EXCHANGE RATE VOLATILITY AND MACROECONOMIC PERFORMANCE IN SMALL ISLAND DEVELOPING STATES

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Abstract

The purpose of the study is to provide an investigation into the impact of exchange rate volatility on the macroeconomic performance of Small Island Developing States (SIDS). Taking a sample of 15 SIDS, the present study analyses econometrically the impact of exchange rate volatility on major macroeconomic variables, viz economic growth, external trade and foreign direct investment on the SIDS. The paper first constructs the z-score measure, developed by Wolf et al (2003) as a measure of exchange rate volatility and employs data spanning the period 1999 to 2010 to analyse robust estimates in a static framework as well as in a dynamic and longitudinal data framework using the Generalised Method of Moments. It also analyses the impact of exchange rate volatility on macroeconomic performance of the economies. The OLS with robust standard errors results indicate that, exchange rate volatility impacts negatively on current account balance but positively on the growth rate of the economies studied. In a dynamic setting, however, exchange rate volatility does not influence the macroeconomic variables.

Keywords: Exchange rate volatility, macroeconomy, Small Island Developing States, GMM.

1. INTRODUCTION

Pursuant to the shift to the floating of the US dollar in 1973, capital account liberalisation and the exponential increase in cross border financial transactions during the last three decades, important volatility and uncertainty in exchange rates have now become important features in the modern foreign exchange market. This has raised eyebrows among academicians, policy makers and researchers pertaining to the effect of exchange rate volatility on the macroeconomic performance of world economies. Whilst some theories postulate that exchange rate volatilities hamper macroeconomic performance, others advocate otherwise. From a micro viewpoint, Schabl (2007) points out that exchange rate volatility reduces growth in Gross Domestic Product as it raises international trade costs as well as the costs of capital flows. From a macro

viewpoint, it would bring macroeconomic instabilities for Small Island Developing States (SIDS) and warrants the practice of 'beggar-thy neighbour' depreciation among well reputed trading blocs.

Furthermore, the recent pronounced currency volatilities of world major currencies of the like of euro and USD and the ensuing economic instability in addition to the economic crises in the past in various parts of the globe such as the Asian Crisis, the peso crisis among others authenticates that volatilities in the forex market have some sort of domino effect and can spread their tentacles to the entire macro economy and stimulate major crises.

Since the early 1980s, many developing countries have embarked into capital account and trade liberalisation. Protections in international trade have radically been reduced but on the other hand, these economies have had macroeconomic as well as exchange rate instabilities. Mauritius and other SIDS are of no exception. The SIDS adopt an export led growth strategy, relying mostly on manufacturing and tourism for their survival. Hence, frequent swings in exchange rates have been injurious to the external position and subsequently has had spill over effects on their domestic economy.

Moreover, despite the various swings in the exchange rates of the SIDS, exchange rate risk hedging facilities in these countries are virtually nonexistent. Even if hedging facilities are available, they are considered to be expensive. As a result, exporters bear the consequences of unexpected changes in the exchange rates. So far, despite the fact that the impact of exchange rate volatility on economic performance has been a widely researched area, studies in SIDS are scarce due to lack of data.

The objective of the paper is to evaluate the impact of exchange rate volatility on the macroeconomic performance of a sample of SIDs. In essence, the paper analyses the impact of exchange rate volatility on current account, economic growth and foreign direct investment by using Generalised Method of Moments. Instead of doing a time series analysis, the study will employ data from a pool of fifteen SIDS1 spanning over several years (1999-2010). According to Baltagi (1995), panel data accounts for the fact that the countries are heterogeneous in terms of their economic policies and standards within certain dynamic duration, a situation that cannot be found in either time series or cross section studies. Second, in panel data I include all the countries' data without having to resort to aggregation or averaging, which of course eliminates all biases associated with the latter. Thirdly, the study will employ dynamic panel data analysis to account for the persistence of the effect of exchange rate movements on the macroeconomic variables mentioned. In this vein, dynamic panel data is employed instead of plain OLS as used in previous studies. The results have important policy implications as it will help decision making to policy makers in the SIDs in devising their exchange rate policy with a view to stimulate their macro economy. The study will also raise questions about the performance of the SIDS and what might be done to ensure stability and reduce vulnerabilities in these economies.

To achieve its objective, the paper is structured as follows. Section 2, reviews the literature on exchange rate volatility and macroeconomic performance, while Section 3 gives the situational analysis. Section 4 specifies the models of the study and Section 5 gives a brief description of the volatility measure that is employed in the study. Section 6 presents the data sources and methodology applied and Section 7 analyses the results and finally, Section 8 concludes the paper.

2. REVIEW OF LITERATURE

There exists a plethora of theories to explain the impact of exchange rate volatilities on macroeconomic performance. One variant of literature stresses on the impact of exchange rate volatility on trade whilst others stress on how in different exchange rate systems, real and monetary shocks in the international macro economy influence the domestic economy; how exchange rate volatilities influence foreign direct investment and economic growth. The theoretical literature is more fully explained below.

Theoretical models on the impact of exchange rate volatility on trade is mixed and explained by partial equilibrium and general equilibrium models. The partial equilibrium approach has been explained in the literature by Clark (1973), Hooper and Kohlhagen (1978), Makin (1978), Cushman (1983, 1986) among others. The partial equilibrium approach assumes that there exists no hedging possibilities, firms are risk averse and a higher proportion of revenues and expenditures are in foreign currency such that exchange rate volatility negatively impacts on the level of trade. This is because firms do not change their output levels following a change in exchange rate as production plans are made well in advance in anticipation of changes in exchange rates. Makin (1978) criticized Clark's view and suggested that hedging possibilities do in fact exist such that the impact of trade of exchange rate changes can be hedged. Also, Cushman (1983, 1986),

avers that the impact of exchange rate volatility on trade is mitigated to the extent that if the price of export is priced in a depreciating currency, the loss that might arise from the depreciated exchange rate might be offset partially by incomplete pass through. The partial equilibrium approach also assumes that the only variable that changes is some measure of exchange rate volatility and all other factors remain unchanged. Yet, to get a more concrete picture of the impact of exchange rate volatility, the general equilibrium framework takes into account all major macroeconomic variables. In this vein, Bacchetta and Van Wincoop (2000) developed a simple two-country model wherein uncertainty emanates from monetary, fiscal and technology shocks and the level of trade as well as welfare are contrasted under different exchange rate regimes. The author concludes no linkage between trade level and the exchange rate regime. The theory is based on the premise that an increase in money supply in the foreign country is followed by a depreciation of the foreign currency. causing a fall in demand for imports. However, increased aggregate demand triggered by the increase in money supply may cancel out the part or all of the exchange rate effect. As such, a shock that changes the exchange rate leads to changes in other macroeconomic variables that offset the impact of the movements in the exchange rate. Hondroyiannis et al. (2005) examine the link exchange rate volatility and export for 12 industrial economies using GMM and random coefficient (RC) regressions and find insignificant and nonnegative link between exchange rate and trade. Conversely, Tenreyro (2007) and Arize et al (2008) find negative relationship between exchange rate volatility and exports in new emerging countries.

Another branch of literature stress that the impact of exchange rate volatility on the macro economy depends on the exchange rate regime which the economy follows, although there has been no comprehensible harmony on the ideal regime for macroeconomic performance. Those who are in favour of fixed exchange rate regimes (like Mc Kinnon (1963), Mundell (1973), Frankel and Rose 2002)) stipulate that the macroeconomy is promoted via higher trade levels which would promote economic stability, foreign direct investment, economic growth and hence standard of living. However, more recently, Fischer (2001), argues that fixed exchange rates would encourage speculative capital inflows, moral hazard and overinvestment. On the other hand, those who are in favour of flexible exchange rates (Meade 1951, Friedman 1953 et al), argue that fluctuating exchange rate helps to correct disequilibrium both, local and external, notwithstanding real asymmetric shock. Under a situation of fixed exchange rate regime and international capital mobility, money supply is deemed to be endogenous such that money demand shocks cause money supply to change and therefore LM shocks leave output or inflation unchanged. Under a fixed exchange rate, an external shock is injurious to the domestic economy. A decline in foreign income might result in a fall in domestic demand for exports and since exports are an important function of aggregate demand, the adverse shock to aggregate demand will lead to a fall in domestic income and employment via the multiplier effect. Under a system where exchange rate is determined by market forces, the latter will be allayed through a depreciation of the exchange rate. Hence a foreign shock will have differing effects under different exchange rate regimes. Similarly, a hike in foreign interest rates may lead to a depreciation and an increase in income under fluctuating exchange rates whilst under a fixed exchange rate system, there is bound to be a monetary contraction and a fall in income. Empirical studies regarding exchange rate volatility and macroeconomic performance is scant in small island economies even though there several empirical studies such as Baxter and Stockman (1989), Flood and Rose (1995), Crosby (2000), Bayoumi and Eichengreen (1994) and Kwan and Lui (1999). Baxter and Stockman (1989) uncover less evidence of macroeconomic behaviour or trade flows under differing exchange rate regimes for a sample of 49 countries. Flood and Rose (1995) study US dollar and macroeconomic performance for the G7 countries including The Netherlands and Sweden and find no evidence of a link between monthly nominal exchange rate and macroeconomic performance. Kwan and Lui (1999) find that the introduction of a currency board in Hong Kong reduced output and inflation volatility after 1983. The same conclusion is reached by Crosby (2000), that is the introduction of a currency board reduced macroeconomic volatilities. Bayoumi and Eichengreen (1994) find that under floating rates, output growth is lower for G7 countries.

Theories explaining exchange rate volatility and foreign direct investment (FDI) may be broadly classified into production flexibility theory and risk aversion theory. According to the former, FDI is increased following volatility since firms are assumed to be able to alter their variable factors pursuant to shocks. On the other hand, according to the risk aversion theory, Goldberg and Kolstad (1995) postulate that since higher fluctuations in exchange rate lessen the certainty equivalent expected exchange rate, FDI is reduced following higher exchange rate volatility. Dixit and Pyndick (1994) established a negative relationship between exchange rate volatility and FDI through their irreversibility literature such that exchange rate volatility negatively impacts on FDI. Ceteris paribus, future cash flows to be derived from foreign direct investor will be more volatile if exchange rate is volatile. Markusen (1995) postulates that businesses invest in foreign countries mitigate international trade costs which inter alia embrace foreign exchange risk. Some firms prefer to meet the demand of foreign markets by setting production facilities rather than exports in order to mitigate foreign exchange risk. Empirical evidence regarding the link between

FDI and exchange rate volatility is mixed. For instance, Cushman (1988), Foad (2005) find that exchange rate volatility increases FDI in US. Similarly, Stokman et al (1996) find that FDI is encouraged with exchange rate volatility in Netherlands. De Menil (1999) studies the impact of exchange rate volatility on FDI in the EU and find that FDI is increased by 15% following a 10% upsurge in exchange rate volatility.

However, there are also several studies which find negative links between exchange rate volatility and FDI in line with Pyndick and Dixit (1994) which include inter alia, Darby et al (1999) for France, Germany, the US, UK and Italy; Hubert and Pain (1999), Benassy-Quere et al (2001) for developing countries.

As regards the impact of exchange rate volatility on economic growth, Rodrik (2009) postulate that an undervaluation of the real exchange rate encourages economic growth as it increases the share of tradable sector to GDP. The author points out that the tradable sector is more vulnerable than the non-tradable sector because of institutional weaknesses and market failures, explaining why the tradable sector is too small in developing countries. An undervaluation of the exchange is seen as a policy that would improve export competitiveness, encourage investment in the tradable sector and hence foster economic growth. Other authors, viz Levy, Yeyati and Sturzenegger (2007) deny that expansion in the tradable sector would enhance economic growth. According to them, an undervaluation in exchange rate promotes savings which in terms encourage capital accumulation and hence promote economic growth. Another strand of literature postulates large deviations of real exchange rates from equilibrium reduces growth. Aguirre et al (2005), for instance, postulate that a real overvaluation of the exchange rate might lead to deficits in the current account balance and ultimately to a currency crisis whilst undervaluation provokes inflation and overheats the economy. Large volatilities in exchange rates wrongly signal economic agents; factor inputs are wrongly allocated among competing ends and ultimately create an unstable milieu. There has been extensive research carried out as regards exchange rate volatility and economic growth. For instance, Vieira and MacDonald (2007) examine the impact of real exchange rates misalignment on long run growth for ninety countries for the period 1980-2004 using two step Generalised Method of Moments (GMM) estimates and find that that the coefficients for real exchange rate misalignment are positive for different models and samples, signifying that a more depreciated real exchange rate fosters long run growth whilst a more appreciated real exchange rate hampers long run growth. Akinbobola and Oyetayo (2010) examine the impact of real exchange rate on domestic output growth in Nigeria using data spanning the period 1986-2004. The authors find that the real exchange of Nigeria positively impacts on output growth after a considerable lag. Schnabl (2007) studies the impact of exchange rate volatility for a sample of 41 small open economies in the EMU. The author finds that a stable exchange rate creates a stable milieu for the adjustment of asset and labour market hence fostering growth. For countries with liberalised capital accounts, estimates show a robust negative relationship between exchange rate volatility and growth. Bosworth, Collins and Yuchin (1995) examine the impact of real exchange rate volatility on economic growth for a large sample of developing countries and the results reveal that real exchange rate volatility, by dampening productivity growth, reduces economic growth. In a similar vein, Aghion et al (2009) show that as developing countries develop their financial sector, the negative impact of real exchange rate volatility is less pronounced.

3. SITUATIONAL ANALYSIS

Notwithstanding the in-built restraints facing the Small Island Developing States1, the countries have achieved remarkable macroeconomic performance over the years being studied (1999-2010). On average the economies experience an average growth rate of about 3.5% with some countries like Antigua and Barbuda, Cape Verde, Dominican Republic, Singapore, Grenada and even Suriname experiencing double digit growth rates. This is mainly due to diversification of the economies to meet the Millennium Development Goal of reducing poverty. Even Antigua and Barbuda and other countries like Bahamas, Barbados, Jamaica and Trinidad and Tobago did even experience high negative growth rates after 2008, chiefly on account of competition in their traditional exports emanating from emerging low cost producing economies. The path of growth rate in real GDP is shown in Figure 1 in the annexure.

Moreover, most economies taken in the sample rely heavily on exports of manufactures and tourism services for their survival and practise an export led growth strategy. On the external front, given their size, the economies did fairly well with an average current account balance of USD.1.65 billion (up from below

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¹ The Small Island Developing States studied are Antigua and Barbuda, Bahamas, Bahrain, Barbados, Cape Verde, Dominica, Dominican Republic, Fiji, Grenada, Jamaica, Mauritius, Singapore, Suriname, Trinidad and Tobago and Papua New Guinea. The choice of the countries is based on relative economic performance and availability of data.

USD 1 billion in the late 1990s) over the years. The trend in current account balance is shown in Figure 2 in the annexure.

The main aim of monetary policy in these economies is to bring about price stability. Despite the fact that some countries experienced double digit inflation rates over the period like Suriname in the early 2000's, in Jamaica and Trinidad and Tobago, on average, the inflation has been under check. The economies recorded an average inflation rate of 5.8% over the period (See Figure 3 in the annexure), well below rates recorded by many developed and emerging economies.

The level of inward foreign direct investment (FDI) also increased exponentially over the period considered. From an average of roughly USD.7,900 million in 1999, FDI skyrocketed to an average of USD.16,500 million in 2010. Some countries like Mauritius, Bahamas, Dominican Republic and Jamaica did attract record level of FDI during the recent years. FDI inflows in the SIDS have mostly been investments in extractive industries and services, including tourism industry, real estate and financial services. There was a need to shift away from their mono-based economies towards more diversified economies in order to meet the Millennium Development Goals of poverty reduction, hence various attractive policies were being practised to attract FDI. The trend in FDI is shown in Figure 4 in the annexure.

As regards exchange rate volatility, most currencies (See Table 1 for list of currencies) showed some volatilities save the East Caribbean dollars (pegged to the USD), Bahamian dollar, Bahamas dollar and the Bahraini dollar which showed some degree of stability vis-a-vis the US dollar. Yet, on average the currencies of the SIDS generally appreciated over the years, albeit the currencies remaining quasi stable as from the year 2005 as shown in Figure 5 in the annexure.

4. MODEL SPECIFICATION

This section explains the models to be estimated as regards exchange rate volatility and trade, economic growth and FDI.

From Hondroyiannis, Swamy, Tavlas and Ulan (2005), the trade balance equation for the SIDS is formulated as follows:

$$\log CA_{i,t} = a_1 CA_{i,t-1} + a_2 \log X_{i,t} + a_3 V_{i,t} + e_{i,t}$$

Equation 1

Where $CA_{i,t}$ is the current account balance of country i, X_{it} is a vector of control variables and consists of the level of income as measured by ln real GDP, ln Foreign Direct Investment(FDI) ln investment (ratio of investment to GDP), and inflation rate. V represents volatility of the exchange rate and e_{it} is the stochastic error term.

An increase in Foreign Direct Investment will help an economy produce and export more. Ceteris paribus, this is expected to improve the current account. An increase in the level of income as measured by In real GDP means that import expenditure will rise as SIDS generally have a high propensity to import, which tends to adversely affect the current account. An increase in Gross Domestic Fixed Capital Formation as measured by the investment ratio in the SIDS contributes to rising productivity, improves export competitiveness and thus improves the current account. Yet, inflation is deemed to be detrimental to the current account balance. A higher inflation rate leads to an increase in the price of exports and a fall in the price of imports. Given competition in the world market, such a situation erodes exports competitiveness whilst inflating import bills. Hence inflation adversely affects the current account.

It is expected that $a_3 < 0$, a_2 can either be > 0 or < 0 depending on the factor considered. A real depreciation (appreciation) of the currency will lead to an improvement (deterioration) in the current account, assuming Marshall-Lerner conditions hold.

Following Sallenave (2010), the growth equation for the SIDS is formulated as follows:

$$Y_{i,t} - Y_{i,t-1} = \alpha Y_{i,t-1} + \beta X_{i,t} + \gamma V_{i,t} + e_{i,t}$$

Equation 2

Where Y_{it} is real GDP and Y_{it} - Y_{it-1} is the growth in real GDP. Y_{t-1} is lagged real GDP, X_{it} is a vector of control variables and consists of gross national savings, financial development, inflation, foreign direct investment and export growth.

A change in Gross National Savings (GNS) is considered important for economic growth. An increase in Gross National Savings is synonymous with an increase in investment as savings are important for investment to take place. Investment has not been included in the equation for the simple reason of multicollinearity problems. An increase in Gross National Savings is thus a potential engine of economic growth. GNS is represented by the ratio of Gross National Savings to GDP. Financial development is expected to generate growth in SIDS. The theoretical explanation for financial development leading to economic growth is provided by many authors including King and Levine (1993). Financial Development is, however, represented by the ratio of Broad Money to GDP. Inflation can be both beneficial and detrimental to economic growth. A low rate of inflation preserves business optimism and hence increases economic growth via increased investment. However, a higher rate of inflation discourages investment and hence hampers economic growth. Foreign Direct Investment is a potential source of economic growth in SIDS. A higher level of FDI is a potential reservoir of the unemployed, generates income and employment and hence increases economic growth rate. Export growth also promotes growth in SIDS since they adopt an export led growth strategy and rely heavily on exports for their survival. Hence an increase in export growth is expected to increase economic growth.

V represents volatility of the exchange rate and e_{it} is the stochastic error term. It is expected that $^{\gamma}$ can be either positive or negative depending on the direction of exchange rate movement. An appreciation of the exchange rate is considered detrimental as it leads to loss of competitiveness and hence export revenue. Since the SIDS rely heavily on exports, a fall in exports leads to lower growth rates. However, a depreciation of the exchange rate improves competitiveness and hence economic growth. $^{\beta}$ can either <0 or > 0 depending on the factor considered.

From Arratibel, Furceri et al (2009), the FDI equation for the SIDS is formulated as follows:

$$\ln FDI_{i,t} = \ln FDI_{i,t-1}\alpha_i + \beta X_{i,t} + \delta V_{i,t} + e_{i,t}$$

Equation 3

Where In FDI is the natural log of stock of inward FDI in country i at time t. X is a vector of control variables and include the growth of real GDP, the level of infrastructural development as depicted by number of telephone lines per 100 population, the level of financial development as measured by the ratio of broad money to GDP, inflation and the economic diplomacy as proxied by export growth. V represents volatility of the exchange rate.

Economic growth is supposed to increase FDI in the SIDS as economic growth means an increase in income and if FDI is seeking consumer markets, an increase in the growth of real GDP adds to the stock of FDI. Moreover, foreign direct investors will move to countries where there is well-developed social infrastructure (infrastructural development). It has been reckoned that poor infrastructural development in developing countries have been major obstacles to economic growth since it does not encourage FDI flows. Hence infrastructural development is expected to increase FDI flows in SIDS. High inflation discourages FDI flows to SIDS as the net real return would be adversely affected. The level of economic diplomacy, however, encourages FDI as a high level of economic diplomacy indicates that the SIDS have trade agreements and negotiations in place for exports of their goods and services. Economic diplomacy is proxied by export growth.

 β can be negative or positive depending on the factor mentioned above. δ can be either positive or negative depending on the direction of exchange rate movement.

5. CONCEPTUAL FRAMEWORK-VOLATILITY MEASURE

A pertinent decision needs to be made as regards the volatility measure to be employed so as to estimate the impact of exchange rate volatility on macroeconomic performance. According to Arratibel, Furceri et al (2009), in order to have a more reliable estimate regarding the impact exchange rate volatility has on the macro economy, de facto measures for exchange rate would be more appropriate. Hence, we use the z-scores measure developed by Wolf et al (2003) as a measure of exchange rate volatility in this study. This measure

combines movements in exchange rate around a constant level as well as around a steady depreciation/appreciation rate as follows:

$$Z_{,t} = \sqrt{\mu_t^2} + \sigma_t^2$$

Where μ_t^2 is the arithmetic average changes in the nominal exchange rate vis-à-vis US dollar in time t; σ_t^2 is the standard deviation of the nominal exchange rate vis-à-vis the US dollar at time t.

6. DATA SOURCES AND METHODOLOGY

Owing to scarcity of data for some countries, the study employs data spanning 1999 to 2010. For all variables, yearly data is employed for the simple reason that data are only available on a yearly basis for some countries. However, regarding exchange rate volatility, monthly data are used to compute the yearly z-score. The countries taken from the sample includes Antigua and Barbuda, Bahamas, Bahrain, Barbados, Cape Verde, Dominica, Dominican Republic, Fiji, Grenada, Jamaica, Mauritius, Singapore, Suriname, Trinidad and Tobago and Papa New Guinea. The data was obtained from the International Monetary Fund's International Statistics, United Nations Educational, Scientific and Cultural Organization (UNESCO), World Bank database and www.oanda.com regarding exchange rates as well as Central Bank's annual reports in some countries.

To address the objective of the paper, dynamic panel data analysis is used. Plain panel Ordinary Least Square regression is carried out. However, to correct for heteroskedasticity in some equations, OLS with robust standard errors are run for all equations. We then proceed with a two sets of panel regressions. The first set consists of fixed effects and random effects estimation. The second set consists of Generalised Method of Moments (GMM) estimation which is compared to the first set, which is deemed to be inconsistent. According to Swamy and Tavlas 2001, common fixed coefficients provide inadequate approximation to the true model since by applying OLS to panel data, it assumes that the constant term and slopes of the regressions to be homogenous for all countries taken in the sample as well as time. If the country specific constant term is uncorrelated with the explanatory variables, the Random Effect (RE) stipulates that the country specific random element is synonymous to the stochastic error term. The Random Effects uses the GLS approach to regression and allows for explanatory variables that are constant overtime.

Moreover, the least squares estimates in the presence of a lagged dependent variable among the regressors give both biased and inconsistent estimates. The solution to deal with these problems in dynamic models was brought forward by Anderson and Hsiao (1982), who proposed instrumental variables based on the first-differenced form of the original equation. However, Arellano and Bond (1991) avers that the Anderson and Hsiao proposal is not efficient given that it does not develop all instruments available and proposes that all available lagged values of the endogenous as well as the exogenous variables be used as instruments to gain efficiency. The Arellano-Bond dynamic approach allows the past values of the dependent variable to affect its current value such that there is no need to include lags in our model as the Arellano-Bond method automatically specifies our model using the lag component. Another test that we shall be using is the Sargan Test for over identifying restrictions. The use of GMM rather than plain OLS for estimating the regression equations is to account for persistence of the effect of exchange rate movements on the macroeconomic variables mentioned. Also, according to Hall (2005), GMM estimates provide estimates that are consistent, efficient and have asymptotic normality properties.

7. RESULTS

7.1 Current Account Equation Results

OLS results with robust standard errors (SE) for the current account equation are given in Table 2 in the Appendix. The P-Value of the model stands at 0.0001, less than 0.05, depicting a statistically significant relationship between the regressands and the regressors. The R-Squared figure of 0.1128 shows that the model explains 11.28% of variance in the current account balance. The P-Values are the two tail values for each parameter estimates and test the hypothesis that the estimates are different from zero. To reject the hypothesis, p-values have to be lower than 0.05. After correcting for heteroskedasticity, from the OLS estimates with robust SE, only ln FDI and z-score are statistically significant in explaining the changes in current account balance, with p-values of 0.021 and 0.007 respectively. This means that exchange rate

volatility did have an adverse impact on the current account balance of the economies considered. About 90% of changes in the current account balance is explained by exchange rate volatility.

For the current account equation, the Hausman Specification tests give us a tabulated value of Prob>chi2=1.0 which is greater than the stata output of 0. This means that the fixed effect is preferred. The estimates for fixed effects are given in Table 2 in Appendix II. Fixed effects estimates suggest that all the predictors are statistically significant in explaining changes in current account balance, save inflation rate and the z-score, which means that under the fixed effects estimates, exchange rate volatility does not explain changes in current account balance.

Diagnostic tests reveal no diagnostic problems. There is no multicollinearity as depicted by a mean Variance Inflating Factor of 1.19 (less than 10) as shown in Table 5 in Appendix III. As far as model specification test is concerned, stata output reveals that the model is well-specified as shown in Table 6 in Appendix III.

The Arellano-Bond GMM estimates are also in Table 2 in the appendix II. The results show that all variables are statistically insignificant except ln FDI, which means that in a dynamic setting, only changes in foreign direct investment has a significant influence on changes in the current account balance. Exchange rate volatility does not have an impact on current account in the SIDS in a dynamic setting. Looking at the diagnostics, we can safely say that after performing the two step regressions, the current account equations are not over identified. The Sargan test gives us a Chi-Sq value which is very far from zero and thus no overidentification is concluded. We, therefore, do not reject the null hypothesis of the Sargan test that the instrumental variables are not correlated with a set of residuals. In addition to the Sargan tests, the Wald tests indicate fine goodness of fit as indicated by high values for Wald Chi2(6) of 15.28.

7.2 Growth Equation

The OLS results with robust standard errors (SE) for the growth equation are given in Table 3 in Appendix II. The P-Value of the model stands at 0.0000, less than 0.05, depicting a statistically significant relationship between the regressands and the regressors. The R-Squared figure of 0.1757 shows that the model explains 17.57% of variance in the GDP growth rate. The P-Values are the two tail values for each parameter estimates and test the hypothesis that the estimates are different from zero. To reject the hypothesis, p-values have to be lower than 0.05. After correcting for heteroskedasticity, from the OLS estimates with robust SE, only lagged ln GDP growth rate, inflation, ln FDI and z-score are statistically significant in explaining the growth in GDP, with p-values of 0.0000, 0.000, 0.014 and 0.0000 respectively. This means that exchange rate volatility did have an impact on the economic growth of the economies considered, albeit only 2.35% of economic growth is explained by exchange rate volatility.

For the growth equation, the Hausman Specification tests give us a tabulated value of Prob>chi2=0.0000, which is greater than the stata output of 40.88, which means that the random effects is preferred. The estimates for random effects are given in Table 3 in Appendix II. In contrast with OLS regression, Random Effects estimates suggest that z-score is statistically insignificant in explaining the economic growth in the SIDS. This Growth is more fully explained by growth in previous years and inflation as depicted by the P-values of 0.000 for lagged GDP growth rates and 0.030 for inflation. This is in line with the emphasis placed by the central banks of the economies in promoting price stability to promote growth.

Diagnostic tests reveal no diagnostic problems. There is no multicollinearity as depicted by a mean Variance Inflating Factor of 1.19 (less than 10) as shown in Table 5 in Appendix III. As far as the model specification test is concerned, stata output reveals that the model is well-specified as shown in Table 6 in Appendix III.

The Arellano-Bond GMM estimates are also provided in Table 3 in the Appendix II. The results show that all variables are statistically insignificant. Financial Development is the major engine of economic growth in the SIDS in a dynamic setting. Exchange rate volatility does not have an impact on economic growth in the SIDS in a dynamic setting. Looking at the diagnostics, we can safely say that after performing the two step regressions, the growth equation is not over-identified. The Sargan test gives us a Chi-Sq value which is very far from zero and thus no over identification is concluded. We, therefore, do not reject the null hypothesis of the Sargan test that the instrumental variables are not correlated with a set of residuals. In addition to the Sargan tests, the Wald tests indicate fine goodness of fit as indicated by high values for Wald Chi2(7) of 32.29.

7.3 FDI Equation

The OLS results with robust standard errors (SE) for FDI equation are given in Table 4 in Appendix II. The P-Value of the model stands at 0.0028, less than 0.05, depicting a statistically significant relationship between the regressands and the regressors. The R-Squared figure of 0.2445 shows that the model explains 24.45% of variance in changes in inward FDI. The P-Values are the two tail values for each parameter estimates and test the hypothesis that the estimates are different from zero. To reject the hypothesis, p-values have to be lower than 0.05. After correcting for heteroskedasticity, from the OLS estimates with robust SE, only lagged In FDI and economic diplomacy are statistically significant in explaining inward FDI, with p-values of 0.0020, 0.035 respectively. However, the z-score is found to be statistically insignificant in explaining changes in FDI in the SIDS with a P value of 0.403.

For the FDI equation, the Hausman Specification tests give us a tabulated value of Prob>chi2=0.0001 which is greater than the stata output of 30.59, and this means that the random effects is preferred. The estimates for random effects are given in Table 4 in Appendix II. Similar to what was observed in the OLS regression, the z-score is statistically insignificant and depicts that exchange rate volatility does not explain changes in inward foreign direct investment in the SIDS studied. Instead, the random effects estimates reveal that foreign direct investment in previous years explains movements in foreign direct investment for the current year by 40.32% as well as economic diplomacy, albeit by only 1.29%.

Diagnostic tests reveal no diagnostic problems. There is no multicollinearity as depicted by a mean Variance Inflating Factor of 1.65 (less than 10) as shown in Table 5 in the Appendix III. As far as model specification test is concerned, stata output reveals that the model is well specified as shown in Table 6 in Appendix III.

The Arellano-Bond GMM estimates are also provided in Table 4 in Annexure II. The results show that all variables are statistically insignificant except lagged ln FDI, ln GDP growth rates and economic diplomacy are major drivers of inward FDI in the SIDS in a dynamic setting. Exchange rate volatility does not have an influence on the changes in inward foreign direct investment in the SIDS. Looking at the diagnostics, we can safely say that after performing the two step regressions, the growth equation are not over-identified. The Sargan test gives us a Chi-Sq value which is very far from zero and thus no over-identification is concluded. We therefore do not reject the null hypothesis of the Sargan test that the instrumental variables are not correlated with a set of residuals. In addition to the Sargan tests, the Wald tests indicate fine goodness of fit as indicated by high values for Wald Chi2(7) of 73.46.

7.4 Analysis of the Results

From the foregoing results, it is found that, in a static setting, exchange rate volatility influences the current account balance using robust OLS estimates, a finding in line with Tenrevro (2007) and Arize et al (2008). The SIDS practice an export led growth strategy and import significant amounts of raw materials for production and export. Despite unfavourable exchange rate movements, given that imports are inelastic, import bills rise as they are under several trade agreements to supply their goods. In a static setting, the exporting firms in the SIDS cannot alter their factor inputs and production volume. The rise in import volume coupled with the invariant situation for exports result in current account deficits. However, in a dynamic setting, using GMM estimates and in line with Hondroyiannis et al (2005), exchange rate volatility has no impact on current account balance in the SIDS as traders adjust their factor inputs and production levels to mitigate the impact of the exchange rate shocks and the SIDS diversify their exports to immune their economies from external shocks. Similarly, for the economic growth equation, since the SIDS have an export led growth strategy, exchange rate volatility positively influences economic growth via the trade channel. However, only 1.8% of economic growth is explained by economic growth, despite the fact that the SIDS achieved remarkable economic growth rates over the years. Economic Growth is mostly explained by growth in previous years and changes in foreign direct investments. In a dynamic setting, however, exchange rate volatility has no impact on economic growth, in line with Akinbobola and Oyetayo (2010), Aghion et al (2009). The SIDS developed their financial sector significantly and are more able to immune themselves from exchange rate shocks. The exporters in SIDS rely a lot on exports for their survival and protect themselves from frequent swings in exchange rates to become more resilient and do not face severe macroeconomic setbacks.

For the FDI equation, both in a static setting and in a dynamic setting, exchange rate volatility has no impact on the level of FDI in the SIDS. Only economy diplomacy and the level of FDI in previous years are significant in explaining changes in FDI. In order to develop their economies, the SIDS have engaged extensively in looking for trade agreements with the emerging and developing economies.

8. CONCLUSION

This study investigated the impact of exchange rate volatility on the macroeconomic performance of Small Island Developing States. The exchange rate volatility measure that is employed is the z-score, which combines movements in exchange rate around a constant level as well as around a steady depreciation/appreciation rate. Our findings based on ordinary least square regression with robust standard errors (SE) revealed that exchange rate volatility has both an economically and a statistical significant effect on changes in current account balance, in line with Tenreyro (2007) and Arize et al (2008). However, in a dynamic setting, GMM estimates show that exchange rate volatility has no influence on changes in current account balance. The same is found for the growth equation. OLS estimates with robust SE showed that exchange rate volatility positively influences economic growth, in line with Rodrik (2009), who avers that an undervaluation of exchange rate improves export competitiveness, encourages investment and hence promotes growth. Yet, in a dynamic setting, GMM estimates reveal that exchange rate volatility has no impact on growth for the SIDs. In contrast with the current account and growth equations, exchange rate volatility does not influence changes in inward foreign direct investment in the SIDS both under the OLS with robust SE and under a dynamic setting. Overall, we may recapitulate that, in a dynamic framework, the main drivers of macroeconomic performance in the SIDs are changes in inward foreign direct investment levels, financial development, economic diplomacy and growth in GDP and not exchange rate volatility. However, in a static framework, exchange rate volatility adversely changes in current account balance and positively influences economic growth.

The results from the paper have important insights to offer as regards macroeconomic policies to be practised with regards to current account balance, economic growth and foreign direct investment. Given that exchange rate volatility does not influence current account balance in a dynamic framework, exchange rate policies cannot be used to influence current account balance. In a static framework, however, instead, since exchange rate volatility adversely affects current account, although the use of hedging is costly in SIDS, policy makers should encourage exporters through the development of derivative products to cover themselves in all their export activities to immune themselves from exchange rate shocks. The results obtained for economic growth equation also revealed that exchange rate policies will not help achieve higher growth rates in the SIDS

Also, the results obtained for economic growth equation showed that exchange rate weakly affects growth in a static framework but has no influence in a dynamic framework. In view thereof, exchange rate policies cannot be used to bring more growth to the SIDS. However, the economies should try to develop their financial sector more in order to achieve higher growth rates. Similarly, exchange rate volatility is insignifant in explaining the level of FDI both in a static and in a dynamic setting. Economic diplomacy is the main factor in influencing foreign direct investment in the SIDS. Policies should be geared in international agreements to promote foreign direct investments in SIDS.

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Small Island Developing State	Currency used
Antigua and Barbuda	East Caribbean Dollar
Bahamas	Bahamian Dollar
Bahrain	Bahraini Dollar
Barbados	Barbados dollar
Cape Verde	Escudo
Dominica	East Caribbean Dollar
Dominican Republic	Dominican peso
Fiji	Fijian Dollar
Grenada	East Caribbean Dollar
Jamaica	Jamaican Dollar
Mauritius	Mauritian Rupee
Singapore	Singapore dollar
Suriname	Surinamese Guilder
Trinidad and Tobago	Dollar
Papua New Guinea	Kina

Appendix I - Currencies used by the SIDS

 Table 1: Currencies used by the SIDS

Appendix II- State regression estimates

 Table 2: Current Account Equation Estimates

	OLS Estimates with Robust SE (at 95% Confidence Interval)			
Predictors	Coefficient	Robust SE	t	P value
Lagged 1n current account	-0.02369	0.02878	-0.82	0.412
ln FDI	3.9404	1.6856	2.34	0.021
In Real GDP	-2.1962	1.5562	-1.41	0.160
Investment/GDP ratio	1.5652	2.6320	0.59	0.553
Inflation	0.4206	1.9405	0.22	0.829
Z-score	-0.9071	0.3294	-2.75	0.007
Constant	-0.7550	0.9069	-0.83	0.406
F(6,172)	4.95	R-Squared	0.1128	
Prob>F	0.0001			
Fixed Effects Estimates Predictors	Coefficient	SE	t	P value
lagged In current account	-0.1666	0.0726	2.29	-0.023
ln FDI	3.8886	1.1443	3.40	0.001
In Real GDP	-3.0291	0.7831	-3.87	0.000
Investment/GDP ratio	9.9671	4.1942	2.38	0.019
Inflation	-2.5176	2.7758	-0.91	0.366

Z -score	-1.2907	1.0752	-1.20	0.232
Constant	-2.6519	1.0701	-2.48	0.014
GMM Estimates				
Predictors	Coefficient	SE	z	P value
lagged ln current account	-0.0898	0.06403	-1.40	0.161
ln FDI	5.6004	1.6125	3.47	0.001
In Real GDP	-2.3444	1.8541	-1.26	0.206
Investment/GDP ratio	5.5311	5.098	1.08	0.278
Z-score	-1.1607	1.0338	-1.12	0.262
Inflation	-0.41610	4.4381	-0.09	0.925
Constant	-1.8723	1.3559	-1.38	0.167

Source: Stata 11 Output

 Table 3: Growth Equation Estimates

	OLS Estimates	with Robust SE	(at 95% C	onfidence
	Interval)			
Predictors	Coefficient	Robust SE	t	P value
lagged In GDP growth rate	0.3574	0.0862	4.14	0.000
Gross National Savings ratio	-0.01351	0.0259	-0.52	0.603
Financial Development (Broad Money/GDP)	-0.0009	0.0126	-0.07	0.943
Inflation	-0.0794	0.0199	-3.98	0.000
Export Growth	.00106	0.0011	0.93	0.353
ln FDI	0.0284	0.0115	2.47	0.014
Z-score	0.018	0.0042	4.32	0.000
Constant	0.023	0.0091	2.60	0.010
F(6,172)	7.16	R-Squared	0.1757	
Prob> F	0.0000			
Random Effect Estimates Predictors	Coefficient	SE	t	P value
lagged In GDP growth rate	0.3574	0.0708	5.05	0.000
Gross National Savings ratio	001351	0.0262	-0.51	0.607
Financial Development (Broad Money/GDP)	-0.0009	0.0104	-0.09	0.931

Inflation	-0.079	0.0365	-2.17	0.030
Export growth	0.0010	0.0010	1.02	0.307
ln FDI	0.028	0.0152	1.86	0.062
Z-score	0.018	0.0118	1.54	0.123
Constant	0.0235	0.0103	2.27	0.023
GMM Estimates Predictors	Coefficient	SE	z	P value
lagged In GDP Growth rate	0.0077	0.0894	0.09	0.931
Gross National Savings	0.0863	0.0511	1.69	0.091
Financial Development	-0.1431	0.0414	-3.45	0.001
Inflation	-0.0104	0.0608	-0.17	0.864
Export Growth	0.0023	0.0012	1.94	0.052
ln FDI	0.0408	0.0246	1.66	0.097
Z-score	0.0124	0.0141	0.88	0.380
Const	0.1130	0.0337	3.35	0.001

Source: Stata 11 Output

 Table 4: OLS Estimates with Robust SE- FDI Equation (at 95% Confidence Interval)

OLS Estimates with Robust SE Predictors	Coefficient	Robust SE	t	P value
Lagged In FDI	0.4032	0.1308	3.08	0.002
In GDP growth rate	0.0129	0.0069	1.86	0.065
Infrastructural Development	-0.0409	0.2018	-0.20	0.839
Financial Development	0.0599	0.0876	0.68	0.495
Inflation	-0.1112	0.1474	-0.75	0.452
Economic Diplomacy	0.4714	0.2213	2.13	0.035
Z-score	0.0221	0.0263	0.84	0.403
Constant	0.0335	0.0372	0.90	0.369
F(7,172)	3.26	R-Squared	0.2445	
Prob> F	0.0028			
Random Effect Estimates Predictors	Coefficient	SE	t	P value
Lagged In FDI	0.4032	0.0677	5.95	0.000
In GDP growth rate	0.4714	0.3219	1.46	0.143
Infrastructural Development	-0.0409	0.15821	-0.26	0.796
Financial Development	0.0599	0.0751	0.80	0.425

Inflation	-0.1112	0.16632	-0.67	0.504
Economic Diplomacy	0.0129	0.0046	2.78	0.005
Z-score	0.0221	0.0541	0.41	0.683
Constant	0.0335	0.0419	0.80	0.424
Predictors	Coefficient	SE	Z	P value
Lagged In FDI	0.4477	0.0592	7.56	0.000
In GDP growth rate	0.8684	0.3052	2.84	0.004
Infrastructural Development	-1.2559	0.7935	-1.58	0.114
Financial Development	0.0004	0.1327	0.00	0.998
Inflation	-0.0715	0.2276	-0.31	0.753
Economic Diplomacy	0.0108	0.005	2.29	0.022
Z-score	-0.0393	0.0549	-0.72	0.474
Constant	0.3922	0.2276	1.72	0.085

Source: Stata 11 Output

Appendix III – Diagnostic tests

1. Variance Inflating Factors for regressors

 Table 5: Variance Inflating Factors

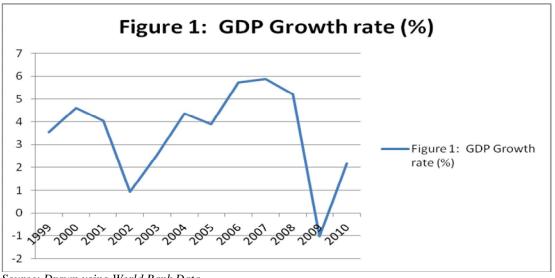
Current Account Equation's regressors	VIF	1/VIF
Inflation	1.55	0.646110
Z-Score	1.44	0.695468
Ln real gdp	1.07	0.934559
Investment ratio	1.04	0.959787
Ln FDI	1.02	0.983434
Lagged current account	1.01	0.991678
Mean VIF	1.19	
Variable-Growth Equation's regressors	VIF	1/VIF
Inflation	1.49	0.672004
Z-score	1.46	0.682786
Financial Development	1.11	0.899662
Export Growth	1.10	0.908352
Ln FDI	1.10	0.911526

Gross National Savings	1.07	0.936235
Lagged In GDP Growth	1.01	0.989789
Mean VIF	1.19	
Variable- FDI Equation's regressors	VIF	1/VIF
Financial Development	2.77	0.361167
Infrastructural development	2.66	0.375464
Inflation	1.49	0.673286
Z-score	1.48	0.675134
Economic Diplomacy	1.05	0.948125
GDP Growth rate	1.04	0.959177
Lagged Ln FDI	1.04	0.960336
Mean VIF	1.65	

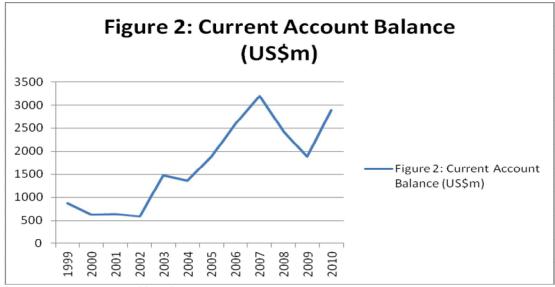
Source: Stata 11 output

 Table 6: Other Diagnostics

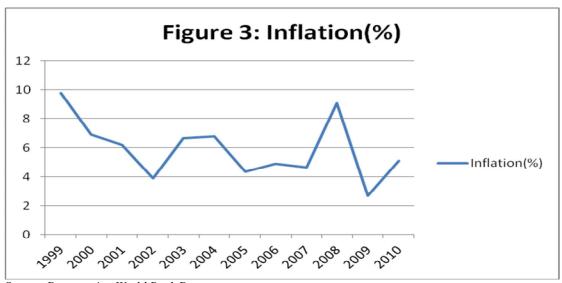
	Current Account Equation	Economic Growth Equation	FDI Equation
Ramsey Reset Test			
F Value	F(3, 169) = 5.42	F(3, 169) = 0.39	F(3, 169) = 5.80
Prob>F	Prob > F = 0.0014	Prob>F= 0.000005	Prob > F = 0.0008
	(Model is well specified as Prob>F is 0.0014 and low compared to the F value)	(Model is well specified as Prob>F is 0.0014 and low compared to the F value)	as Prob>F is 0.0014 and
Wald Test for GMM	Wald Chi2 (6) = 15.28	WaldChi2(7) = 32.29	Wald Chi2(7) = 86.21
Sargan test			
Chi2 Value	chi2 (54) = 50.83892	chi2(54) = 82.17358	chi2(54) = 73.45667
Prob > Chi2	Prob > chi2 = 0.5971	Prob>chi2 = 0.0080	Prob > chi2 = 0.0403



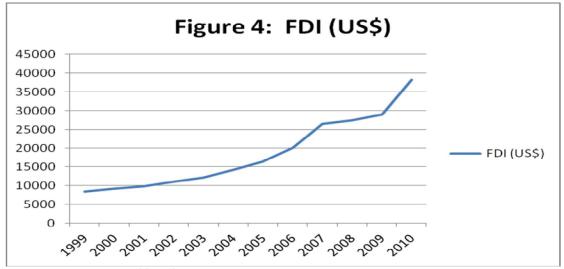
Source: Drawn using World Bank Data



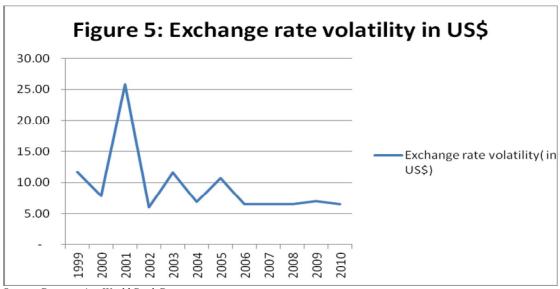
Source: Drawn using World Bank Data



Source: Drawn using World Bank Data



Source: Drawn using World Bank Data



Source: Drawn using World Bank Data