Expectations and Exchange Rate Dynamics." Journal of Political Economy, vol. 84, no. 6, December 1976, pp. 1161-1176.

Engel, Charles and Frankel, Jeffrey. 1984. "Why Interest Rates React to Money Annoncements: An Explanation from the Foreign Exchange Market." Journal of Monetary Economics, vol. 13, no. 1, pp.31-39.

Flood, Robert P., Rose, Andrew K., 1995. "Fixing Exchange Rates: A Virtual Quest for Fundamentals." Journal of Monetary Economics, vol. 85, no. 1, August 1995, pp. 3-37.

Jaramillo, Laura and Sancak, Cemile. "Growth in the Dominican Republic and Haiti: Why has the Grass Been Geener on One Side of Hispanila?" IMF Working Paper. WP/07/63. March 2007. 35p.

Mark, Nelson C. 1995. "Exchange Rates and Fundamentals: Evidence on Long-Horizon Predictability." American Economic Review, vol. 85, no. 1, March 1995, pp. 201-218.

Mark, Nelson C. 2001. International Macroeconomics and Finance :Theory and Econometric Method. Wiley-Blackwell. 1 Ed., August 2001, 296p.

Mark, Nelson C. and Sul, Donggyu. 2001. "Nominal exchange rates and monetary fundamentals: Evidence from a small post-Bretton woods panel." Journal of International Economics, vol. 53, no. 1, February 2001, pp. 29-52.

Meese Rechard, and Rogoff, Kenneth. 1983. "Empirical Exhange Rate Models of the Seventies: Do They Fit Out of Sample? Journal of International Economics, vol. 14, no. 1-2, February 1983, pp 3-24.

MPCE and PNUD. Politique Macroéconomique et Pauvreté en Haiti (1981-2003)., UNDP Haiti. 2006, 151p.

Orozco, Manuel. 2006. "Understanding the remittance economy in Haiti." World Bank. March 2006. 38p.

Swindells, Felicia. 1996. "U.N. Sanctions in Haiti :A Contradiction Under Articles 41 and 55 of the U.N. Charter." Fordham International Law Journal, vol.20, Issue 5, Article 13, pp. 1876-1960.

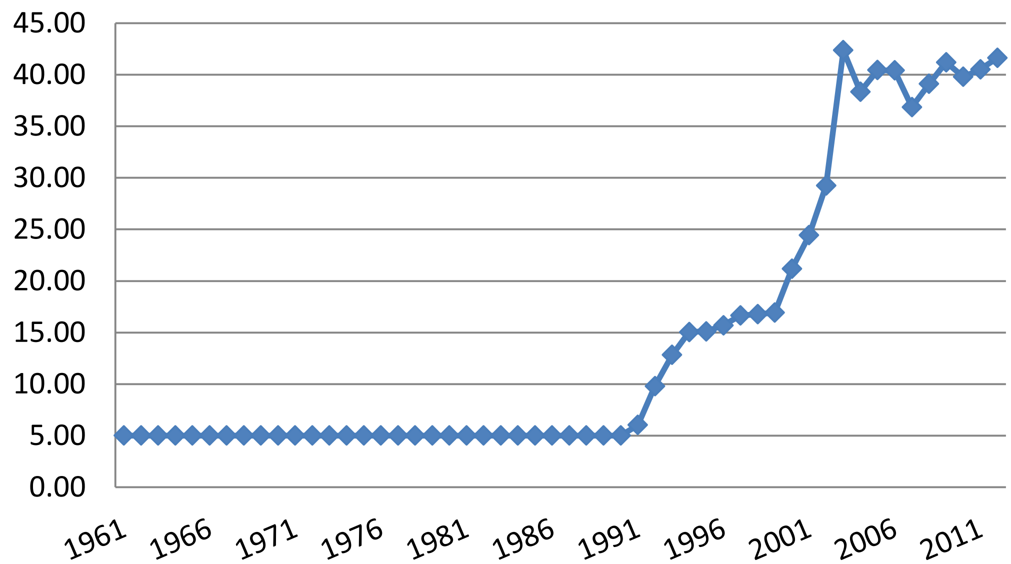
Walker, Annya. 2002. “The Microstructure of the Jamaican Foreign Exchange Market: Volumes, Volatility and Spreads.” Bank of Jamaica. February 2002. pp 1-38.

APPENDICES

Appendix A: Some macroeconomic variables of the Haitian economy

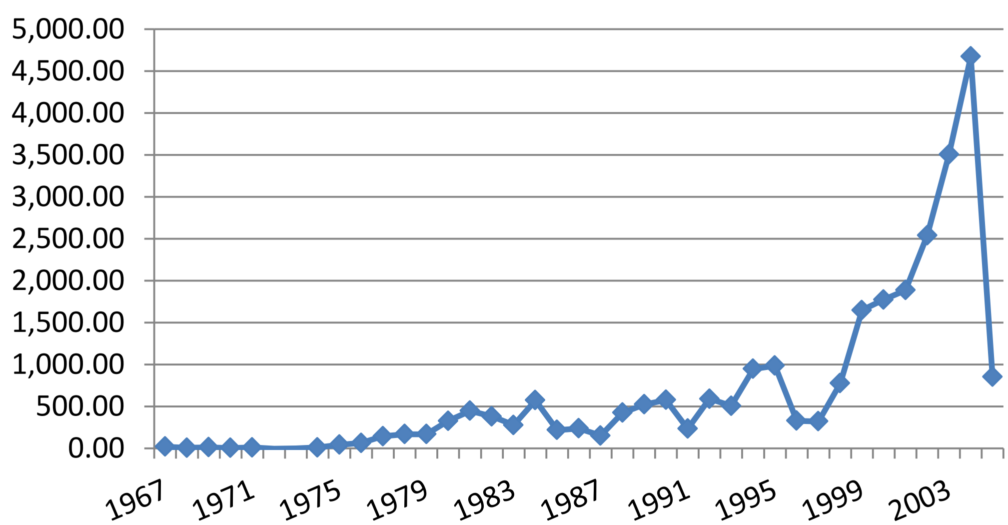
A1) Exchange rate

FIGURE 1: Exchange Rate (Haitian Gourdes for 1 $ US 1961-2012)

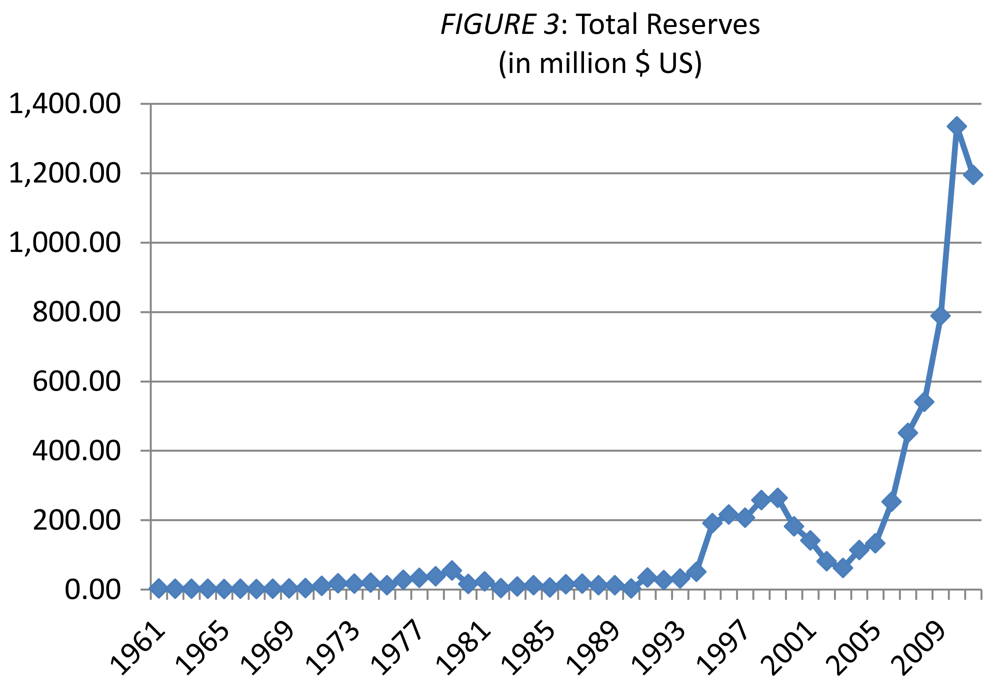


A2) Government budget deficit

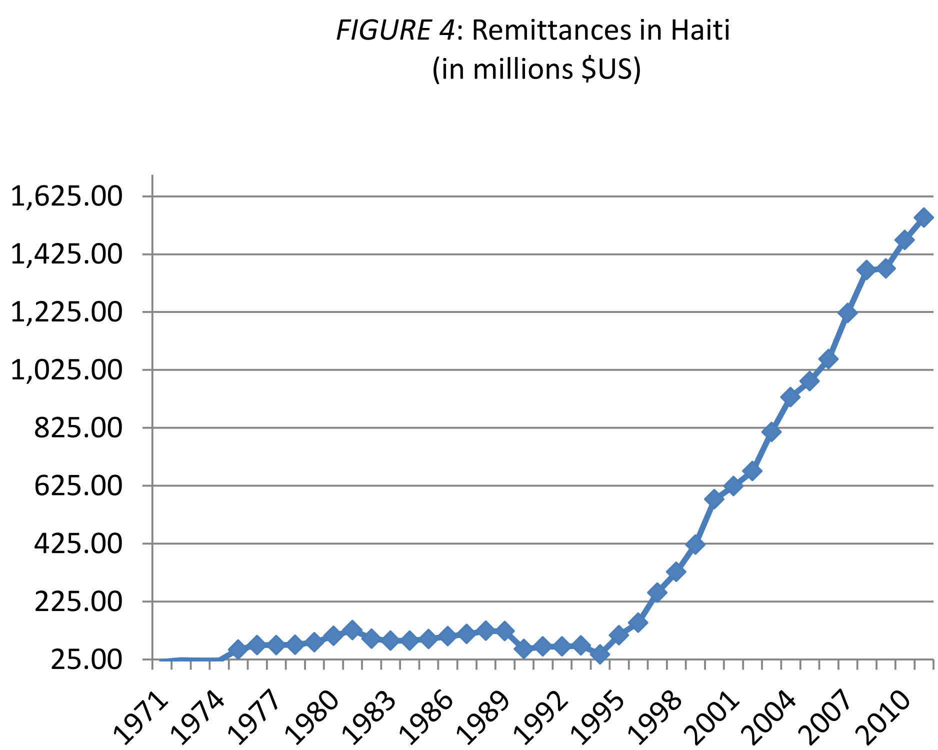
FIGURE 2: Haitian Government Budget Deficit (in million gourde)



A3) Total Reserves



A4) Remittances received by the Haitian economy



Appendix B: Econometric result outputs

B1) Stationarity Test

Table 2**: Augmented Dickey-Fuller Test**

Null Hypothesis: ST has a unit root			
		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.15	0.50
Test critical values:	1% level	-4.23	
	5% level	-3.54	
Null Hypothesis: DMT has a unit root			
		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.53	0.05
Test critical values:	1% level	-4.22	
	5% level	-3.53	
Null Hypothesis: DYT has a unit root			
		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.39	0.38
Test critical values:	1% level	-4.23	
	5% level	-3.54	
Null Hypothesis: BT has a unit root			
		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.59	0.78
Test critical values:	1% level	-4.22	
	5% level	-3.53	

B2) Chow Breakpoint Test

Table 3**: Chow Breakpiont Test**

Chow Breakpoint Test: 1990			
Null Hypothesis: No breaks at specified breakpoints			
Varying regressors: DMT DYT BT			
Equation Sample: 1971 2009			
F-statistic	29.77	Prob. F(3,32)	0.00
Log likelihood ratio	51.97	Prob. Chi-Square(3)	0.00
Wald Statistic	89.30	Prob. Chi-Square(3)	0.00
Chow Breakpoint Test: 1994			
Null Hypothesis: No breaks at specified breakpoints			
Varying regressors: DMT DYT BT			

Equation Sample: 1971 2009			
F-statistic	2.48	Prob. F(3,32)	0.08
Log likelihood ratio	8.15	Prob. Chi-Square(3)	0.04
Wald Statistic	7.44	Prob. Chi-Square(3)	0.06

B3) Lag Structure

Table 4**: VAR Lag Order Selection Criteria**

VAR Lag Order Selection Criteria						
Endogenous variables: ST DMT DYT BT BREAK_1990						
Exogenous variables: C						
Sample: 1971 2009						
Included observations: 34						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	127.86	NA	5.00E-10	-7.23	-7.00	-7.15
1	289.47	266.19	1.65E-13	-15.26	-13.91*	-14.80
2	322.06	44.08	1.17E-13	-15.71	-13.24	-14.87
3	357.77	37.81*	8.24E-14	-16.34	-12.75	-15.11
4	383.73	19.85	1.47E-13	-16.40	-11.68	-14.79
5	458.98	35.41	3.07E-14*	-19.35*	-13.52	-17.36*
* indicates lag order selected by the criterion						
LR: sequential modified LR test statistic (each test at 5% level)						
FPE: Final prediction error						
AIC: Akaike information criterion						
SC: Schwarz information criterion						
HQ: Hannan-Quinn information criterion						

B4) OLS estimates

Table 5**: OLS Estimate**

Dependent Variable: ST				
Method: Least Squares				
Sample: 1971 2009				
Included observations: 39				
Variable	Coef.	Std. Error	T-Stat.	Prob.
DMT	0.15	0.06	2.55	0.02
DYT	0.71	0.04	19.90	0.00
BT	0.06	0.03	2.12	0.04

BREAK_1990	-0.02	0.02	-0.79	0.43
C	-1.89	0.34	-5.64	0.00
R-squared	1.00	Mean dependent var	1.01	
Adjusted R-squared	1.00	S.D. dependent var	0.37	
S.E. of regression	0.02	Akaike info criterion	-4.57	
Sum squared resid	0.02	Schwarz criterion	-4.36	
Log likelihood	94.11	Hannan-Quinn criter.	-4.49	
F-statistic	2365.91	Durbin-Watson stat	0.55	
Prob(F-statistic)	0.00			

B5) VECM estimates

Table 6**: VECM Estimates**

Vector Error Correction Estimates					
Sample (adjusted): 1973 2009					
Included observations: 37 after adjustments					
Standard errors in ( ) & t-statistics in [ ]					
Cointegrating Eq:	CointEq1				
ST(-1)	1.00				
DMT(-1)	-0.30				
	-0.13				
	[-2.38]				
DYT(-1)	-0.25				
	-0.08				
	[-2.90]				
BT(-1)	-0.27				
	-0.06				
	[-4.67]				
BREAK_1990(-1)	-0.32				
	-0.06				
	[-5.47]				
C	3.11				
Error Correction:	D(ST)	D(DMT)	D(DYT)	D(BT)	D(BREAK_1990)
CointEq1	-0.63	-0.49	-0.80	0.66	-0.79
	-0.11	-0.13	-0.12	-0.43	-0.49
	[-5.75]	[-3.66]	[-6.78]	[1.53]	[-1.59]

D(ST(-1))	0.72	0.74	1.08	1.19	-0.68
	-0.39	-0.48	-0.42	-1.53	-1.77
	[1.81]	[1.55]	[2.53]	[0.77]	[-0.38]
D(DMT(-1))	-0.24	-0.34	-0.23	0.31	-2.18
	-0.16	-0.19	-0.17	-0.62	-0.72
	[-1.49]	[-1.74]	[-1.31]	[0.50]	[-3.04]
D(DYT(-1))	-0.34	-0.53	-0.58	-1.05	1.08
	-0.33	-0.39	-0.35	-1.26	-1.46
	[-1.03]	[-1.33]	[-1.65]	[-0.83]	[0.73]
D(BT(-1))	-0.09	-0.08	-0.14	0.08	-0.33
	-0.06	-0.07	-0.06	-0.22	-0.25
	[-1.53]	[-1.10]	[-2.24]	[0.38]	[-1.28]
D(BREAK_1990(-1))	-0.12	-0.08	-0.21	0.19	-0.27
	-0.05	-0.06	-0.06	-0.20	-0.23
	[-2.26]	[-1.33]	[-3.67]	[0.93]	[-1.13]
C	0.02	-0.01	0.03	0.05	0.00
	-0.01	-0.01	-0.01	-0.03	-0.04
	[2.61]	[-1.19]	[3.74]	[1.461]	[0.00]
R-squared	0.65	0.38	0.72	0.10	0.26
Adj. R-squared	0.57	0.25	0.67	-0.08	0.12
Sum sq. resids	0.04	0.05	0.04	0.54	0.72
S.E. equation	0.03	0.04	0.04	0.13	0.15
F-statistic	9.10	3.05	12.97	0.55	1.79
Log likelihood	76.14	69.07	73.35	25.87	20.47
Akaike AIC	-3.74	-3.36	-3.59	-1.02	-0.73
Schwarz SC	-3.43	-3.05	-3.28	-0.71	-0.42
Mean dependent	0.02	-0.01	0.03	0.05	0.03
S.D. dependent	0.05	0.05	0.06	0.13	0.16
Determinant resid covariance (dof adj.)		0.00			
Determinant resid covariance		0.00			
Log likelihood		305.08			

Akaike information criterion	-14.33			
Schwarz criterion	-12.59			

B6) Variance Decomposition

Table 7**: Variance Decomposition**

Variance Decomposition of ST:						
Period	S.E.	ST	DMT	DYT	BT	BREAK_1990
1	0.03	100.00	0.00	0.00	0.00	0.00
2	0.05	91.75	0.54	1.35	1.14	5.22
3	0.06	56.43	0.62	2.08	3.45	37.42
4	0.08	32.00	2.07	1.79	3.78	60.37
5	0.11	22.07	2.80	1.26	3.61	70.26
6	0.13	18.15	3.30	0.95	3.41	74.19
7	0.15	16.30	3.53	0.76	3.28	76.13
8	0.16	15.29	3.69	0.64	3.18	77.20
9	0.18	14.65	3.79	0.55	3.12	77.89
10	0.20	14.21	3.86	0.49	3.07	78.37
Variance Decomposition of DMT:						
Period	S.E.	ST	DMT	DYT	BT	BREAK_1990
1	0.04	7.16	92.84	0.00	0.00	0.00
2	0.05	4.52	89.88	2.46	0.17	2.96
3	0.07	5.53	73.98	2.43	0.63	17.44
4	0.08	9.32	60.19	2.22	0.72	27.56
5	0.10	12.61	50.61	1.84	0.80	34.15
6	0.11	15.02	44.42	1.61	0.83	38.12
7	0.12	16.71	40.22	1.44	0.85	40.77
8	0.13	17.96	37.23	1.32	0.87	42.62
9	0.14	18.87	35.05	1.23	0.88	43.97
10	0.15	19.58	33.38	1.16	0.89	45.00
Variance Decomposition of DYT:						
Period	S.E.	ST	DMT	DYT	BT	BREAK_1990
1	0.04	81.37	0.15	18.48	0.00	0.00
2	0.05	83.31	0.08	13.08	1.92	1.61
3	0.07	47.71	0.29	7.94	5.97	38.09
4	0.09	27.02	0.89	4.27	5.75	62.07

5	0.12	20.91	1.25	2.83	5.03	69.98
6	0.15	19.32	1.59	2.24	4.54	72.31
7	0.18	18.82	1.72	1.94	4.25	73.26
8	0.20	18.66	1.82	1.77	4.06	73.69
9	0.22	18.59	1.89	1.66	3.93	73.93
10	0.24	18.56	1.93	1.58	3.84	74.08
Variance Decomposition of BT:						
Period	S.E.	ST	DMT	DYT	BT	BREAK_1990
1	0.13	2.97	2.61	1.28	93.14	0.00
2	0.19	7.46	2.13	3.68	86.72	0.02
3	0.23	11.20	2.83	4.07	81.41	0.49
4	0.27	14.99	2.73	4.03	76.72	1.53
5	0.31	18.16	2.51	4.05	72.65	2.64
6	0.34	20.47	2.30	4.09	69.70	3.43
7	0.37	22.14	2.17	4.13	67.55	4.01
8	0.40	23.39	2.06	4.16	65.96	4.44
9	0.43	24.34	1.99	4.17	64.73	4.77
10	0.45	25.09	1.92	4.19	63.77	5.03
Variance Decomposition of BREAK_1990:						
Period	S.E.	ST	DMT	DYT	BT	BREAK_1990
1	0.15	7.95	0.14	1.06	19.53	71.32
2	0.24	13.18	8.05	0.51	19.88	58.38
3	0.30	15.75	6.91	0.69	18.77	57.89
4	0.35	17.19	6.84	0.61	18.25	57.11
5	0.40	18.35	6.44	0.57	17.37	57.26
6	0.44	19.21	6.38	0.54	16.77	57.09
7	0.48	19.87	6.27	0.53	16.29	57.04
8	0.52	20.35	6.21	0.52	15.95	56.96
9	0.56	20.73	6.16	0.52	15.68	56.92
10	0.59	21.02	6.12	0.51	15.48	56.87
Cholesky Ordering: ST DMT DYT BT BREAK_1990						

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