

Impact of exchange rate volatility on export of small economies

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Abstract

Purpose – This paper examines the extent to which exchange rate volatility (ERV) is crucial for small island economies. These economies by their very nature and size tend to be net importers and highly dependent on trade for their economic survival. The island of Mauritius is used as a case study.

Design/methodology/approach – A GARCH model has been utilized using yearly data for the period 1993–2022. The ARDL bounds cointegration approach has been used to determine the long run relationship between exchange rate volatility and the performance of exports. The ECM-ARDL model has been used to estimate the short-run relationships, that is the speed of adjustments between the variables under consideration.

Findings – The findings reveal that exchange rate volatility has a positive and significant effect on exports in the short run as well as in the long run. The study also finds out that export has a long-term relationship with world GDP per capita. Both the presence and degree of exchange rate volatility are important aspects for consideration in policy making.

Originality/value – The literature gap that this study attempts to close is one related to global impacts within the recent time horizon. Recently, numerous important events shaped the financial and economic landscape globally, including but not limited to the financial crisis of 2008 and the COVID-19 pandemic in 2019. Both these events stressed the global volume of trade and the exchange rate markets, and these events affects small islands comparatively more given their heavy dependence on international trade for economic development, albeit economic survival.

Keywords Exchange rate volatility, GARCH, Mauritius, Trade, ARDL, Small island economies

Paper type Research paper

1. Introduction

Mauritius is a small economy that is heavily dependent on international trade. Its trade to Gross Domestic Product (GDP) ratio was equivalent to 98% as at 2021. It has a population of 1.27 million and is significantly influenced by changes in global demand and currency volatility. The island gained its independence in 1968. From a monocrop economy in early 1970s, Mauritius has been able to consistently re-invent and transform itself [1] into a country with a high GDP per capita, around \$9,100 in 2021. Mauritius has, in fact, one of the highest per capita GDP among African countries. Over the years Mauritius exports has been increasing consistently in terms of value, with the exception of the years of the financial crisis and Covid-19 pandemic. Its export is crucial not only for sustainable growth and for the generation of foreign earnings for the country but also in terms of employment level. Mauritius experienced a net inflow of Foreign Direct Investment (FDI) amounting to \$253m [2]. Besides being trade dependent, like all other small island states, Mauritius also faces the



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concentration issues in terms of both number of products traded as well as trading partners. More than 70% of its total trade is concentrated with 10 partners [3].

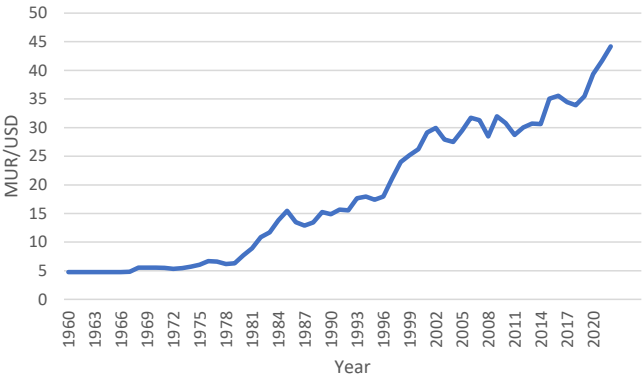
Since 1994, Mauritius adopted a managed floating exchange rate system. The central bank intervenes solely to reduce exchange rate volatility. Figure 1 shows how Mauritian rupee fluctuated vis-à-vis the US Dollar (USD) over the years [4].

While a number of studies have been undertaken which treats the relationship between exchange rate volatility and trade, the literature is quasi mute on this link in terms of small island states. While such studies on small islands is rare, the existing ones are also quite old. Given the different specificities of these island with the rest of the world, especially in terms of trade dependance and limited domestic market, there is a need to trace this relationship for this group of countries, either individually or within a group of countries with similar specificities. This study attempts to close this literature gap to some extent, and uses recent data. The importance of an up to date understanding of this relationship is crucial since recently, numerous important events shaped the financial and economic landscape globally, including but not limited to the financial crisis of 2008 and the Covid-19 pandemic in 2019. Both these events stressed the global volume of trade and the exchange rate markets. It is important to assess how the relationship between exchange rate volatility and exports behaves in light of the recent events.

In this section we use the graphs of exchange rate volatility and exports to see if we can visibly see a relationship between these two variables. It also shows the characteristics of the chosen data. This is done as a complement to the regression analysis that follows in the next sections. Figure 2 shows total annual exports between the years 1977 and 2021. The main trend in exports, represented by the straight line, has been increasing through the years. Exports have been fluctuating around this trend.

Exports are growing over time which is consistent with applied theory and the reality of many countries. Even if the export is fluctuating, it does not move extensively around the main core. Seasonality should not be found in the data since it has been adjusted for by the database. However, some patterns can be seen in the later years, 2006 to 2019. Exports have more or less been above the trend, on average.

Figure 3 shows annual volatility in the exchange rate for the \$/MUR between the years 1993 and 2021. Volatility does not follow any seasonal pattern. Hence, seasonality is not a problem in either of the variables. Volatility does not have a trend that grows or decreases over time. The year 2008 stands out as an outlier. This was due to the financial crisis effect.

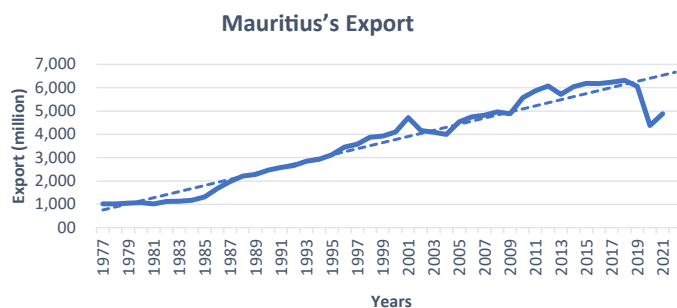


Source(s): Authors' computation

Figure 1.
USD/MUR exchange
rate 1960–2020

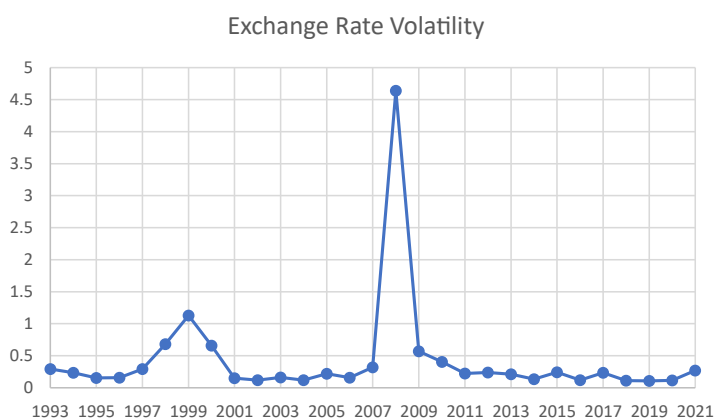
One can easily see how small islands like Mauritius which are highly trade dependent and have a high concentration exports ration get largely impacted at times of crises. However, one can see that the volatility is often lower since the year 2008. There is no relationship to be found when comparing the two graphs.

This paper examines the effects of ERV by employing an ARDL-GARCH model. This technique is superior to the simple GARCH model in that it allows for the possibility to estimate time lag spillover effect over the instantaneous spillover effects as it permits the use of the lag value of return and volatility series. The short run speed of adjustments/impact multiplier between the variables is estimated using the ECM-ARDL model. The fact that the variables are cointegrated implies that there is some adjustment process preventing the errors in the long-run relationship from becoming larger, and an important feature of the ECM comes from the fact that the disequilibrium error term is a stationary variable. Since the ECMs is formulated in terms of first differences, it eliminates trends from the variables involved, and as such resolves the problem of spurious regressions. The ARDL model is firstly, statistically more significant in estimating cointegrating associations in data samples which are not too large – as in this case where 30 years data is used; and secondly, does not require that regressors are of the same order. ARDL models can accommodate a mix of $I(1)$ and $I(0)$ within the same estimation. Thus, the ARDL model is a good fit.



Source(s): Authors' computation

Figure 2.
Total exports of
Mauritius between
1977 and 2021



Source(s): Authors' computation

Figure 3.
Volatility for the
Mauritius exchange
rate between 1990
and 2021

The paper is organized as follows: [Section 2](#) provides a review of the literature, [section 3](#) describes the methodology used, while [section 4](#) discusses the results. Finally, the conclusion and policy recommendations are presented in [section 5](#).

2. Literature review

2.1 Theoretical review

The linkages between exchange rate and trade have been expansively studied over time and across sectors. Exchange rates allow the comparison of prices of goods and services produced in different countries, and this is crucial in international trade. As such, many scholars have attempted to theoretically explain the effect of exchange rate volatility on trade across borders. These studies can be grouped under different schools of thoughts. In what follows, we provide some insights of the most widely used ones, namely the Keynesian multiplier, the Marshall-Lerner (ML) condition, the J-curve effect, the policy approach and purchasing power parity theory.

The Keynesian multiplier demonstrates an inverse relationship between the two variables because most traders are risk averse. This theory explains that when traders are uncertain about future exchange rate movements, they will naturally try to reduce their exposure toward exchange rate risks. If exporters foresee a depreciation in their currency vis-à-vis the currency in which trade is taking place, then they will certainly seize the opportunity.

The ML condition demonstrates the conditions under which a change in a country's currency will result in a change in trade. According to this theory, a devaluation of a country's currency will lead to an improvement in balance of trade of that country given that the sum of the price elasticities of its exports and imports is greater than one. For trade to improve, the country's export price must increase so as to compensate for the increase in import price. If the elasticities add up to exactly one in absolute numbers, then a change in the exchange rate will have no impact on the current account. The ML condition is used to verify whether the foreign exchange market is stable or not. Conclusions from the ML condition can be drawn depending on the shape of a country's import and export demand curves. However, determining its exact shape is hard. If the determination of supply curves were straightforward, a current account deficit could easily be corrected by depreciating the currency.

The J-curve illustrates how a currency's depreciation creates a worsening trade balance, followed by a significant improvement, as depicted in [Figure 4](#). The J-curve effect and the ML

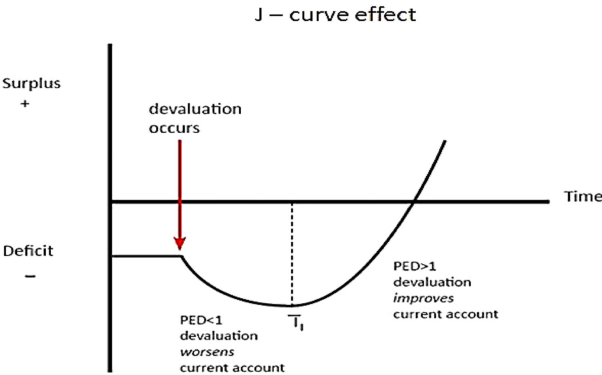


Figure 4.
The J-Curve effect in
theory

Source(s): <https://www.tpci.in/indiabusinesstrade/blogs/heterogeneity-in-reaping-exports-benefits-from-currency-depreciation/>

condition are connected. The ML condition demonstrates that when export and import elasticities are greater than one, current account will improve. According to the J-curve effect, this condition is assumed to hold in the long run.

A currency depreciation has an immediate negative impact on the country's current account. Imports become more expensive and exports become cheaper immediately after the depreciation, resulting in a growing trade deficit. Reaching to point T1, the current account starts to improve. Because demand is inelastic, a short-term depreciation in the currency rate might lead to a worsening of the current account. On the other hand, when demand becomes more price elastic over time, the current account starts to strengthen.

According to the policy approach, prevailing macroeconomic conditions affect exchange rate and trade. Changes in macroeconomic policy can cause fluctuations in exchange rate leading to changes in imports and exports. For instance, if the government adopts an expansionary monetary policy, this will depreciate the local currency leading to a fall in imports volume. The exchange rate policy has an impact on the entire economy. Policymakers can use floating, fixed or controlled exchange rate regime to influence macroeconomic trends. As a result, FOREX has an impact on a country's economic activity, inflation rate and employment rate.

The PPP theory compares the purchasing power of one country's currency with the purchasing power of other countries' currencies. According to this theory, a basket of goods and services should have the same value in both countries. This theory dictates that the real exchange rate, which is the nominal exchange rate adjusted for inflation, should be equal to one. In practice however, this is not often the case. Discrepancy in real exchange rate can occur for several reasons. Trade barriers, such as tariffs, quotas and subsidies, can affect the relative prices of goods and services across countries. As a result, countries with higher number of free trade agreements have less parity in goods and services prices than those with fewer trade agreements.

2.2 Empirical review

International trade largely preoccupies researchers since it is an important component of a country's balance of payment. With the collapsed of the Bretton Woods System in 1971, numerous studies have analyzed the relationship between exchange rate volatility and international trade. These research works can be categorized into three main themes, based on the relationship observed between these 2 variables:

- (1) Researches that found no relationship,
- (2) Researches that found a positive relationship,
- (3) Researches that found a negative relationship,

In this section of the paper, we will provide an overview of such studies. We will compare and contrast the findings of these studies, as well as the methodologies adopted. [Annex 1](#) provides a summary of these studies in a very concise format with all the relevant information.

It is important to note that before the work of [Bahmani-Oskooee and Aftab \(2017\)](#), all studies that assessed the impact of exchange rate volatility on trade flows assumed that the effects are symmetric, that is traders reacts in the same manner whether the expectation is for currency appreciation or currency depreciation. [Bahmani-Oskooee and Aftab \(2017\)](#) showed that the effects of exchange rate volatility on trade flows could be asymmetric, and this is explained by the fact that the expectations of traders change depending on whether a currency depreciates or appreciates. They applied an ARDL approach in the context of Malaysia, using monthly data for 54 Malaysian industries that export to the U.S. and from 63 Malaysian industries that import from the U.S. Their results support short-run as well as long-run asymmetric effects in almost 1/3rd of the industries studied.

2.2.1 Studies that are non-conclusive. Through the use of disaggregated data on exports from the Indian manufacturing sector, [Haider and Adil \(2017\)](#) concluded that real exchange rate had no effect on exports. [Hooper and Kohlhausen \(1978\)](#) and [De Grauwe \(1988\)](#) explored the impact of FOREX uncertainty on trade volume among developed industrialized countries. They could not establish any significant link between these 2 variables. [De Vita and Abbott \(2004\)](#) examines the impact of UK'S export to EU. Using monthly disaggregated data from 1993 to 2001, and an autoregressive distribution lag (ARDL) model, the authors concluded that UK exports to EU are significantly unaffected by short term exchange rate volatility. Using data from 1889 to 1999, [Aristotelous \(2001\)](#) estimates the impact of exchange rate fluctuation on British exports to the United States using a gravity model. He concluded that exchange rate volatility has no effect on export volumes. [Aristeriou et al. \(2016\)](#) employed an ARDL model to detect long-term relationships on foreign trade volumes in selected countries, namely Mexico, Indonesia, Nigeria and Turkey. Except for Turkey, the authors found that there is no long-term link between exchange rate volatility and foreign trade activity. [Urgessa \(2024\)](#) examined the effects of real effective exchange rate volatility on Ethiopia's export earnings using quarterly data covering 2007 to 2021. The study examined the symmetric and asymmetric effects of exchange rate volatility on the three categories of export earnings. To estimate the effects, both the linear autoregressive distributed lag and nonlinear ARDL models were employed. The results show that in the long run, there is no asymmetric effect of exchange rate volatility on total and commodity-level export earnings.

2.2.2 Studies that reported positive relationships. [Kasman and Kasman \(2005\)](#), [Vieira and MacDonald \(2016\)](#), [Klein \(1990a, b\)](#), [Hwang and Lee \(2005\)](#), [Cheong et al. \(2005\)](#), [McKenzie and Brooks \(1997\)](#), [Franke \(1991\)](#) have found positive linkages between the two variables. Using the bivariate Generalized AutoRegressive Conditional Heteroskedasticity (GARCH) mean model and data for the period 1990 to 2000, [Hwang and Lee \(2005\)](#) concluded that UK's import and exchange rate volatility are positively associated. [Kasman and Kasman \(2005\)](#) applied the Johansen's multivariate procedures on a dataset for the period 1982 to 2001. The authors concluded that exchange rate volatility has a positive impact on Turkey's export volume in the long run. [Bilgili et al. \(2019\)](#) also studied the effect exchange rate volatility on exports for Turkey, by employing monthly data for the period 2003–2015. They observed the extent to which structural breaks and/or regime shifts affect this relationship. They found that a regime switching model in which regime changes are observed in constant and in all regressors, exhibits the positive effects of volatility on Turkish exports. This finding is also supported by an estimated dynamic ordinary least square model. [Bredin et al. \(2003\)](#) employed a cointegration and error correction approach in Ireland for the years 1978–1998. They demonstrated that while exchange rate volatility did not have any significant impact on Irish exports in the short run, it has a large long-term positive effect. [Rey \(2006\)](#) found a positive effects between these two variables for Israel and Morocco. The author used the AutoRegressive Conditional Heteroskedasticity (ARCH) model for the period 1970–2002. [Appuhamilage and Senanayake \(2010\)](#) investigates the effects of exchange rate variations on trade performance using the Sri Lanka–China trade relationship from 1993–2007. He concluded that the depreciation of the Sri Lankan rupee against the Chinese Yuan has a significant positive effect on Sri Lankan exports to China, but has a negative effect on imports from China. [Hooy et al. \(2015\)](#) employ a panel dynamic ordinary least squares (DOLS) model to analyze the impact of the Chinese Renminbi on ASEAN exports. Their findings indicate that a depreciation has a strong positive influence on exports of high-technology and medium-technology final and intermediate items. [Yunusa \(2020\)](#) examined the effect of volatility of exchange rate on Nigerian crude oil export to its trading partners. He used the GARCH and the ARDL models on monthly data for the period 2006–2019. The results suggest that exchange rate volatility greatly influence crude oil exports by Nigeria. [Javaid \(2023\)](#) studied exchange rate volatility and exports of Pakistan, under different political regimes using a standard deviation approach in the period 2000–2020 using

monthly data. The correlation results show that exchange rate and export were positively associated during 2 regimes time periods. The study suggests that it is essential for the political governments to adjust implementation solutions, handle the bottlenecks and create association between exchange rate policy and exports. [Bosupeng et al. \(2024\)](#) used monthly data from 1960 to 2020 to examine the asymmetric effects of exchange rates on the trade balance while accounting for exchange rate volatility. Their study applies a nonlinear bivariate model that allows asymmetric effects and volatility to be examined concurrently. They found that exchange rate volatility reduces the positive effects of an appreciation shock on the trade balance in developed countries in the short and long run. In developing nations, however, exchange rate volatility promotes the positive effects of a depreciation shock on the trade balance, both in the short and long run.

2.2.3 Studies that reported an inverse relationship. [Cheung and Sengupta \(2013\)](#) studied the Indian non-financial sector enterprises for the period 2000–2010. They estimated a negative and strong impact of exchange rate volatility on trade. [Dell'Aricca \(1999\)](#) studied 15 EU members and Switzerland for the period 1975–1994. Using a gravity model, they found that exchange rate volatility has a small but significant negative impact on trade. Similarly, [Tenreyro \(2007\)](#) found a small negative effect. He used panel data for the period 1970–1997. Employing a gravity model, he found that reducing exchange rate volatility to zero raises trade by only 2%. Analyzing data from 2000 to 2015 through the ARDL analysis, [Kim \(2017\)](#) found that volatility between the US dollar and the Korean Won has a negative impact on Korea's seaborne import volume. [Handoyo et al. \(2022\)](#) studied Indonesia's exports to the Organisation of the Islamic Cooperation (OIC) countries. They employed an EGARCH and an ARDL model on monthly data for the period 2007–2019. They found that exchange rate volatility negatively affects the export of some products both in the long run and in the short run. [Serenis and Tsounis \(2013\)](#) found that exchange rate volatility have a negative effect on export volume between Croatia and Cyprus. They studied this relationship for the period 1990–2012 using a vector error correction model. [Dada \(2021\)](#) applied a generalized autoregressive conditional heteroscedasticity, model to study this relationship in sub-Saharan Africa for the period 2005–2017. He found a negative in both long and short-run. [Arize et al. \(2021\)](#) found the presence of a negative effects of exchange rate risk on the volume of exports from Thailand. The researcher made use of an ARDL model using data for the period 2000–2019.

One interesting observation we made during the process of this empirical review is that Most studies that made use of panel data found a negative impact of exchange rate volatility on trade. [Rose et al. \(2000\)](#) and [Clark et al. \(2004\)](#) found evidence of a significant negative impact of exchange rate volatility on trade. Using gravity model, [Rose et al. \(2000\)](#) found that trade would drop by 13% for every standard deviation rise in exchange rate volatility. Applying fixed effect estimation, [Clark et al. \(2004\)](#) estimated that a rise of one standard deviation in exchange rate volatility would decrease trade by 7%. [Hall et al. \(2010\)](#) employed panel data for the period 1980–2006 and used two different estimation methods - the generalized method of moments (GMM) and a time varying coefficient (TVC) method. In their analysis, they looked at the influence of FOREX volatility on exports from 10 emerging market economies (EMEs) and 11 additional developing nations. According to the findings, exchange volatility has a negative and significant influence on non-EME exports but has no effect on EME exports. [Irina Tarasenko \(2021\)](#) found that FOREX volatility asserts a negative effect on exports of manufactured products, machinery, transportation equipment and agricultural raw materials. The author made use of gravity model for the period 2004–2018 to assess Russia's trade with its 70 trading partners. [Ekanayake and Dissanayake \(2022\)](#) studied US's export to BRICS. They found that long run exchange rate volatility has a negative effect on export in all five countries. The researchers made use of quarterly data for the period 1993–2021 and uses two approaches to measure exchange rate volatility namely ARDL and Error-cointegration model. [Sugiharti et al. \(2020\)](#) found that exchange rate volatility reduced Indonesia's exports to Japan, India,

South Korea and the US, but encouraged exports to China. They employed the GARCH and the ARDL models on data for the period 2006–2018.

The literature has numerous studies on this area, albeit each study is different from one another in the details. Once the methodologies applied, the period of analysis, the sector of analysis, the country groupings or individuality and other aspects are considered, no two studies are the same. However, as we have reported, these numerous studies can be grouped depending on the relationships established between these two variables. Overall, it seems that more studies support the widely accepted theory that trade is negatively impacted by exchange rate fluctuations. This relationship, however, cannot be studied in isolation as there are a number of other important factors that have to be controlled for as they are equally important in affecting trade. These are factors such as economic growth, level of financial development, period of special shock amongst others. However, what is striking is that literature on small island states, either individually or as a group of similar countries is close to non-existence. This study attempts to close this gap, by studying the Mauritius case.

This study does not incorporate the nonlinear aspects of exchange rate volatility as advocated by [Bahmani-Oskooee and Aftab \(2017\)](#) because this is not appropriate in the context of empirical studies on small island economies for two reasons. Firstly, small islands are, by their specific nature, dependent on foreign markets as their domestic markets are small. Not only this, but also, they tend to be dependent on a very limited number of foreign markets usually guided by some sort of preferential trade arrangements. Whether traders are risk averse or risk lovers, they do not have much of a choice but to continue exporting, and to these same countries whether exchange rate appreciates or depreciates. Also, they tend to source their products from a concentrated set of countries. Second, empirically testing for nonlinear aspects requires higher level disaggregated sector/industry data to be able to make a clear comparison. Small economies in practice only have a handful of industries and within each of those industries, only a handful of operators. For these reasons, this study considers that incorporating the nonlinear aspects exchange rate volatility in the context of small islands is not technically viable.

3. Methodology

The overall goal of this research is to assess the importance, elasticity and significance, of exchange rate volatility on the exports of the small island of Mauritius. While exchange rate volatility is the main focus of this study, sufficient attention is provided to assess the importance of other variables than potentially also affect exports.

The methodology employed in this study is the autoregressive distributed lag (ARDL) approach to cointegration, an approach developed by [Pesaran *et al.* \(2001\)](#). The procedure is adopted for the following three reasons. Compared to other multivariate cointegration techniques, such as [Johansen and Juselius \(1990\)](#), the ARDL model allows the cointegration relationship to be estimated by Ordinary Least Square (OLS) once the lag order of the model is identified. Moreover, this model is applicable irrespective of whether the regressors in the model are purely I(0), purely I(1) or mutually cointegrated. ARDL affords flexibility about the order of integration of the variables ([Frimpong and Oteng, 2006](#)) [5]. Thirdly, the test is relatively more efficient in small or finite sample data sizes as is the case in this study. The ARDL approach is appropriate for generating short run and long-run elasticities for a small sample size at the same time and follow the ordinary least square (OLS) approach for cointegration between variables ([Duasa, 2007](#)).

In its basic form, an ARDL regression model of order (p, q) can be expressed as:

$$y_t + \beta_1 y_{t-1} + \dots + \beta_p y_{t-p} = \lambda + \alpha_0 x_t + \alpha_1 x_{t-1} + \dots + \alpha_q x_{t-q} + \varepsilon_t \quad (1)$$

The model is autoregressive because y_t is explained by lagged values of itself. It also has a distributed lag component in the form of successive lags of the explanatory variable x . The ARDL(p, q) model is estimated by applying the OLS method and this estimation yields biased coefficient estimates due to the presence of lagged values of the dependent variable as regressors. If the disturbance term, ε_t , is autocorrelated, the OLS will also be an inconsistent estimator, and in this case, Instrumental Variable estimation is used in applications of the model.

After finding the long-run association existing between variables, the study uses the error correction model (ECM) to find the short-run dynamics. A dynamic error correction model (ECM) can be derived from the ARDL bounds test through a simple linear transformation.

The specified model has been estimated with all stationary variables. The Augmented Dicky Fuller (ADF) unit root tests have been performed on all variables to select whether to use the variables in levels or in difference. The ARDL bounds cointegration approach has been used to determine the long run relationship and short run dynamics between exchange rate volatility and the performance of export. Furthermore, the diagnostic and stability tests are run to determine the goodness of fit of the ARDL model. The diagnostic tests check for serial correlation, functional form, normality and heteroscedasticity. The Cumulative Sum (CUSUM) and Cumulative Sum Square (CUSUMSQ) have been estimated to check the stability of the coefficients.

3.1 Model specification

The econometric model that has been used in this study is specified by the following equation:

$$x_t = \beta_0 + \beta_1 DREER_t + \beta_2 Y_t + \beta_3 ERV_t + \beta_4 GDP_t + \beta_5 GER_t + \beta_6 Dummy \quad (2)$$

This association is given in the form of a log-linear empirical model that can be specified as:

$$\ln x_t = \beta_0 + \beta_1 \ln DREER_t + \beta_2 \ln Y_t + \beta_3 \ln ERV_t + \beta_4 \ln GDP_t + \beta_5 \ln GER_t + \beta_6 Dummy + \varepsilon_t \quad (3)$$

where,

X is Mauritius's total export of goods and services at time t ; $DREER$ stands for real effective exchange rate; Y is GDP per capita for Mauritius; ERV is exchange rate volatility; GDP refers to world GDP per capita; GER stands for secondary gross enrollment ratio; t denotes the time dimension; β_0 is a constant and $Dummy$ is a dummy variable generated to capture COVID19 effects. It takes a value of zero for each year except the years 2019–2021 [6] to capture for the dramatic drop in Mauritius's exports during these years.

Equation (3) can be written in ARDL form as follows:

$$\begin{aligned} \Delta \ln x_t = & \beta_0 + \sum_{i=1}^p \beta_{1i} \Delta \ln x_{t-i} + \sum_{i=1}^p \beta_{2i} \Delta \ln DREER_{t-i} + \sum_{i=1}^p \beta_{3i} \Delta \ln Y_{t-i} + \sum_{i=1}^p \beta_{4i} \Delta \ln ERV_{t-i} \\ & + \sum_{i=1}^p \beta_{5i} \Delta \ln GDP_{t-i} + \sum_{i=1}^p \beta_{6i} \Delta \ln GER_{t-i} + \sum_{i=1}^p \beta_{7i} \Delta Dummy_{t-i} + \beta_8 \ln x_{t-1} \\ & + \beta_9 \ln DREER_{t-1} + \beta_{10} \ln Y_{t-1} + \beta_{11} \ln ERV_{t-1} + \beta_{12} \ln GDP_{t-1} + \beta_{13} \ln GER_{t-1} \\ & + \beta_{14} Dummy_{t-1} + \varepsilon_t \end{aligned} \quad (4)$$

where β_0 represents drift component while Δ shows the first difference, and ε_t shows the white noise.

The ECM for the estimation of short-run linkages can be formulated as follows:

$$\begin{aligned} \Delta \ln x_t = & \beta_0 + \sum_{i=1}^p \beta_{1i} \Delta \ln x_{t-i} + \sum_{i=1}^p \beta_{2i} \Delta \ln DREER_{t-i} + \sum_{i=1}^p \beta_{3i} \Delta \ln Y_{t-i} + \sum_{i=1}^p \beta_{4i} \Delta \ln ERV_{t-i} \\ & + \sum_{i=1}^p \beta_{5i} \Delta \ln GDP_{t-i} + \sum_{i=1}^p \beta_{6i} \Delta \ln GER_{t-i} + \sum_{i=1}^p \beta_{7i} \Delta Dummy_{t-i} + \phi_1 ECT_{t-1} + \varepsilon_t \end{aligned} \quad (5)$$

where ϕ_1 is the coefficients of ECM for short-run dynamics.

3.2 Explaining the regressors and the regressand

3.2.1 Export (X). The data for export for goods and services in this study has been derived from trademap and comtradeplus. Export value in constant term rather than the value at current price has been used since the constant term adjusts for the effect of inflation and therefore a more reliable indicator as it controls for the pure price effect in export value.

3.2.2 Real effective exchange rate (REER). The real effective exchange rate is the weighted average of a country's currency with respect to a basket of other currencies. It provides an estimate of a country's currency value in relation to other major currencies. It also controls for inflation for each currency in the basket. Thus, it may be used to determine what a currency can truly buy.

The formula that has been used to calculate REER in this study is as follows:

$$\prod_{i=1}^n REER = \left(\left(\frac{E}{Ei} \right) * \left(\frac{P}{Pi} \right) \right) * Wi \quad (6)$$

where,

i is the " i "th currency in the basket; E is the exchange rate of Mauritius; Ei is the exchange rate of foreign currency " i " in index form; P is Mauritius's consumer price index (CPI); Pi is the CPI of the country associated with the foreign currency " i "; Wi is the weight attached to the foreign currency " i ", based on its relative importance on trade for Mauritius;

Wi has been computed by using trade volume data for the five main trading partners for Mauritius, namely South Africa, France, UK, USA and Madagascar. This data was obtained from the trademap. The formula used is as follows:

$$Wi = Xi / \sum_{i=1}^n Xi \quad (7)$$

where Xi is exports of Mauritius to country i ; $n = 1 \dots 5$, and $\sum_{i=1}^n Xi$ refers exports of Mauritius to the five main export partners.

The data on CPI of each country was obtained from the World Bank and data on exchange rates were obtained from SBM, BOM and [investing.com](https://www.investing.com). The *REER* is expected to have a negative value indicating and inverse relationship with export.

3.2.3 Exchange rate volatility (ERV). The exchange rate volatility is a metric designed to capture the insecurity felt by exporters and importers as a result of unpredictability in currency rates. Various methods for calculating exchange rate volatility have been used in the literature. The 2 most widely used estimation methods in recent literature are the moving average standard deviation (MASD) and the GARCH model. In this study, we made use of GARCH (1,1). For this estimation, monthly historical data on Mauritius rupees against USD

was gathered from fxtop.com for the period 1993 to 2022. The *ERV* is expected to be inversely related to exports.

3.2.4 Gross domestic product per capita (*Y*, *GDP*). GDP per capita is a financial metric which is used to evaluate a country's prosperity by measuring economic growth per person in that country. It is calculated by dividing the GDP of an economy by its population. We gathered Mauritius's GDP per capita (*Y*) and world's GDP per capita (*GDP*) from the World Bank for the period 1993 to 2022. All GDP data gathered are in constant terms to control for inflation. *Y* is expected to have a negative value while *GDP* is expected to be positively related to exports.

3.2.5 Secondary gross enrollment ratio (*GER*). Gross enrollment ratios demonstrate the educational attainment level of a country. It is a proxy measure for the level of human development. Data on Secondary Gross Enrollment Rate (*GER*) was gathered from the World Bank. It shows the number of students enrolled in secondary education, regardless of age, as a percentage of the population. *GER* is expected to be positively related to exports.

The descriptive statistics of the time series data under analysis is provided in [Table 1](#). This will help readers better understand the details of the data set and the readers can monitor the asymmetry or symmetry properties of the data.

3.3 Estimation technique and issues

The ARDL model does not require that regressors are of the same order. ARDL models can accommodate a mix of *I*(1) and *I*(0) within the same estimation. This implies that it avoids the pre-testing issues associated with traditional cointegration, which necessarily require all variables to be categorized as either *I*(1) or *I*(0) before proceeding to the estimation. However, the ARDL model crashes if it includes variables of order 2 or beyond. According to [Ouattara \(2004\)](#) in the presence of *I*(2) variables the computed F-statistics provided by [Pesaran et al. \(2001\)](#) are not valid because the bounds test is based on the assumption that the variables are *I*(0) or *I*(1). Therefore, it is still necessary to perform unit root tests in the ARDL procedure to ensure that none of the variables is integrated of order 2 or beyond. *I*(2) variables would lead to spurious results/ In this study, the variables used are *I*(0) and *I*(1).

3.3.1 Unit root test. Variables in an ARDL, whether *I*(0) or *I*(1) need to be stationary. Non-stationarity leads to spurious results. Non-stationary data is unpredictable and hence cannot be modeled or forecasted. Non-stationary data in levels can be transformed to stationary using any of these three methods: (1) differencing, (2) detrending by model fitting and (3) taking the log form. In this study, the differencing model has been used, whenever required.

	D1	LNERV	LNNGDP	LNREER	LNXT	LN _Y
Mean	0.133333	-1.345230	8.871676	4.030626	22.27181	8.747411
Median	0.000000	-1.473039	8.893781	2.527131	22.28921	8.844544
Maximum	1.000000	1.534835	9.301729	8.059604	22.63459	9.362500
Minimum	0.000000	-2.228954	8.365768	1.959092	21.76871	7.997594
Std. Dev	0.345746	0.833541	0.294577	2.092652	0.244882	0.456499
Skewness	2.157277	1.593189	-0.178923	0.628629	-0.395778	-0.190435
Kurtosis	5.653846	5.910785	1.734738	1.757504	2.196825	1.451605
Jarque-Bera	32.07286	23.28209	2.161175	3.905621	1.589563	3.178235
Probability	0.000000	0.000009	0.339396	0.141875	0.451680	0.204106
Sum	4.000000	-40.35691	266.1503	120.9188	668.1542	262.4223
Sum Sq. Dev	3.466667	20.14892	2.516484	126.9965	1.739042	6.043356
Observations	30	30	30	30		

Source(s): Authors' computation

Table 1.
Descriptive statistics

In this study, all the variables in the cointegration estimation are stationary, either level or differenced form. There are various statistical tests that can be conducted to check for stationarity. The two most commonly used statistical tests for stationarity in the recent literature are the Augmented Dickey-Fuller (ADF) test and the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test. The ADF test determines whether the mean, the variance and the co-variance of a time-series variable are independent of time, whereas the KPSS test checks for the trend stationarity of the data. In this study, the ADF test has been used. A summary of the results for the ADF tests performed for the variables used in this study are showed in [Table 2](#).

3.3.2 Bound F-test. The bounds tests are used to estimate if long-run relationships are present in a group of time-series, some of which may be stationary, while others are not. Once the ADF tests have been completed and prior to estimating the long run cointegration relationships, it is important to test whether there is evidence of a long-run relationship between the variables. This test is performed using a bound test. Following [Pesaran et al. \(2001\)](#) the lower bounds and the upper bounds on the critical values for the *asymptotic* distribution of the F-statistic are considered. Several information criteria are used in the literature for evaluating how well a model fits the data. that it was generated from. Some of them are the Akaike information criterion (AIC). The Bayesian Information Criterion (BIC) (which is sometimes called Schwartz's Bayesian Criterion (SBC)) and Amemiya's Prediction Criterion (APC). In this study the AIC is adopted. This is because the AIC fits better for criteria with lower under-fitting rates, like when the number of observations is small. In this process, the determination of lag is very important. Lag shows the length of time which the dependent variable takes to respond to changes in the independent variable. The Bound *F*-test estimates for this analysis is depicted in [Table 3](#). From the computation, the F-statistics exceeded the upper bound critical value in all the four scenarios. Thus the null hypothesis of no cointegration is rejected.

Table 2.
Unit root test result

Variables	T-statistics	Critical value at 5% significance	Probabilities	ADF test: stationary at levels or difference
ERV	-4.791522	-2.967767 (lower tail, > t-stat)	0.0006 (<0.05)	Level
DREER	-7.550069	-2.971853 (lower tail, > t-stat)	0.0000 (<0.05)	Level
Y	-5.127979	-2.976263 (lower tail, > t-stat)	0.0003 (<0.05)	1st difference
Xt	-5.080055	-2.976263 (lower tail, > t-stat)	0.0003 (<0.05)	1st difference
GDP	-5.080130	-2.967767 (Lower tail, > t-stat)	0.0003 (<0.05)	1st difference
GER	-4.292251	-2.976263 (lower tail, > t-stat)	0.0022 (<0.05)	Level

Source(s): Authors' computation

Table 3.
Bound *F*-test results

Case	Critical values at 5% significance level		<i>F</i> -test values
	I (0)	I (1)	
Case 2: Restricted constant and no trend	2.27	3.28	9.480981
Case 3: Unrestricted constant and no trend	2.45	3.61	9.416964
Case 4: Unrestricted constant and restricted trend	2.63	3.62	12.48361
Case 5: Unrestricted constant and unrestricted trend	2.87	4	13.57780

Source(s): Authors' computation

4. Analysis and findings

4.1 Long-run relationship: ARDL estimates

To estimate the long-run relationship between the variables, an ARDL (1,1,1,2,2,1,2) model has been employed. To flatten the curve thereby reducing the impact of high values on the estimation, the log form (ln) of the data has been used. The results of the estimation are reported in Table 4.

The probability values show whether the variables are statistically significant or not. For a variable to be statistically significant, the probability value should be lower than 5% (<0.05). We can therefore conclude that variables LNGDP and LNERV are statistically significant. That is, Mauritius's export (X_t) has a long-term relationship with world GDP per capita (LNGDP) and with exchange rate volatility (LNERV).

The coefficients show the relationship between the independent variables and the dependent variable both in terms of magnitude and direction. Only the variables which have a long-run relationship are interpreted. It is observed that both world GDP per capita and exchange rate volatility are positively related to Mauritius's exports. In terms of magnitude, it is observed that, in the long run, a 1% increase in world GDP per capita and exchange rate volatility will increase Mauritius's export by 116.3 and 6.72% respectively.

4.2 Short-run relationship: ECM estimates

The ECM-ARDL model has been used to estimate the short-run relationships, that is the speed of adjustments between the variables under consideration. It is expected that the error correction term (ECT) of the model is stable. According to Pahlavani *et al.* (2005), stability is observed if the value of the ECT is less than -1 and at the same time that variable is statistically significant. It is only then that it will justify the cointegration connection between the variables.

The results of the ECM-ARDL model is provided in Table 5. The results demonstrate that the ECT, denoted by $\text{CoinEq}(-1)$ in the table, is negative and statistically significant at the 1%

Variables	Coefficients	T-statistics	Probability values
LN Y	-0.196528	-1.092558	0.2979
LN GER	0.166908	0.624442	0.5451
LN GDP	1.162609	3.050838	0.0110
LN ERV	0.067227	2.573702	0.0259
LN $DREER$	-0.039005	-1.682151	0.1207
Dummy	0.163312	1.152703	0.2735
C	12.96372	8.546529	0.0000

Source(s): Authors' computation

Table 4.
ARDL long run test
result

Variables	Coefficients	Probabilities
D(LN Y)	-0.367757	0.0026
D(LN GER)	1.069026	0.0002
D(LN GDP)	1.262014	0.0002
D(LN ERV)	0.024313	0.0080
D(LN $DREER$)	-0.003426	0.3930
D(Dummy)	-0.141128	0.0010
CointEq(-1)	-0.704040	0.0000
R-squared	0.950146	
Adjusted R-squared	0.925219	
Durbin Watson statistics	2.433572	

Source(s): Authors' computation

Table 5.
ARDL-ECM short Run
Results

level. The estimated values mean that, for the variables under consideration, any shock in the preceding period (denoted by the (-1) of the CoinEq variable) will adjust with a speed 70.40% in the short-run.

The R-squared value provides an estimate on the degree of influence of the independent variables over the dependent variable. In general, an R-squared value of 60% and above is considered as a good fit. In this case, the R-squared value is 95.01%. This means that variations in Mauritius exports (X_t) can be explain at 95% by the independent variables considered.

The adjusted R squared value takes into account only the independent variables that have an influence on the specified model's performance. It is normally lower than the value of R-squared. For this analysis, the adjusted R-squared is 92.52%, indicating that the independent variables considered explain 92.52% of the variations in the dependent variable.

The Durbin Watson (DW) statistic demonstrates whether autocorrelation is present in the regression model. Its value ranges between zero and four. The average value of 2 indicates zero autocorrelation. Any value higher (lower) than 2 indicates positive (negative) correlation. A reasonable range for the value is 1.50–2.50. The DW value for this study is 2.43, indicating positive autocorrelation. This means that for the model specified in this study, an increase observed in a time interval, would lead to a higher than proportionate increase in the lagged time interval.

While LNDREER is not statistically significant (p -value >0.05), the other variables under consideration are statistically significant. LNY and Dummy variables have a significant negative relationship with our dependent variables while the remaining have a significant positive relationship. A 1% increase in Y will decrease Mauritius's export by 36.78% in the short-run. However, Mauritius's export will experience an increase of 107%, 126.2 and 2.43% in the short-run if there is a 1% increase in GER, GDP and ERV.

4.3 Stability test: CUSUM and CUSUMSQ

Cumulative sum (CUSUM) and CUSUM of squares (CUSUMSQ) tests are used for checking the structure stability in a model. While both these tests check for structure stability, yet their focus are different. The CUSUM test checks for a structural break in the intercept of the regression equation and means of the regressors. On the other hand, the CUSUMSQ tests checks for a structural break in the slope coefficient or the variance of the error term.

In this study, the variables CUSUM and CUSUMSQ have been estimated to check whether the model used is stable both in the long-run and short-run. The results are showed in [Figures 5 and 6](#). To predict for stability, the plots for CUSUM and CUSUMSQ should be within the critical bound of 5% significance level, with the bounds illustrated by a pair of straight line.

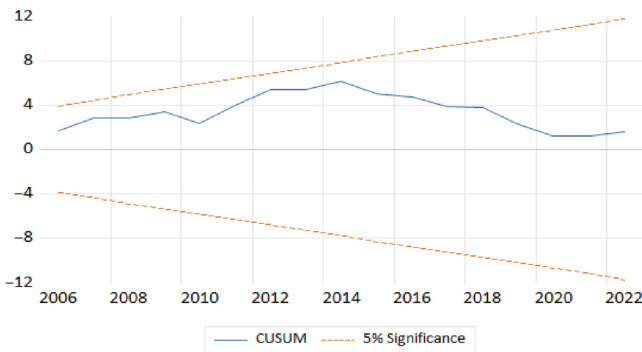
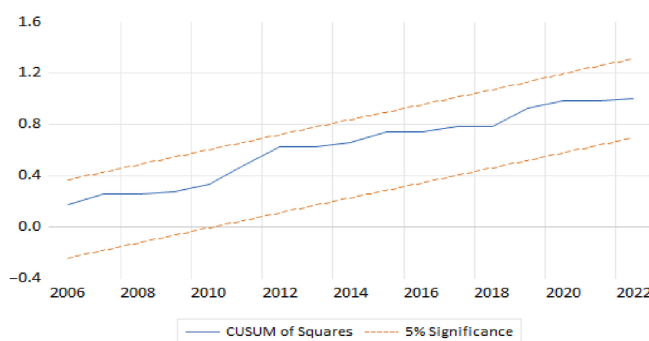


Figure 5.
CUSUM diagram

Source(s): Authors' computation



Source(s): Authors' computation

Figure 6.
CUSUMSQ diagram

As illustrated by these two plots, neither of them exceeds the critical bounds. This means there is no evidence of any significant structural instability.

4.4 Diagnostics test

As a final step in the model estimation and analysis, several diagnostic tests have been performed to check for the robustness of the model. These tests are the serial correlation, the heteroscedasticity (the White heteroskedasticity test) and the normality of errors.

The serial correlation shows the relationship between a variable and its lagged version over various time intervals. A serially correlated variable indicates that the variable may not be random and therefore errors (either over estimation or under estimation) associated with a given time period would be carried over into future time periods.

The test for heteroscedasticity tests whether the variance of the errors from a regression is dependent on the values of the independent variables. This test was introduced in 1979 Trevor Breusch and Adrian Pagan in 1979 to test for heteroskedasticity in a linear regression model and it assumes that the error terms are normally distributed. This test is performed by using the fitted values of the model, the predictors in the model and a subset of the independent variables. The existence of heteroscedasticity is a major concern as it invalidates statistical tests of significance that assume that the modelling errors all have the same variance.

Normality of errors means that it is reasonable to assume that the errors in the estimated model have a normal distribution. Non-normal distributions may arise due to the following: (1) a lack of symmetry in the data, (2) some data may have extreme values and may be serious outliers or (3) the data set may have a flatter or steeper “dome” than a typical bell. A significant violation of the normal distribution assumption is often a “red flag”. It indicates that there is some other problem with the model assumptions and that there may be some unusual data points that requires further investigations.

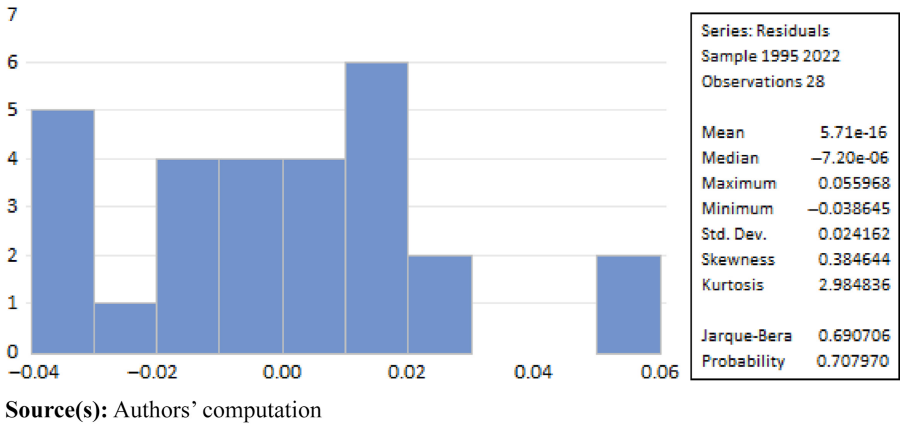
The results for these tests are provided in Table 6 and Figure 7. The results show that in this case all these tests are positive with a probability value greater than 5%. The results from

Diagnostic test	Statistics	<i>p</i> -value	Conclusions
Breusch-Godfrey H0: No serial correlation	2.115957	0.1765	Fail to reject H0 (<i>p</i> -value >0.05)
Heteroskedasticity H0: No ARCH effects	1.201772	0.3863	Fail to reject H0 (<i>p</i> -value >0.05)

Source(s): Authors' computation

Table 6.
Summary of result for
serial correlation and
Heteroskedasticity
tests

Figure 7.
Normality test of the
ARDL model



the Breusch-Godfrey test show that there are no serial correlations among the residuals of the model. Furthermore, the heteroscedasticity test confirms that the residuals are homoscedasticity.

In the case of normality of errors test, the null (H0) and alternative hypotheses (H1) are specified as follows: H0: Residuals are normally distributed and H1: Residuals are not normally distributed. It is expected that the H0 will be accepted. The critical estimate in this case is the probability value of Jarque-Bera. A value of less than 0.05 will imply rejection of the null hypothesis. In the case of this study, the results show that the probability value is 0.707 (i.e. >0.05). Thus, in this case the null hypothesis is accepted, implying that the residuals are normally distributed. In particular, the normality test shows that the model is well fit.

5. Non-linearity testing

Since exchange rate volatility is crucial for all island economies given their level of trade dependance and exports as well as trading partners concentration, we compare the findings obtained for Mauritius with a set of other small islands – namely, Fiji, Seychelles, Maldives, Trinidad, Cape Verde and Barbados. The reason for undertaking this non-linearity test is because conclusions based on a single country examination may not be sufficient enough to establish any significant relationship between the variables studied variables, in particular the relationship between trade and exchange rate volatility. More so, since the data period under consideration covers the COVID-19 pandemic, analysis of one single country is more likely to spike the findings.

We estimated the model using a panel data analysis. Panel data contain information of temporal and spatial dimensions. The temporal dimension is the period in which repeated measurements are made (yearly in this case) and the spatial dimension is the unit of observations [7]. The general regression model of panel data can be expressed as follows:

$$x_{it} = \beta_0 + \beta_1 y_{it,1} + \dots + \beta_k y_{it,k} + v_{it} \quad (8)$$

where i is the unit of observation, t is the period of time, k indicates the k th explanatory variable β_0 is the intercept, β_k is the coefficient of each explanatory variable, v_{it} is the composite error term. The composite error term, v_{it} , can be decomposed into two components: a cross-sectional unit-specific error, a_i , and an idiosyncratic error, u_{it} . a_i does not change over time, while u_{it} , varies over the cross-sectional units and time (Baltagi, 2001; Greene, 2003).

This decomposition of v_{it} illustrates that by using panel data if some of the error terms could be eliminated, concerns around omitted variable bias caused by unmeasured unit-specific factors, would be minimized.

$$v_{it} = a_i + u_{it} \quad (9)$$

The time-constant and unit-specific error, a_i , is an unobserved factor. The different panel data estimation methods are in fact related to how the treatment of the error term, a_i . The pooled least square [8] (PLS) model does not distinguish a_i from other types of errors. The PLS assumes that there are no unobservable entity-specific effects [9]. The fixed effects model (FEM) regards a_i as coefficients to be estimated. This model uses only data on individuals having multiple observations, and estimates effects only for those variables that change across these observations [10]. The random effects model (REM) treats a_i as random variables. The REM treats the unobserved entity-specific effects as random and uncorrelated to the explanatory variables.

The log-linear empirical panel data model in this study is specified as follows:

$$\ln X_{it} = \beta_0 + \beta_1 \ln DREER_{it} + \beta_2 \ln Y_{it} + \beta_3 \ln ERV_{it} + \beta_4 \ln GDP_{it} + \beta_5 \ln GER_{it} + \beta_6 Dummy + v_{it} \quad (10)$$

Before moving on to the panel data analysis, multicollinearity among the different independent variables was tested. The methodology used for the test was the Variance Inflation Factor (VIF) and the results showed that there is no presence of multicollinearity among them [11].

In deciding on the correct estimation method to use for the panel analysis, these steps were followed:

- (1) Choosing between PLS and FEM. The PLS model is a restricted model where it applies the same intercept to all individuals while the FEM is an unrestricted model. We used the Breusch-Pagan test to make this decision. The test results show a p -value of 0.00 (i.e. $P < 0.05$), indicating that the PLS is not a good fit for the analysis.
- (2) Choosing between FEM and REM. In this case, the Hausman test was run. This test determines the unique errors are correlated to the regressors in the fixed affect, while this is not the case in the random effect. The test results show that the one-way random effect model is a better fit for this analysis.

The results of the estimation are showed in Table 7. Similar to the case of Mauritius, the variables LNGDP and LNERV are statistically significant and have the expected positive signs. Therefore, these results show that exchange rate volatility is indeed crucial for small island economies in general.

6. Conclusion

The debate about the relationship between exchange rate volatility and international trade has been in the literature since the days of the Bretton Wood. This debate intensified with the collapse of the Bretton Wood system. The literature on this relationship is therefore quite extensive. While there is no definitive answer as to the direction and magnitude of these fluctuating on trade, there is yet an inclination towards a positive relationship in the literature supported by the larger number of studies which found positive relationships. This study also found positive relationships. This study adds to the body of literature by analyzing the relationship between exchange rate volatility and trade for a small island state. Studies on small islands do not seem to have received due attention recently, and this paper closes this gap. The

Dependent Variable: LNXT
Method: Panel EGLS (Cross-section random effects)
Date: 04/08/24 Time: 12:07
Sample: 1993–2002
Periods included: 30
Cross-sections included: 7
Total panel (balanced) observations: 210
Swamy and Arora estimator of component variances

Variable	Coefficient	Std. Error	t-statistic	Prob
LNXY	0.247611	0.149872	1.652115	0.1000
LNREER	0.050380	0.029344	1.716896	0.0875
LNGER	−0.777515	0.154420	−4.728831	0.0000
LNGDP	1.117878	0.166904	6.697732	0.0000
LNERV	0.051526	0.015807	3.259675	0.0013
D1	−0.312891	0.093328	−3.352594	0.0010
C	5.639532	1.325860	4.253491	0.0000
Effects specification				
		S.D.		Rh0
Cross section random		0.890484		0.8214
Idiosyncratic random		0.415193		0.01786
<i>Weighted statistics</i>				
R-square	0.987207	Mean dependent Var		14.37622
Adjusted R-square	0.986428	S.D. dependent Var		3.563866
S.E. of regression	0.415193	Sum square resid		54.24223
F-Statistic	14.87507	Durbin–Watson Stat		0.368631
Prob (F-statistic)	0.000000			
<i>Unweighted statistics</i>				
R-squared	0.058039	Mean dependent var		14.37622
Sum squared resid	2500.472	Durbin–Watson stat		0.007977

Table 7.
Results of panel data
analysis

Source(s): Authors’ Calculation

effects of exchange rate volatility, which is generated by employing an ARDL model, on Mauritius’s exports over the period 1993–2022 has been studied. The results obtained shows that world GDP per capita and exchange rate volatility have a positive effect on Mauritius’s exports, both in the long-run and short-run. This means that foreign income has positive effects on Mauritius exports, as well as do exchange rate fluctuations. The results also show that exports are not significantly associated with real effective exchange rate.

The results suggest that policy makers in Mauritius should not ignore exchange rate volatility when designing export promotion policies. Exchange rate volatility should form an essential part of trade and exchange rate policy formulation and implementation. The positive linkage also means that if the currency depreciates, exports value would tend to fall. This makes sense in the case of Mauritius, like any small island, because its exports are concentrated in a very few products and the scale in the world market is negligible. Hence, the monetary authorities should strive to keep exchange rate stable as far as possible, if not allow its appreciation. However, exchange rate stabilization strategy should be carefully thought out to avoid further depleting foreign reserve buffers that could result in vulnerability to external shocks. Measures to influence exchange rate expectations and anchor inflation will be highly desirable.

Notes

1. Mono crop sugar dominated in the 1980s, industrialization in the 1990s and diversified services sector in 2000s.
2. Data source: World Bank, <https://data.worldbank.org/>
3. For exports: UK, USA, Madagascar, South Africa and France; For imports: China, India, UAE, South Africa and France.
4. Data source: World Bank.
5. But the model fails in the presence of I(2) series.
6. This study uses yearly data for the period 1993–2022. The sources of data are the World Bank, the Mauritius Commercial Bank (MCB), the State Bank of Mauritius (SBM), the Bank of Mauritius (BoM), investing.com, [trademap](https://trademap.com), fxtop.com and [comtradeplus](https://comtradeplus.com)
7. In this analysis, the temporal dimension is 30 years (1992–2022), and the spatial dimension is 7 countries. Thus, the total panel (balanced) observation is 210.
8. Also called the Pooled Ordinary Least Square (POLS)
9. That is all entities in the data set are considered to have the same underlying characteristics. The error structure is independently and identically distributed (iid) with zero mean and variance.
10. The FEM is a statistical model that represents the observed quantities in terms of explanatory variables that are treated as if the quantities were non-random
11. The test values of the VIF were all below 4.21. The accepted limit for VIF is 10.0. If the test shows any values higher than 10.0, then multicollinearity is present.

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Further reading

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Author (s)/year published	Study period	Model used	Country/group	Relationship observed
Haider and Adil (2017)	1999–2013	OLS	India's export to 5 countries	No effect
Hooper and Kohlhagen (1978)	1965–1975	OLS	US and German trade	No effect
De Grauwe (1988)	1960–1984	ARDL	Multiple countries	No effect
De Vita and Abbott (2004)	1993–2001	ARDL	UK and EU	No effect
Aristotelous (2001)	1889–1999	Gravity model	Britain and US	No effect
Aristeriou <i>et al.</i> (2016)	1999–2015	ARDL	Multiple countries	No long term effect
Kasman and Kasman (2005)	1982–2001	Johansen's multivariate	Turkey	Positive effect
Bilgili <i>et al.</i> (2019)	2003–2015	Regime Switching Model and DOLS	Turkey	Positive effect
Vieira and Macdonald (2016)	2000–2011	GMM	Multiple countries	Positive effect
Klein (1990)	1976–1988	Fixed effect	Multiple countries	Positive effect
Hwang and Lee (2005)	1990–2000	GARCH	UK	Positive effect
Cheong <i>et al.</i> (2005)	–	VAR	UK	Positive effect
Bredin <i>et al.</i> (2003)	1978–1998	ECM	Ireland and EU	Positive effect
Rey (2006)	1970–2002	ARCH	Multiple countries	Positive effect
McKenzie and Brooks (1997)	1973–1992	ARCH model	Single country (Germany)	Positive effect
Hooy <i>et al.</i> (2015)	1999–2013	DOLS	Multiple countries	Positive effect
Yunusa (2020)	2006–2019	GARCH/ARDL	Nigeria	Positive effect
Appuhamilage and Senanayake (2010)	1993–2007	Panel Regression	Sri Lanka and China	Mixed effects
Cheung and Sengupta (2013)	2000–2010	OLS	India	Negative effect
Dell'Ariccia (1999)	1975–1994	Gravity	Multiple countries	Negative effect
Kim (2017)	2000–2015	ARDL	Korea	Negative effect
Serenis and Tsounis (2013)	1990–2012	-VECM	Croatia and Cyprus	Negative effect
Dada (2021)	2005 to 2017	generalised autoregressive	Multiple countries	Negative effect
Hall <i>et al.</i> (2010)	1980–2006	GMM and TVC	Multiple countries	Negative effect
Tenreiro (2007)	1970–1997	Gravity	Multiple countries	Negative effect
Rose (2000)	1970–1990	Gravity	Multiple countries	Negative effect
Clark <i>et al.</i> (2004)	1975–2000	GARCH	Multiple countries	Negative effect
Tarasenko (2021)	2004–2018	Gravity	Multiple countries	Negative effect
Ekanayake and Dissanayake. (2022)	1993–2021	ARDL/ECM	Multiple countries	Negative effect
Handoyo <i>et al.</i> (2022)	2007–2019	EGARCH/ARDL	Multiple countries	Negative effect
Sugiharti <i>et al.</i> (2020)	2006–2018	GARCH/ARDL	Indonesia	Negative effect
Arize <i>et al.</i> (2021)	2000–2019	ARDL	Thailand	Negative effect

Source(s): Table compiled by authors'

Table A1.
Summary of empirical
research

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