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Exchange Rate Impact on Growth in Jamaica

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Abstract

This paper investigates the exchange rate and economic growth nexus in Jamaica. In this context, the study assesses the impact of movements in nominal and real effective exchange rate on economic activity. In particular, the paper refines the analysis by dichotomizing economic activity into tradable and non-tradable industries as well as exploring the presence of nonlinearity. The results demonstrate that depreciation of the Jamaica Dollar, positively impacts economic activity. Furthermore, there exists asymmetry in the exchange rate-growth relationship in that the positive impact of depreciation is reduced during high inflation episodes, thus highlighting the importance of price stability. The study also examines the difference in investment behaviour in response to movements in the exchange rate in the manufacturing industry and finds that firm investment decisions react positively to depreciation as well as to growth in sales.

JEL classification: F31, F43, O11, C23

Keywords: Panel Data, Investment, Monetary Policy, Exchange Rates, Growth.

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Contents

I. Introduction

A pivotal role of policy makers is to have a comprehensive understanding of the dynamic relationships between macroeconomic variables for policies to be effective. In this regard, this paper seeks to further deepen the cadre of tools and models used to estimate the interaction between key macroeconomic variables, by examining the relationship between exchange rate and growth. To the authors knowledge a direct investigation of the relationship between these two variables has not been explored explicitly for Jamaica. Literature on exchange rate movements in Jamaica have focused primarily on the impact of exchange rate movements on inflation through import prices, referred to as the exchange rate pass-through (Macfarlane, 2002). In this context, it was thought useful to investigate the role of the exchange rate in Jamaica's GDP growth. Intuitively, the paper seeks to elucidate the potential role of exchange rate movements in stimulating real economic activity through the channels of trade and investment. The paper also discusses the implications of the use of exchange rates management towards stimulating economic growth through the adjustments to Jamaica's competitiveness. In addition, it was also thought valuable to dichotomize the investigation to unearth the exchange rate impact on the value added of tradable and non-tradable industries. The paper also examines whether the impact of exchange rate on GDP and / or industries growth has asymmetric impact in high and low inflationary periods. The impact of exchange rate movements on the investment decisions of the manufacturing industry at the firm level was also explored. From this analysis we glean the impact of exchange rate movements on firms' profitability and overall levels of investment (Campa et al, 1999). Moreover, exchange rate movements can also alter the relative attractiveness of domestic versus foreign production. This is important as investment fluctuation, in plant and equipment, are an important component of business cycles (Lafrance, et al., 2000).

In setting up the framework for the desired investigations there are important theoretical foundations that should be kept in mind. Of note are some stylized facts which inter alia include that, exchange rates, when flexible, tend to be highly volatile. Additionally, there is a very close correspondence between real and nominal exchange rates. Furthermore, real exchange rates are highly persistent as evidenced by the slow mean reversion in real exchange rates (MacDonald,

2000). Concerning the theory on causality relationship, the direction of causation may be thought of as exchange rate movements causing growth, as examined in this paper. Alternatively, the reverse causal relationship of economic activity influencing exchange rates is premised on the persistent nature of real exchange rates and is popularly explained by either the Balassa-Samuelson effect or the Houthakker-Magee-Krugman (HMK) hypothesis. The Balassa-Samuelson effect posits that a country which has relatively high productivity in its traded goods sector, compared to its non-traded goods sector, will have an overvalued currency relative to its trading partner(s). The HMK hypothesis suggests that countries with different long term growth rates, relative to their trading partners, face different elasticities of import and export demand, may result in long-run changes in their real exchange rate (MacDonald, 2000).

With respect to the exchange rate impact on the economic growth process, theory states that depreciation leads to greater profitability of domestic producers and results in capacity utilization in the short term and, possibly an increase investment in the medium term. However, in practice there exists some ambiguity as the aforementioned theoretical effects ignore a number of factors inter alia the cost of imported intermediate inputs into production as well as other macroeconomic consequences which could offset or perhaps even reverse the initial effects (MacDonald, 2000).

In sum, the paper estimates the size and determinants of the effects of exchange rate changes on economic growth in Jamaica, using quarterly data from 1992:Q1 to 2012:Q1. The relationship is derived from a single equation instrumental variable estimation and a vector error correction model (VECM). This is followed by a panel estimation of the association between exchange rate and investment using annual firm level data.

The paper is arranged as follows. Section II discusses the theoretical relationship between the exchange rate and economic growth as well as findings from the existing literature. Section III

details the methodology and the empirical analysis is presented and results are discussed in Section IV. Section V has concluding comments.

II. Literature Review

Theoretically, the impact of the exchange rate on overall economic activity can be traced from the exchange rate and its connections with inflation and economic growth. Economic growth is impacted by both the nominal exchange rate, as it is a sensitive policy indicator, as well as the real effective exchange rate (REER) i.e. the weighted average of a country's currency relative to an index or basket of other major currencies adjusted for the effects of inflation. Misalignment in the real effective exchange rate influences the production structure, the allocation and distribution of factor payments, international reserves and external debt. Suffice to say, persistence overvaluation erodes business confidence resulting in the lowering of investment and savings, ultimately leading to a decline in growth (McPherson et al., 2000).

An examination of the literature reveals mixed results. On one side of the spectrum, Rodrick (2008) using cross-country panel regressions found empirical evidence indicating correlation of his measure of undervaluation with economic growth. Additionally, he provides evidence that the REER-growth relationship is larger and more robust in developing countries. These results were in line with Rapetti et al. (2011) in a study of REER-growth relationship that showed that a depreciated exchange rate would have an expansionary impact on growth in developing countries. Likewise, empirical estimates from a study of the Euro-zone by MacDonald (2000) support a significant levels effect of the real exchange rate on euro-zone trade and validate the positive impact on growth that emanates from the depreciated value of the euro. Examining the same relationship, Tarawalie (2010), by employing the Johansson cointegration technique for the period 1990Q1–2006Q4, found supporting evidence that a depreciation of the REER as well as increases in both money supply and government expenditure increased output growth. He further noted that the REER was found to have the least effect on output growth. The positive

correlation between exchange rate and growth has, however, been criticized on a number of accounts. Woodford (2009), in a critique of Rodrick (2008) pointed out that Rodrik's result exaggerates the strength and robustness of the link between the real exchange rate and growth. He further posits that although monetary policy can affect real exchange rates through its impact on the nominal rate, monetary policy alone cannot maintain a weak real exchange rate for long enough to serve as part of a long-run growth strategy.

The literature also reveals that in cases where there is a positive relationship the magnitude maybe time dependent. Di Mauro et al. (2008), in their investigation of the impact of exchange rate changes on euro area economy, found that, amongst other things, the impact of exchange rate changes on euro area export volumes of goods may have declined over time, albeit with significant cross-country heterogeneity. Nevertheless, the authors noted by using a rolling panel regression, the impact of an exchange rate shock on euro area GDP has remained fairly stable over time. Campa and Golberg (1999) in their study of United States, Canada, the United Kingdom, and Japan, found that that the sensitivity of investment, and ultimately growth, to exchange rates movements varies over time. More specifically, the authors found that the responsiveness of investment varied positively in relation to sectoral reliance on export share and negatively with respect to the share of imported inputs in production. Furthermore the association between the REER undervaluation and per capita GDP has also been found to be non-monotonic (Rapetti et al, 2011). Additionally, Razin and Rubinstein (2006), on the other hand found that the relationship between the exchange rate and economic growth was not stable over time or clear-cut due to the existence of nonlinear effects.

On the other hand, other studies such as McPherson et al, (2000) in examining the relationship between economic growth and exchange rate in Kenya for the period 1970 to 1996, found no evidence of a strong direct relationship between changes in the exchange rate and GDP growth in Kenya. Instead, the author’s study, which employs a fully specified (but small) macroeconomic model, a single equation instrumental variable estimation, and a vector-autoregression model,

presents evidence that economic growth in Kenya is directly impacted by other factors which have sustained a real exchange rate over-valuation. The paper concluded that improvements in exchange rate management alone is not sufficient to stimulate growth in Kenya, without a broader program of economic reform.

As highlighted in McPherson et al. (2000), it is difficult to establish the impact of exchange rates on the rate of economic growth as the effect is both direct and indirect. The total impact of movements in the exchange rate is captured through the interaction among the exchange rate, inflation and economic growth. This is further complicated in instances of high and rising inflation amidst a slow-adjusting nominal exchange rate. MacFarlane (2002), Di Mauro et al (2008) and others have found a more distinct link between the exchange rate and inflation, and states that inflation increases uncertainty that impedes economic growth. Similar work by Rodrik (2008) has found that in general the extent to which the exchange rate affects domestic prices via import prices largely depends on the pricing behaviour of exporting and importing firms. Furthermore, the exchange rate pass-through to inflation is rapidly incorporated into prices where the exchange rate is used as a nominal anchor to inflationary expectations. In contrast, an inflation targeting regime and similar regimes movements in the exchange rate would have a lower impact on domestic prices as inflation expectations are mainly anchored by the central bank's inflation target (MacFarlane, 2002).

III. Methodology

The empirical investigation embodied in this paper is twofold: (1) an investigation of the impact of exchange rate movements on economic activity; (2) examining the impact of exchange rate movements on the investment decisions of the manufacturing industry.

The empirical model used to assess the impact of exchange rate volatility on economic growth in Jamaica follows that of Aghion et al. (2006) and Benhima (2008). The latter study used a general method of moments (GMM) model so as to eliminate endogeneity bias in its examination of the

impact of exchange rate movements on growth in Asia, Latin America and Africa. The estimated equation takes the form:

$$\Delta y_t = c + \Delta y_{t-1} + \gamma_1 FD_{t-1} + \gamma_1 e_t + \Delta TI_{t-1} + \Delta GB_{t-1} + \pi_{t-1} + \Delta edu_{t-1} + dumgdp + FDI_{t-1} + \varepsilon_t \quad (1a)$$

Where $y_t$is the logarithm of real output (GDP), e_t the exchange rate and FD_t represents private sector credit to GDP, which captures financial development. The remaining variables are control variables. GB is government burden measured by Government debt as a percentage of GDP, π_t is inflation and edu_{t-1} captures education measured by total public and private enrolment in secondary schools. $Dumgdp$ is a dummy used to capture the impact on GDP of the recent global crises of 2009, FDI_t is foreign direct investment (FDI) and TI_t represents trade openness/intensity measured by the share of total exports and imports in GDP. The set of control variables follows Levine et al. (2000) and Aghion et al. (2006). Each variable was examined for stationarity in the levels and first difference was taken where data was found to demonstrate a unit root (Table 1). Given its computational attractiveness, the GMM procedure was used to estimate the model in first differences using further lags of the dependent variable as instruments. These instrumentals variables included lags of financial development, real effective exchange rate, trade intensity, government burden, inflation, education and foreign direct investment.

In addition to the GMM estimation, a long run dynamic relationship between the exchange rate and growth is examined using an aggregated small-scale macroeconomic model similar to that of Robinson and Hall (2004). The VECM for GDP is specified as a function of interest rates and exchange rates consistent with the traditional open economy IS curve. The impact of alumina prices was also incorporated in the model. As a result, the following econometric model of GDP was estimated:$\Delta X_t = \alpha_0 + \varphi \times X_{t-1} + \sum_i c_i \times \Delta X_{t-1} + \varepsilon_t \quad (1b)$

where $\varphi = \alpha \times \beta$, β are the cointegrating vectors, $\beta \times X_{t-1}$ captures the long-run relationships (cointegration equations), α represents the speed of adjustment to the long run relationship and X are the endogenous variables, namely, GDP, exchange rates, interest rates and alumina prices.

The second investigation follows the work of Swift (2006) to examine the relationship between exchange rates and investment through an optimizing adjustment-cost model of investment. The theoretical framework assumes that a firm will choose the optimal level of investment to maximize expected future cash flows. The GMM regression is as follows:

$$\Delta I = \beta_0 + \beta_1(MKUP_{t-1})\Delta e_t + \beta_2 \Delta sales_{t-1} + \beta_3 \Delta r_{t-1} + \Delta I_{t-1} + \varepsilon_t \qquad (2)$$

where I is investment in new capital expenditure, e_t is the real effective exchange rate, $\Delta sales_{t-1}$ represents growth rate of real total sales in the industry and Δr_{t-1} the real interest rate. The inclusion of the sales variable is used to control for other industry–specific factors that may have influenced investment growth over the period. The industry competitive structure, $MKUP$, is the derived measure of average markup to represent market power in the industry. Algebraically, $MKUP$ is computed as the ratio of revenue to cost. Its inclusion allows for consistent comparison of changes in profit margins over time as the exchange rate changes. Intuitively, lower levels of markup increase the responsiveness of investment to exchange rate changes (Swift, 2006). The interaction of e_t and MKUP incorporates the influence of competitive structure on exchange rate effects. Equation 2 was estimated for the total investment of companies listed on the Jamaica Stock Exchange and for listed manufacture firms. Given the possibility of serial correlation and subsequent bias in the estimates as a result of the inclusion of the lagged dependent variable, the instrumental variables estimation (2SLS) was employed with additional lags of investment and sales as instruments.

IV. Empirical Analysis and Results

The analysis begins by estimating single equation regressions of the real output growth and the real exchange rate. Given that the nominal exchange rate is a sensitive policy indicator, this paper considers the impact of the nominal end-of-period and nominal quarterly average exchange

rates on economic growth with the latter used to capture intra quarter volatility. Quarterly time series data covering the period 1992:Q1 to 2012:Q1 was used.

The empirical analysis begins with determining the direction of causation of the variables of interest followed by the lead/ lag relationship. The results of the granger causality test indicate a rejection of the null hypothesis that GDP rate does not cause the average quarterly exchange in levels and in first difference at the 10 per cent level of significance (Table 2a). Furthermore, the granger causality test between the REER and the GDP indicated a rejection of the hypothesis that GDP does not granger cause the REER at the 5 per cent level of significance. Similar test between the GDP of non-tradable and tradable industries, and measures of exchange rate were inconclusive. The cross-correlation statistics in Table 2b and 2c demonstrates that, with the exception of the first difference correlation between GDP and the average exchange rate, the average exchange rate exhibits contemporaneous relationship with GDP in levels, while the REER lags behind GDP in levels and in first difference. Given these results the model was estimated with the assumption that the exchange rate impacts GDP growth.

Table 3 in the Appendix shows the results from the GMM regression in equation (1). Columns (1) - (3) report the results using the real effective exchange rate, the end of period nominal exchange rate and the quarterly average nominal exchange rate, respectively.[2]

With the exception of the education variable, the signs of the traditional control variables are in line with *a priori* expectations. Economic activity is negatively impacted by increases in government consumption as well as the lack of price stability. On the other hand, the level of trade openness and foreign direct investment were found to be growth enhancing. From the results it should be also noted that the coefficients on the inflation and trade openness variables are larger than the exchange rate variable. This indicates greater potential gains from price stability and a high degree of trade openness that maybe achieved relative to exchange rate

[2] In this paper, both the end of period and average exchange rates are defined in terms of Jamaica Dollars per US dollar. However, the REER is US dollars per Jamaica Dollar

movements. Of note, the coefficient of the FDI variable was small and found to be significantly different from zero, according to the Wald test. The role of financial development was not always found to be statistically significant. However, in the instances when financial development was significant, the coefficient, albeit small, was found to be significantly different from zero from the Wald tests conducted. This result corroborates the notion that stricter credit requirements results in lower growth. Furthermore, convergence emerges since the coefficient of the lag of economic growth on itself is negative. The statistically significant and negative sign on the education coefficient could possible reflect the combined impact of the continued low level of passes from the secondary level as well as the impact of brain drain of the most qualified individuals.

The results from all measures of the exchange rate showed that a depreciated exchange rate had a positive impact on economic growth in Jamaica. The impact ranged from 0.05 per cent to 0.13 per cent. Largely similar results were obtained when GDP was divided into tradable and non-tradable industries with the exception of changes in the end-of-period nominal exchange rate[3]. As expected, the impact on the tradable industries was much larger than that on the non-tradable industries. The growth within the tradable industries in response to a depreciated exchange rate ranged between 0.19 per cent to 0.35 per cent from 0.07 per cent to 0.13 per cent for the non-tradable industries (see Tables 3a and 3b in the Appendix). However, the result for the tradable industry using the end-of-period nominal exchange rate indicated that a depreciated exchange rate leads to a contraction in output of 0.17 per cent. Intuitively, a trend appreciation of the real effective exchange rate is considered unfavorable for the growth of exports, as it favors imports from competing countries. The Sargan test for the robustness of instrumental variables in all estimated equations indicated a failure to reject the null hypothesis that the over-identifying restrictions are valid. These results coincide with that of Rapetti, et al. (2011) who, by using a dynamic panel approach using the generalized method of moments (GMM), found that the coefficients of the real effective exchange rate, remained stable in the range between 0.017 and

[3] The end-of-period nominal exchange rate, measured as the US dollar / Jamaica Dollar exchange rate for the last day of trading for each quarter, reduces the intra quarter volatility of the exchange rate and was found to negatively impact growth in the tradables industries.

0.023 under one classification and lies in the 0.022 - 0.025 range using an alternate classification. Rodrik (2008), in investigating the relationship between undervaluation and growth, found that the estimated coefficient of the real exchange rate for developing countries with GDP per capita less than a cutoff in the range of $6,000-$16,000, is between 0.024 and 0.017.

The existence of a nonlinear impact of exchange rate on growth was also explored. Dummies were employed to ascertain whether results were sensitive to conditions of high or low inflation periods.[4] Tables 3c, 3d and 3e in the appendix illustrate the results for test of the nonlinear relationship between exchange rate changes and overall GDP, tradable value added and non-tradable value added, respectively. In summary, in high inflationary periods, the results give support to the hypothesis of a nonlinear relationship between economic growth and movements in the exchange rate. More specifically, the positive impact of depreciation on overall GDP was found to be higher during lower inflationary periods. Intuitively, the results give credence to the hypothesis that lack of price stability reduces or may produce a counter intuitive impact of exchange rate management to influence economic growth. Similarly, the increase in economic growth from depreciation tends to be lower in high inflationary periods for both the tradable and non-tradable industries relative to low inflationary periods. Additionally, the results also indicate the existence of a nonlinear relationship between economic growth and some of the control variables. In particular, the impact of FDI on the growth in value added of the tradable and non-tradable industries was found to be reduced in high inflation periods. The government debt overhang was found to have a more negative impact on the growth of tradable industries during high inflation episodes.

Results from the long run VECM indicate that like the GMM estimations all measures of the exchange rate showed that a depreciated exchange rate had a positive impact on economic

[4] High inflation period is defined as annual average inflation greater than or equal to 10 per cent while low inflation is defined as average annual inflation less than 10.0 per cent. The 10.0 per cent benchmark was used as a threshold over which price changes are considered excessive.

activity (see Table 4). Similar results were also obtained for the non-tradable industries. However, the impact was twice that of the GMM estimates and ranged from 0.14 per cent to 0.37 per cent. Of note, the exchange rate variable was not significant in the long run equation of the tradable industries. The real interest rates and a trend were found to be significant in determining GDP for tradable industries in the long run. It is also important to note that the error correction term for each specification was small but significant, suggesting relatively slow quarterly adjustment of output to deviations from equilibrium.

The second phase of the study involved estimating single equation regressions of firm investment and the exchange rate using annual firm data. Table 5 in the Appendix shows the results from equation (2) using data on the manufacturing industry. The results indicate that depreciation of the exchange rate leads to an increase in total investment. The increase in investment ranges from 0.33 per cent to 0.73 per cent. Intuitively, the increase in investment from depreciation captures increased sales through the export channel. Additionally, the negative and significant coefficient on the one-period lag of investment implies that higher levels of investment spending in one period precedes lower levels of spending in subsequent periods irrespective of the external economic conditions (Driver and Dowrick ,1997). With the exception of the estimation which used the real effective exchange rate, the coefficient on the real interest rate is significantly in line with a priori expectations. The positive and significant coefficient on the sales or output variable indicates the dominant effect on investment[5].

V. Conclusion

This paper examines the effect of exchange rate movement on economic growth. The investigation is first done by examining the direct impact of exchange rate on growth and

[5] The results give credence to the conclusion of neoclassical models of investment of the minor role of user cost being dominated by effects on output or sales on investment (Chirinko, 1993).

secondly by the exploration of exchange rate impact on manufacturing firms' investment decisions. The first stage uses times series data to estimate a GMM model of exchange rate and growth along with control variables. The second phase of estimation used annual panel data of the companies listed on the JSE and employs the GMM procedure using lags of the dependent variables as instruments to deal with the problem of simultaneity bias. The results indicate that depreciation in the exchange rate has a positive impact on overall economic growth. The results are mainly reflective of the positive impact of exchange rate movement on non-tradable industries activity, as the impact on the tradable industries was not clear-cut. For activity in the tradables sector[6], there is a positive REER-growth relationship when the real effective exchange rate or the quarterly average nominal exchange rate is used as the exchange rate variable. However, the association between tradables industry growth and the nominal end-of-period exchange rate is negative. Notwithstanding, the paper finds support for the existence of a nonlinear impact of the exchange rate on economic growth in high and low inflation periods. In high inflation periods the positive growth impact in response to depreciation is lower than that which will prevail in low inflation periods. The results from the second phase of estimation conclude that investment of the typical manufacturing firm is positively associated with depreciation in the exchange rate. From this result, it is possible that earnings by exporters increase at a higher rate than the increase in input prices from depreciation. Alternatively, it could be reflective of general risk aversion in firm investment decision process.

Intuitively, the GMM and the panel regression results tell the same story: over-valued real exchange rate impedes growth and investment in Jamaica. However, between 1996 and 2011 the annual depreciation in the Jamaican Dollar and growth in GDP averaged 5.7 per cent and 0.4 per cent, respectively. In this regard, the other structural factors embodied in the control variables of credit, government burden and inflation which when combine helps to explain Jamaica's unsatisfactory economic performance beyond the exchange rate impact, cannot be ignored as

[6] The calculation of tradables and nontradables adapts the method of Henry (2001). Export agriculture, mining and quarrying, manufacturing, mainly textiles, and hotels & restaurant were grouped as tradables. Construction and services excluding hotels were considered non-tradable.

well as other factors as outlined in Thomas and Serju (2007). Other factors, which have undoubtedly played a role in the economy's performance, include the low level of skill among the labour force, the difficultly of doing business, high energy costs and macroeconomic instability related to fiscal solvency. The results from the VECM also underscore the importance of real interest rates in the determination of value added in the tradable industries in the long run. As such, it is recommended that policymakers, in addition to being informed by the exchange rate and economic growth association, employ policy to enhance the productivity in all sectors and encourage stability in the real exchange rate. Furthermore, as pointed out in the critique of Rodrick (2008) exchange rate management is a useful but not sufficient policy instrument to engender long run sustainable growth.

VI. References

Aghion, Philippe, Philippe Bacchetta, Romain Rancière and Kenneth Rogoff (2006), 'Exchange rate volatility and productivity growth: The role of financial development', NBER Working Paper No 12117.

Arnold C. Harberger. 2003. "Economic Growth and the Real Exchange Rate: Revisiting the Balassa-Samuelson Effect," Paper prepared for a Conference Organized by the Higher School of Economics, Moscow, April 2003.

Assaf Razin & Yona Rubinstein, 2006. "Evaluation of currency regimes: the unique role of sudden stops,"Economic Policy, CEPR, CES, MSH, vol. 21(45), pages 119-152, 01.

Campa, Jose Manuel & Goldberg, Linda S, 1999. "Investment, Pass-Through, and Exchange Rates: A Cross-Country Comparison," International Economic Review, Department of Economics, University of Pennsylvania and Osaka University Institute of Social and Economic Research Association, vol. 40(2), pages 287-314, May.

Chirinko, R. S., 1993. "Business fixed investment spending: a critical survey of modeling strategies, empirical results, and policy implications," Research Working Paper 93-01, Federal Reserve Bank of Kansas City.

Di Mauro, Filippo, Rueffer, Rasmus and Bunda, Irina. 2008. The Changing Role of the Exchange Rate in a Globalised Economy (September 8, 2008). ECB Occasional Paper No. 94.

Discussion by Linda Goldberg of "Exchange Rate Variability and Investment in Canada"by Robert Lafrance and David Tessier, Bank of Canada Conference on Revisiting the Case for Flexible Exchange Rates, November 2000

Driver, C. & Dowrick, S., 1997. "Investment Intentions as an Indicator of Actual Investment in Australian Manufacturing," Australian Economic Papers, Wiley Blackwell, vol. 36(68), pages 90-105, June.

Henry, Chandar (2001) "Measuring Competitiveness in Jamaica" working paper, Bank of Jamaica

Kenza Benhima, 2008. "Exchange Rate Volatility and Productivity Growth: The Role of Liability Dollarization," Working Papers 2008-11, Centre de Recherche en Economie et Statistique.

Levine, R., Norman Loayza and T. Beck (2000), 'Financial intermediation and growth: Causality and causes', Journal of Monetary Economics 46(1), 31–77.

MacDonald, Ronald (2000) "The role of the exchange rate in economic growth: a euro-zone perspective". In: UNSPECIFIED, Brussels, Belgium.

McFarlane, Lavern (2002), "Consumer Price Inflation and Exchange Rate Pass-Through in Jamaica", BOJ Working Paper.

McPherson, M. F., and T. Rakovski. 2000. Exchange Rates and Economic Growth in Kenya: An Econometric Analysis. Belfer Center for Science & International Affairs. John F. Kennedy School of Government.

Martin Rapetti & Peter Skott & Arslan Razmi, 2011. "The Real Exchange Rate and Economic Growth: are Developing Countries Different?," Working Papers 2011-07, University of Massachusetts Amherst, Department of Economics.

Rodrik, Dani. 2008. "The Real Exchange Rate and Economic Growth: Theory and Evidence." Working Paper 2008-0141, Weatherhead Center for International Affairs, Harvard University.

Swift, R., 2007. "Measuring the Effects of Exchange Rate Changes on Investment in Australian Manufacturing Industry", Economic Record, Vol. 82, No. S1, pp. S19-S25, September 2006. Available at SSRN: http://ssrn.com/abstract=922162 or http://dx.doi.org/10.1111/j.1475-4932.2006.00329.x

Tarawalie,A., (2010). Real exchange rate behaviour and economic growth: evidence from Sierra Leone. SAJEMS NS 13 (2010) No 1.

VII. Appendix

Table 1: Unit Root Tests (Augmented Dickey-Fuller)

Variable	Level		1st Difference		Degree of Integration
	T-statistic	P-value	T-statistic	P-value	
GDP	-1.439640	0.5593	-8.959237	0.0000	I(1)
Exchange rate (EOP)	-1.299540	0.6264	-5.451992	0.0000	I(1)
Exchange Rate (quarterly average)	-0.968243	0.7611	-8.203467	0.0000	I(1)
Real effective Exchange rate	-3.725998	0.0051			I(0)
Financial development	-1.810908	0.3728	-9.153405	0.0000	I(1)
Education	-1.063858	0.7233	-6.150369	0.0000	I(1)
Government burden	-1.627089	0.4645	-9.128291	0.0000	I(1)
Inflation	-3.979726	0.0023			I(0)
Foreign Direct Investment	-3.634413	0.0075			I(0)
Trade Openness	-1.602781	0.4769	-8.970869	0.0000	I(1)

Lag lengths in the ADF regressions were chosen by the Bayesian information criterion.

Table 2a: Bivariate Granger causality test results

	Levels		1st difference	
Null Hypothesis:	F-Statistic	Prob.	F-Statistic	Prob.
LXRATE1 does not Granger Cause LY	1.65	0.17	1.07	0.38
LY does not Granger Cause LXRATE1	1.11	0.36	1.07	0.38
LXRATE2 does not Granger Cause LY	0.84	0.51	0.40	0.80
LY does not Granger Cause LXRATE2	2.25	0.07	2.15	0.08
LREER does not Granger Cause LY	0.32	0.86	0.11	0.98
LY does not Granger Cause LREER	3.68	0.01	3.55	0.01

Table 2b: Cross Correlations with GDP in levels

	Nominal Exchange rate (End of period)		Nominal Exchange rate (Quarterly Average)		Real effective Exchange Rate	
	LY,LXRATE1(-i)	LY,LXRATE1(+i)	LY,LXRATE2(-i)	LY,LXRATE2(+i)	LY,LREER(-i)	LY,LREER(+i)
i	lag	lead	lag	lead	lag	lead
0	0.8273	0.8273	0.8259	0.8259	-0.0730	-0.0730
1	0.8067	0.8085	0.8044	0.8117	-0.0522	-0.1238
2	0.7854	0.7858	0.7827	0.7910	-0.0318	-0.1205
3	0.7561	0.7633	0.7548	0.7678	-0.0300	-0.0514
4	0.7408	0.7427	0.7400	0.7450	-0.0193	-0.0036
5	0.7149	0.7276	0.7139	0.7293	-0.0357	0.0221
6	0.6848	0.7112	0.6839	0.7139	-0.0808	0.0675
7	0.6813	0.7062	0.6796	0.7066	-0.0727	0.0906
8	0.6799	0.6944	0.6776	0.6959	-0.0384	0.1014
9	0.6667	0.6747	0.6637	0.6770	0.0077	0.0955
10	0.6411	0.6447	0.6379	0.6497	0.0370	0.0982

Table 2b: Cross Correlations with Growth

	Changes in Nominal Exchange rate (End of period)		Changes in Nominal Exchange rate (Quarterly Average)		Changes in Real effective Exchange Rate	
	DLY,DLXRATE1(-i)	DLY,DLXRATE1(+i)	DLY,DLXRATE2(-i)	DLY,DLXRATE2(+i)	DLY,DLREER(-i)	DLY,DLREER(+i)
i	lag	lead	lag	lead	lag	lead
0	0.3292	0.3292	0.1935	0.1935	-0.0895	-0.0895
1	0.0098	0.2684	-0.0072	0.3803	0.0189	-0.2603
2	-0.0020	-0.0649	-0.1157	0.0471	0.0409	-0.3526
3	-0.1488	-0.1740	-0.0657	-0.1171	0.0429	0.1275
4	-0.1385	-0.0064	-0.1833	-0.0775	0.0209	0.2017
5	-0.0080	-0.0119	-0.0325	-0.0709	0.1394	-0.1372
6	0.0359	-0.0929	0.1796	-0.0141	-0.0133	0.1803
7	-0.0009	0.1556	0.0386	0.0650	-0.0647	0.0159
8	0.0496	0.1306	0.0033	0.1501	-0.0992	-0.0819
9	0.0256	0.0834	-0.0510	0.0876	-0.0012	-0.0206
10	-0.0154	0.0443	-0.0550	0.0751	0.1070	-0.0487

Table 3: Impact of Exchange rate on Overall GDP

	(1)	(2)	(3)
Initial output	-0.096469	-0.161631***	-0.051266
	(0.090306)	(0.046739)	(0.082454)
Financial development	-0.000517	0.005743*	0.007609**
	(0.002541)	(0.002827)	(0.003208)
Exchange rate	-0.057893***	0.089366***	0.132281**
	(0.012841)	(0.016695)	(0.020520)
Control variables			
Inflation	-0.082051*	-0.072757**	-0.075048*
	(0.043871)	(0.029282)	(0.039353)
Government burden	-0.013215***	-0.011807**	0.006739
	(0.003968)	(0.005090)	(0.004922)
Trade openness	0.021268***	0.025758***	0.022549**
	(0.006419)	(0.005601)	(0.006937)
Education	-0.330323***	-0.205916***	-0.242032**
	(0.070566)	(0.026001)	(0.082700)
Intercept	0.262471***	-0.003681	-0.013019**
	(0.062075)	(0.003675)	(0.005274)
FDI	0.002120**	0.002976	0.005069
	(0.001025)	(0.000821)	(0.001170)
Dummy	-0.007217***	-0.014120***	-0.015406***
	(0.002186)	(0.001768)	(0.002413)
Observations	43	44	43
R-squared	0.369841	0.424177	0.454759
Durbin-Watson stat	1.902986	2.214789	2.271336
Sargan test of over-identifying restrictions			
Null Hypothesis: the over-identifying restrictions are valid			
Prob(J-statistic)	0.934471	0.958048	0.95365

*Robust t statistics in parentheses * significant at 10%; ** significant at 5%; *** significant at 1%.*

Table 3a: Impact of Exchange rate on the Value Added of Tradable Industries

	(1)	(2)	(3)
Initial output	0.305812***	-0.067652	0.292468***
	(0.050077)	(0.051538)	(0.047197)
Financial development		-0.006761	-0.001116
		(0.007524)	(0.003675)
Exchange rate	-0.191923**	-0.167522**	0.350057***
	(0.087346)	(0.079071)	(0.133320)
Control variables			
Inflation	-0.870474**	-0.460424***	-0.401948***
	(0.346153)	(0.148784)	(0.065698)
Government burden	-0.134206***	-0.080274***	-0.110100***
	(0.024471)	(0.013788)	(0.019642)
Trade openness	0.216623***	0.169215***	0.221291***
	(0.035315)	(0.018503)	(0.031657)
Education	-1.577353***	-1.843930***	-0.483310
	(0.419244)	(0.266808)	(0.396093)
Intercept	0.921752**	-0.010851**	0.013948
	(0.404701)	(0.009411)	(0.015590)
FDI	-0.001840	0.007635	-0.001116
	(0.003721)	(0.002186)	(0.003675)
Observations	41	39	40
R-squared	0.3329	0.403742	0.348605
Durbin-Watson stat	1.912593	1.750037	2.231426
Sargan test of over-identifying restrictions			
Null Hypothesis: the over-identifying restrictions are valid			
Prob(J-statistic)	0.910377	0.994135	0.994094

*Robust t statistics in parentheses * significant at 10%; ** significant at 5%; *** significant at 1%.*

Table 3b: Impact of Exchange rate on the Value Added of Non-tradable Industries

	(1)	(2)	(3)
Initial output	-0.288705***	0.137579	-0.186628***
	(0.063338)	(0.08003)	(0.081819)
Financial development	-0.008153***	0.000349	0.004425***
	(0.001660)	(0.003249)	(0.001977)
Exchange rate	-0.068165***	0.111685**	0.128842***
	(0.012991)	(0.045065)	(0.018521)
Control variables			
Inflation	-0.111577**	-0.134884***	-0.167527***
	(0.055649)	(0.036305)	(0.030944)
Government burden	0.011778***	0.009379**	0.008581**
	(0.003731)	(0.004468)	(0.003973)
Trade openness	0.015901***	-0.019701***	0.011541***
	(0.005496)	(0.006099)	(0.003626)
Education	-0.116704*	0.191472	-0.209433***
	(0.06535)	(0.115302)	(0.038307)
Intercept	0.340633***	0.024559***	
	(0.060846)	(0.0044459)	
FDI	-0.005224***	-0.004037***	0.002660***
	(0.001033)	(0.001211)	(0.000429)
dummy		-0.00730	-0.012666***
		(0.002909)	(0.001996)
Observations	39	39	39
R-squared	0.2148	0.3247	0.2472
Durbin-Watson stat	1.669958	1.871906	1.810725
Sargan test of over-identifying restrictions			
Null Hypothesis: the over-identifying restrictions are valid			
Prob(J-statistic)	0.976852	0.982413	0.983283

*Robust t statistics in parentheses * significant at 10%; ** significant at 5%; *** significant at 1%.*

Table 3c: Nonlinear Impact of Exchange rate on Overall GDP

	(1)	(2)	(3)
Initial output	-0.091500	-0.311938**	-0.053920
	0.073439	0.114591	0.102926
Initial Output in high inflation periods	0.957149***		
	0.051006		
Financial development	-0.005021**	0.004855	0.007369
	0.002710	0.006173	0.005019
Exchange rate	-0.026071**	0.089569**	0.131153***
	0.013298	0.039925	0.020841
Exchange rate (high inflation)	0.042165***	-0.103585*	-0.017545
	0.016265	0.055998	0.058520
Control variables			
Inflation	-0.117887***	-0.084671	-0.096605
	0.028464	0.056543	0.068920
Government burden	-0.008722***	-0.013664*	-0.010451*
	0.003164	0.007772	0.005800
Trade openness	0.003567	0.026583***	0.023237**
	0.004173	0.005756	0.007170
Education	-0.105414	-0.138936***	-0.192419*
	0.062817	0.042226	0.095716
Intercept	0.103983**	-0.004982	-0.008086
	0.058754	0.005269	0.005528
FDI	0.003412***	0.003298**	0.004044**
	0.000889	0.000991	0.001275
Dummy	-0.003187*	-0.012625	-0.013992***
	0.001706	0.002879	0.002995
State of inflation Dummy	-0.190908**	0.000478	-0.000556
	0.074204	0.002177	0.002296
Observations	39	39	38
R-squared	0.776054	0.417246	0.504619
Durbin-Watson stat	0.931671	1.744112	2.187469
Sargan test of over-identifying restrictions			
Null Hypothesis: the over-identifying restrictions are valid			
Prob(J-statistic)	1.461133	0.926428	0.951585

*Robust t statistics in parentheses * significant at 10%; ** significant at 5%; *** significant at 1%.*

Table 3d: Nonlinear Impact of Exchange rate on the Value Added of Tradable industries

	(1)	(2)	(3)
Initial output	0.100150	-0.098567*	0.202260***
	(0.091067)	(0.055877)	(0.038555)
Initial Output in high inflation periods			1.030797***
			0.051288
Financial development	0.056149	0.046254***	0.013401
	(0.054022)	(0.011503)	(0.008109)
Financial development in high Inflation periods		-0.134501***	
		(0.017074)	
Exchange rate	-0.643589*	-0.299755***	0.469874***
	(0.358731)	(0.066347)	(0.100153)
Exchange rate (high inflation)	1.220829**	0.425574***	-0.537914***
	(0.452028)	(0.078750)	(0.158393)
Control variables			
Inflation	-1.413129*	-0.370420**	-0.057208
	(0.504213)	(0.157783)	(0.063919)
Government burden	-0.156049**	-0.102791***	-0.098584***
	(0.030614)	(0.019203)	(0.023387
Government burden in high inflation periods	-0.096525*		
	(0.049155)		
Trade openness	0.049023	0.198781***	0.245782***
	(0.041243)	(0.026571)	(0.052816)
Education	2.414003**	-1.907258***	0.487700
	(0.931435)	(0.390953)	(0.295278)
Intercept	3.209806**	0.040064	0.013307
	(1.543612)	(0.029248)	(0.009898)
FDI	-0.035246*	-0.004412	-0.001650
	(0.020358)	(0.003873)	(0.001911)
Dummy			
State of inflation Dummy	-5.660226***	-0.081419***	-0.002993
	(2.069466)	(0.009241)	(0.005939)
Observations	44	39	40
R-squared	0.054135	0.478851	0.683980
Durbin-Watson stat	1.289071	1.874049	1.943279
Sargan test of over-identifying restrictions			
Null Hypothesis: the over-identifying restrictions are valid			
Prob(J-statistic)	0.917649	0.980388	0.981973

*Robust t statistics in parentheses * significant at 10%; ** significant at 5%; *** significant at 1%.*

Table 3e: Nonlinear Impact of Exchange Rate on the Value Added of Non-Tradable Industries

	(1)	(2)	(3)
Initial output	-0.130793**	0.017210	-0.112662**
	(0.057012)	(0.036485)	(0.050344)
Initial Output in high inflation periods	0.854353**	0.932185***	0.908643***
	(0.072692)	(0.049019)	(0.052315)
Financial development	-0.009810**	0.001988	3.66E-05
	(0.001941)	(0.001974)	(0.002710)
Financial development in high Inflation periods			
Exchange rate	-0.034687**	0.245948***	0.270726***
	(0.014589)	(0.026534)	(0.037668)
Exchange rate (high inflation)	0.042013**	-0.175873***	-0.243969***
	(0.015803)	(0.034770)	(0.038502)
Control variables			
Inflation	-0.127101***	-0.037424	-0.073464*
	(0.046729)	(0.022626)	(0.041688)
Government burden	0.014268***	0.011845***	0.014441***
	(0.003426)	(0.002547)	(0.002847)
Trade openness	0.006885*	0.005220***	0.010352***
	(0.003424)	(0.002004)	(0.003420)
Education	-0.114289	0.043364	0.055248
	(0.094510)	(0.5940)	(0.045358)
Intercept	0.153136**	-0.002037	
	(0.066982)	(0.003283)	
FDI	0.001098*	0.000525	-7.30E-05
	(0.000632)	(0.000669)	(0.000659)
Dummy			-0.002983
			(0.001807)
State of inflation Dummy	-0.191582***	0.002529	0.003393*
	(0.072365)	(0.001585)	(0.001953)
Observations	38	39	39
R-squared	0.664977	0.828264	0.805689
Durbin-Watson stat	1.828616	1.960709	1.687379
Sargan test of over-identifying restrictions			
Null Hypothesis: the over-identifying restrictions are valid			
Prob(J-statistic)	0.966793	0.947882	0.940541

*Robust t statistics in parentheses * significant at 10%; ** significant at 5%; *** significant at 1%.*

Table 4: Long-run parameters *(T-statistics in [] brackets)*

Dependent Variable	**GDP**			**Tradable GDP**			**Nontradable GDP**		
Measure of exchange rate	*LREER(-1)*	*LXRATE1(-1)*	*LXRATE2(-1)*	*LREER(-1)*	*LXRATE1(-1)*	*LXRATE2(-1)*	*LREER(-1)*	*LXRATE1(-1)*	*LXRATE2(-1)*
Exchange rate	0.374	-0.347	-0.34	-0.148625	-0.254	-0.239	0.356	-0.216	-0.202
	[6.21]	[-5.08]	[-5.35]	[-0.333]	[-0.517]	[-0.503]	[4.63]	[-6.84]	[-6.285]
Real interest Rates	0.0041	0.0052	0.004	0.0494	0.049	0.0456	0.000908	-0.001	-0.0016
	[5.98]	[3.827]	[3.82]	[6.42]	[6.77]	[6.63]	[1.0015]	[-2.613]	[-2.91567]
Alumina Price	-0.1674	-0.182	-0.176	0.093	-0.1262	-0.073	-0.1542	-0.126	-0.121
	[-8.727]	[-8.495]	[-8.931]	[0.641]	[-0.815]	[-0.497]	[-6.082]	[-11.96]	[-11.43]
@TREND(86Q1)	--	0.0066	0.006	0.016	0.021	0.019	--	0.002	0.002
	--	[4.412]	[4.56]	[4.921]	[2.21]	[2.057]	--	[3.91]	[3.392]
C	-12.62	-9.875	-9.932	-11.995	-10.40	-10.66	-12.44	-10.296	-10.36
Error Correction:									
Cointegrating Equation	-0.191	-0.236	-0.256	-0.297	-0.243	-0.296	-0.283	-1.023	-1.06
	-0.07156	-0.08063	-0.08544	-0.12734	-0.12027	-0.12958	-0.15305	-0.23327	-0.22904
	[-2.66]	[-2.93]	[-2.99]	[-2.34]	[-2.02]	[-2.28]	[-1.85]	[-4.39]	[-4.63]
R-squared	0.4189	0.4905	0.4913	0.2068	0.1979	0.2106	0.1839	0.3813	0.4023
Adj. R-squared	0.3027	0.3406	0.3417	-0.0095	-0.0208	-0.0047	-0.0113	0.2334	0.2593
Sum sq. resids	0.0058	0.0051	0.0051	0.3561	0.3601	0.3544	0.0104	0.0079	0.0076
S.E. equation	0.0103	0.0100	0.0100	0.0900	0.0905	0.0897	0.0150	0.0131	0.0129
F-statistic	3.6049	3.2727	3.2837	0.9560	0.9049	0.9782	0.9423	2.5775	2.8145
Log likelihood	218.2314	222.6319	222.6870	63.7774	63.4606	63.9141	167.9117	175.9441	176.9431

Table 5: The Impact of Exchange Rate on Investment in the Manufacturing Industry

	(1)	(2)	(3)
Intercept	2.34871***	-1.07693*	-1.10106*
	(0.552068)	(0.582208)	(0.587885)
Exchange rate Interaction	-0.73161***	0.335954*	0.343972*
	(0.166857)	(0.185099)	(0.187115)
Investment (t-1)	0.210344***	-0.26397	-0.26285
	(0.051376)	(0.155822)	(0.156155)
Sales	0.233619**	0.402563	0.408026
	(0.108034)	(0.283531)	(0.287805)
Real interest Rate	0.029836	-0.04754**	-0.0461**
	(0.030962)	(0.013467)	(0.013108)
Observations	58	31	31
R-squared	0.55314	0.7286	0.7307
Sargan test of over-identifying restrictions			
Null Hypothesis: the over-identifying restrictions are valid			
p-value	0.999955	0.999501	0.999527

*Robust t statistics in parentheses * significant at 10%; ** significant at 5%; *** significant at 1%.*