International Journal of Science and Research (IJSR)
ISSN: 2319-7064
Impact Factor 2024: 7.101

Exchange Rate Fluctuations and Sectoral Index Behaviour of the Jamaica Stock Exchange Market (2012-2022)

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Abstract: ***This study examines the relationship between USD/JMD exchange rate fluctuations and the performance of various sectoral indices on the Jamaica Stock Exchange (JSE) from 2012 to 2022. It uses correlation and regression techniques to assess how currency movements influence indices such as the Main Market Index, All Jamaican Composite Index, and JSE Select Index, with additional focus on the Financial and Manufacturing & Distribution Indices from 2021 to 2022. Findings suggest weak, statistically insignificant relationships for major indices, while newer indices like Financial and Manufacturing & Distribution exhibit stronger sensitivity to exchange rate changes, with a perfect positive correlation coefficient of 1. The study offers insights valuable to policymakers and investors navigating economic uncertainty and currency volatility, such as sectoral diversification to leverage against the downturns***.

Keywords: exchange rates, sectoral indices, stock market, currency fluctuations, Jamaica

1. Introduction

Exchange rate fluctuations and the performance of sectoral indices on the JSE are critical components of Jamaica's financial market. Jamaica, like many other economies, has been operating within a globalized financial landscape where currency exchange rates can significantly impact investment, trade, and the overall stability of the economy. The fluctuation of exchange rates can have diverse implications for various sectors, ranging from manufacturing and tourism to agriculture and banking. The Jamaica Stock Exchange (JSE) is the country's primary platform for trading equities in the country which acts as a barometer of the nation's economic health and reflects the collective performance of its distinct economic sectors.

According to Chen [1], the exchange rate is a calculated rate at which one currency can be expressed in terms of another currency through the process of exchange in transactional circumstances. Exchange rate fluctuations, however, refer to the change in the value of one country's currency relative to other countries' currencies. Morrison [2] shared that exchange rate fluctuations are relevant to knowing the significance of the exchange rate movements on international trade competitiveness. He explained that for Jamaica to become a strong economic nation, the country must increase its exports as well as encourage more businesses across the country to participate in international activities that earn foreign exchange. He further stated that with more exports and fewer imports, Jamaica's currency can improve greatly and minimize the inconsistencies of the exchange rate with other countries' currencies. However, it is challenging to increase exports when the inputs needed for sectors such as manufacturing and agriculture are both reliant on imports. As a result, the Jamaican dollar (JMD) has experienced cycles of appreciation and depreciation because of the exchange rate against partnering countries' currencies, such as the United States dollar (USD). For example, in 2019, NU Cepal [3] shared that the Jamaican dollar went through five cycles of appreciation and depreciation, but mostly depreciation with an average depreciation of 3.6% against USD, which was 2.7% more than the depreciation rate in 2018.

Morrison [2] went on to say that a strong currency does not indicate that an economy is healthy. For example, if there is depreciation of the Jamaican dollar against the US Dollar, then it can make Jamaican exports more attractive and competitive in international markets. This can potentially boost the country's exports, which may lead to economic growth and job creation in export-oriented industries such as agriculture, textiles, and manufacturing. The problem is, however, that when there is a sharp depreciation of the Jamaican dollar, it can lead to higher import costs that are likely to affect consumers and businesses that rely on imported goods. This can contribute to inflationary pressures and impact the purchasing power of the population.

The Jamaican Stock Exchange is divided into sectoral indices such as the Main Market Index, Junior Market Index, and the JSE USD Index, which track the performance of specific industries within Jamaica. These indices provide valuable insights into the health and trends of different sectors of the economy. Take, for instance, the JSE Financial Index [a sector index within the Main Market Index], which tracks the performance of financial companies such as National Commercial Bank listed on the stock exchange market. So, if this index experiences significant growth, it can indicate that the financial sector is performing well, suggesting increased investor confidence and positive economic sentiment. Conversely, a decline in the index might indicate that there may be potential issues in the financial market, which can have broader implications for the country's economy.

The interplay between the exchange rates and the JSE indices is multifaceted and complex. Exchange rate fluctuations can influence investor's behaviour and impact

the performance of sectors on the stock exchange market. For instance, based on a study done by Adedokun & Olaniyi [4] in South Africa on the interactions between stock prices and exchange rates, it was found that a bi-directional causal linkage existed between the variables in the short run as well as co-integration. The study recommended that investors develop suitable risk management strategies to either manage or hedge against the risk involved resulting from the relationship of the variables in the domestic market as well as portfolio diversification to deal with any arising volatility in the market. The problem in Jamaica is the need to quantify the data of the variables relationship of the exchange rates and JSE indices to properly identify the relationship locally, and discuss the potential implications of currency movements on investors' behaviour and sector-specific market sentiment. Consequently, this study is very relevant to quantify the relationship and provide suitable findings surrounding the relationship and identification of potential implications to help investors, policymakers, and businesses in Jamaica make informed decisions that contribute to sustainable economic growth.

1.1 The Purpose of the Study

It identifies the aim to analyze USD/JMD fluctuations on JSE sectoral performance and elaborates on macroeconomic implications. By doing so, the study will be able to shed light on the intricate dynamics between the behaviour of various sectors and macroeconomic factors within the Jamaican economy. The study also sought to identify and address any critical gaps in understanding how exchange rate movements influence these sectors individually and collectively. The problem encompasses several key dimensions:

1) Magnitude of Impact: There is a need to quantify the extent of the influence that fluctuations in exchange rates likely exert on the individual sectors within the indices. Therefore, the study aimed to determine if certain sectors are likely to be more susceptible to currency volatility, while others display a relatively muted response.
2) Sector Variability: The study sought to uncover the factors that may contribute to the varying degrees of sensitivity across sectors and thus raises questions about why some sectors might experience amplified reactions to exchange rate changes, while others seem to exhibit more stable or divergent behaviour.'
3) Investor Behaviour and Decision-making: The study delved into how investors respond to exchange rate fluctuations in their investment strategies, particularly with sectors within the indices. Thereby addressing whether investors tend to reallocate their portfolios based on the movements of currency and assessing if these behaviours may contribute to sectoral performance shifts.
4) Implications for Economic Stability and Policy: The study indicated that the research problem is likely to impact the broader economy and thus prompts inquiries into whether the potential implication of sectoral responses to exchange rate fluctuations could impact economic stability, investment planning, and policy formulation at both micro and macro levels.
5) Cross-sectoral Interplay: The research problem highlighted the interconnectedness of sectors within the Jamaican economy and how exchange rate fluctuations can potentially create ripple effects across sectors. Thus, questions surrounding any possibility of spill-over effects from currency movements that traverse sectoral boundaries become important to consider.

This study is significant because it informs economic planning, portfolio management, and sectoral risk assessments in small, open economies subject to exchange rate volatility.

1.2 Research Questions

The following research questions were determined to guide the research process:

1) To what extent do USD/JMD exchange rate fluctuations impact the performance of three sectoral indices [the Main Market Index, the JSE Select Index, and the All Jamaica Composite Index] on the Jamaica Stock Exchange (JSE) stock market between 2012 and 2022?
2) Do economic sectors on the JSE respond differently to the appreciation and depreciation of the local currency?

1.3 Preliminaries

The following preliminary information is related to the mathematical processes and models involved in the study.

Calculating Purchasing Power Parity

The following formula is used to calculate relative Purchasing Power Parity (PPP):

$$S = \frac{C_1}{C_2}$$

where:
S represents the exchange of country A's currency to country B's currency.
C_1 represents the cost of good Y in country A's currency.
C_2 represents the cost of good Y in country B's currency.
Adopted from Source: The Investopedia Team [5]

Calculation of a country's current account in deficit

Let X represent exports, M represent imports, NT represents net current transfers, and NA represents net income abroad.
Now, Trade gap $= X - M$; So,
Current Account $= (X - M) + NT + NA$
Source: Pradhan [6]

2. Literature Review

The theoretical framework for this study focuses on perspectives such as comparative advantage, purchasing power parity, and interest rate parity. Comparative advantage, according to Hayes [7], can be defined as an economy's ability to produce more efficiently a particular good or service that is also economically competitive [at a lower opportunity cost] than its counterparts. This theory is used to refer to happenings on the international markets in terms of goods and services produced for import and export. The theory indicated that sectors that rely heavily on exports and imports are more sensitive to exchange rate fluctuations [8]. So, a country whose local currency depreciates can

make exports more competitive, benefiting export-oriented sectors. For example, a depreciating Jamaican dollar can make the services in the tourism sector more affordable for foreign tourists, thus boosting the tourism industry.

The Investopedia Team [5] defined purchasing power parity (PPP) as a macroeconomic metric used through a 'basket of goods' approach to compare the different currencies of countries across the world. Economic analysts usually compare the standards of living and economic productivity between countries. The purchasing power parity perspective suggests that exchange rate changes reflect changes in relative price levels. Sectors that produce tradeable goods might experience shifts in demand due to changes in real exchange rates. For example, if the USD to JMD exchange rate appreciates, then the prices of imports typically become cheaper, affecting sectors like retail and manufacturing. The Interest Rate Parity perspective, however, refers to the interest rate differentials between countries which can influence exchange rates and may impact sectors with high borrowing needs (see Figure 1).

Figure 1: A visual explanation of purchasing power parity [5]

Twin [9] shared that there are likely changes in exchange rates because interest rate differentials can affect economic sectors with varying levels of debt exposure. For example, an increase in the US interest rate relative to Jamaica's can lead to capital outflows, affecting sectors of Jamaica that rely on foreign capital.

2.1 Exchange Rates and Sectoral Performance

There have been ongoing discussions on exchange rates and sectoral performance across the world, and therefore, research has been done to assess the relationship between exchange rates and sectoral performance. This relationship has often been described as complex and multifaceted, which is influenced by a variety of market-specific, economic, and political factors. Hamad Ameen, *et al*. [10] explained from their study that both the exchange rates and the stock indices are significant on the global market, particularly the exchange rates. They shared that exchange rates are a crucial economic indicator of all countries that drive the decision-making processes of businesses and countries. Their study revealed that exchange rates and sectoral performance shared a negative relationship. They explained that the exchange rate is affected by the impact of interest rates on the value of money [10]. For instance, in an economy where interest rates rise, investors typically invest in cash, and the country can attract more international cash, requiring a demand for currency [10]. This demand for currency usually rises, thus raising the value of the currency. Conversely, investors benefit from a low return on cash investments when interest rates have been lowered. They explained that as the interest rate changes, the exchange rate also changes and the movements in exchange rates often comes with uncertainty to businesses regarding their future and financial performance [10], [11]. The stock markets however, become relevant to businesses to help them understand the likely impact of the exchange rates where the stock indices are the indicators that show likely changes in rates based on the businesses share prices and the indices price [10], [11]. Hamad Ameen, *et al*. [10] also shared that changes in the currency prices impact the value of shares within the stock market which implies that both exchange rates and stock market indices directly affect each other [a direct relationship exist between them].

According to Twin [9], exchange rates are just like interest rates and inflation are important indicators in determining a nation's economic health. Twin [9] further shared even though exchange rates are very crucial in the global economy in dealing trading activities such as imports and exports, it is also important when dealing with investment activities. Exchange rates are determined by a lot of factors but most of these factors relate to trading activities between or amongst countries. Some of these factors are differentials in inflation, differentials in interest rates, current account deficits, and public debt. A country that usually has a low inflation rate consistently overtime tends to have a higher value of its currency which increases the country's purchasing power relative to other countries' currencies. Twin [9] shared that countries such as US, Canada, Japan, Switzerland, and Germany often have consistently low interest rates, especially since the latter part of the 20th century. Conversely, countries with higher inflation rates purchasing power tend to decrease relative to other currencies because the value of their currency declines. Twin [9] went on to point out that exchange rates, interest rates, and inflation are typically highly positively correlated. So, when central banks in countries across the world manipulate interest rates, any change in interest rates influences both exchange rates and inflation. For example, when interest rates increase, lenders in a country's economy are likely to receive higher returns on their investments in comparison to other countries, which facilitates the attraction of foreign investments [capital] and thus may increase the exchange rate.

A deficit can be defined as a country spending more on the international market than they are earning, which is reflected in the current account. Consequently, countries faced with deficits tend to reach out the foreign sources such as the International Monetary Fund (IMF) to borrow capital to make up the deficit [9]. For example, when Jamaica experienced economic uncertainty during the years 2012 and 2013, especially following Hurricane Sandy in 2012, they sought and obtained the IMF agreement to borrow money to help with financial strains [12], [13]. Eventually, excess demand for foreign currency occurred, which tended to lower the country's exchange rate for a period until domestic services and goods became cheaper for foreigners [9]. Also,

in dealing with public debt especially servicing a large debt might be reduced if the inflation is high [9]. The inflation rate is usually affected when the money supply is increased in the financial market by printing more money.

3. Methodology

3.1 Research Design and Approach

This study focused on a quantitative analysis incorporating correlation analysis and time-series analysis. The study aimed to collect data on the US exchange rates and three sectoral indices within the Main Market Index on the Jamaica Stock Exchange during the periods of 2012 and 2022. The study took measures to ensure that the data findings are reliable and credible, by collecting data from reputable online economic and financial data sources in Jamaica. Data on the US exchange rates was collected from the website of the Bank of Jamaica (BOJ), the central bank in Jamaica. Data on the sectors' indices were collected from the Jamaica Stock Exchange stock market website, the primary stock exchange market in Jamaica for trading financial instruments and securities. The data collection process took place in early August 2023, roughly the first two weeks. This study looked at the following sectoral indices: Main Market Index, JSE Select Index, and the All Jamaican Composite Index between 2012 and 2022.

3.2 Operationalization of the Variables between 2012 and 2022

Operationalization of variables involved defining and measuring the variables of interest for this study. The study identified USD/JMD exchange rate changes as the independent variable while sectoral index returns were treated as the dependent variable. This was done because the main aim of the study was to determine the impact of exchange rate fluctuations on the performance of sectors within the indices on the Jamaica Stock Exchange (JSE) between 2012 and 2022.

3.3 Quantitative Analysis

This analysis method was used to assess the extent of the impact of USD/JMD exchange rate fluctuations on the sectoral indices Main Market Index, the JSE Select Index, and the All Jamaican Composite Index between 2012 and 2022. This analysis involved an explanation of specific analytical techniques such as:

- Correlation Analysis: This involved the computation of Product Moment Correlation Coefficients for the relationship of the US exchange rates and each sectoral index, as well as the Main Index, to which the sectors belong.
- Regression Analysis: This was used to assess the relationship between the variables (exchange rate fluctuations and sectoral indices) and quantify the direction and strength of their relationship over time. The multiple linear regression model and the time series regression with ARIMA errors were used to understand how exchange rate fluctuations affect sectoral indices. The model in ensuring reliability assumed the stationarity of the time series data, normality of the residuals, and absence of multicollinearity were assessed before model estimation. From the diagnostic checks leveraging R and SPSS, the study reported the regression coefficients, p-value, and fitting the model to statistics to help ensure transparency.

The study identified and prepared each analysis to help generate tables and figures, along with any possible equations needed to clarify the models used. The tables and figures that were developed illustrate key findings of the study using statistical software such as R for time-series analysis and SPSS. The study also identified and discussed any statistical significance in the study and provided suitable interpretations and implications.

4. Results

This section provides empirical results using data presentations related to the JSE sectoral indices between 2012 and 2022.

4.1 Results Based on Research Question 1

To what extent do USD/JMD exchange rate fluctuations impact the performance of three sectoral indices [the Main Market Index, the JSE Select Index, and the All Jamaica Composite Index] on the Jamaica Stock Exchange (JSE) stock market between 2012 and 2022?

This research question involved the measurement of the correlation between USD/JMD exchange rate fluctuations and the concurrent movements in sectoral indices [the Main Market Index, the JSE Select Index, and the All Jamaica Composite Index]. In the investigation, it quantified the magnitude of the impact of the exchange rate fluctuations on the sectoral indices' movements by the provision of calculated Product Moment Correlation Coefficients and assessed their statistical significance using SPSS. The study also determined the sectors that were found to have either the strongest or the weakest correlations based on the changes in the US exchange rates. Figure 2 provided the descriptive summary statistics for the USD/JMD Foreign Exchange Rates between 2012 and 2022 which showed that the median is slightly higher than the mean implying that there might be some relatively higher exchange rates that are pulling the central tendency. The higher exchange rate based on the negatively skewed distribution [median > mean] is evident based on the upward trend seen in Figure 3 of the rates.

Statistics

FXRate

N	Valid	11
	Missing	0
Mean		125.2583
Median		128.3003
Std. Deviation		20.21878
Minimum		88.46
Maximum		153.43

Figure 2: Summary statistics for the annual USD/ JMD foreign exchange rates between 2012 and 2022

However, the standard deviation of 20.21878 suggested that the exchange rates vary from the mean by an average of 20 units implying limited variability across years. The minimum value indicates that duirng 2012 was when the Jamaica dollar (JMD) was the strongest against the United States dollar (USD); however the maximum value in 2022 signified that the JMD got weaker than in the previous years.

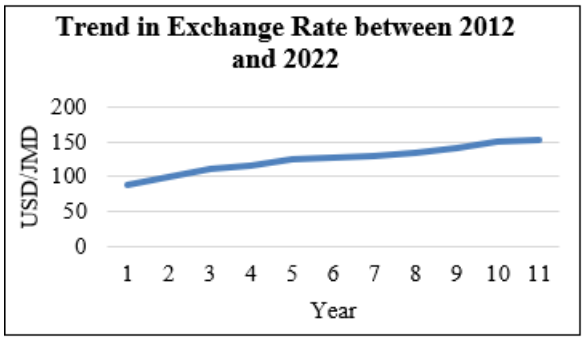

Figure 3. The trend in the annual US/ JMD exchange rates between 2012 and 2022

The data however indicated that there was evidence of the exchange rate fluctuating throughout the years between 2012 and 2022 (see Figure 4). This is reflected in the annual percentage changes of the exchange rate from 2012 to 2022 in Figure 4 displaying erratic behaviour [seemingly cyclical but not necessarily so]. The percentage change for the Main Index also indicated a sense of fluctuations which when graphed with the percentages of the USD/JMD foreign exchange rate the Pearson Product Moment Correlation Coefficient of -0.344 showed signs of low moderately negative correlation (see Figures 6 and 9). This implies that both the USD/JMD foreign exchange rates and the Main Index move in opposite directions thus sharing an inverse relationship (see Figure 5). It is noticeable that no one-to-one unit of relationship is observed, and it is mostly because for a high percentage change in USD/JMD foreign exchange rates, there is a marginally low percentage change (or negative percentage change) and vice versa.

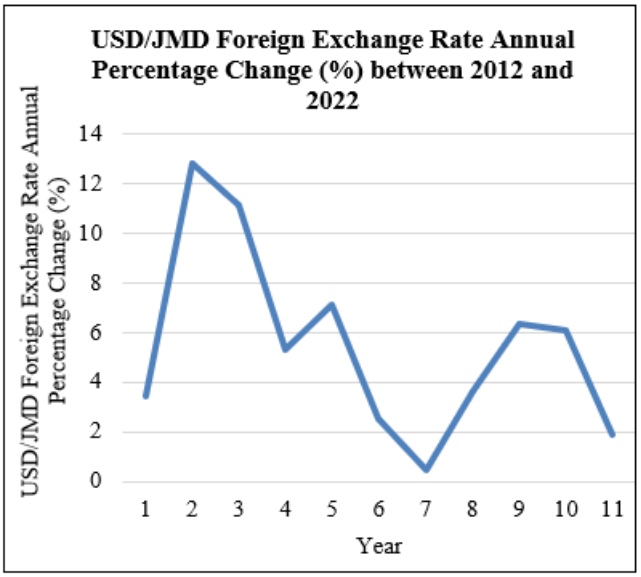

Figure 4: Annual USD/ JMD foreign exchange rate fluctuations (%) between 2012 and 2022

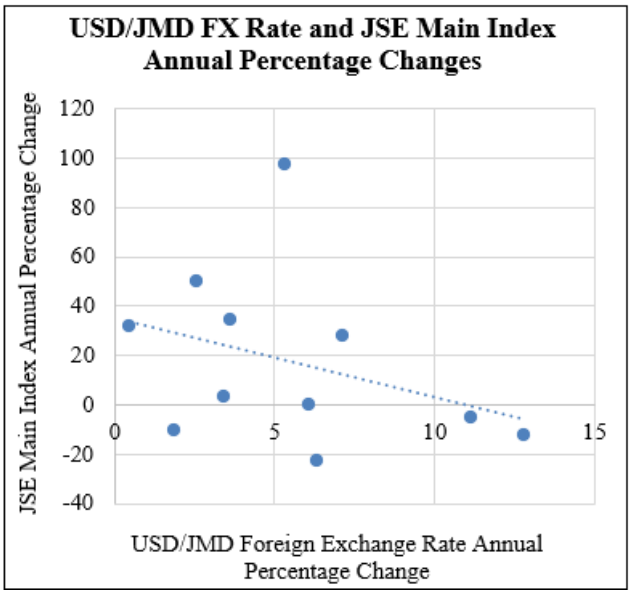

Figure 5: Scatterplot of JSE Main Index and the USD/ JMD foreign exchange annual percentage changes between 2012 and 2022

For example, between 2013 and 2014, the percentage change in the USD/JMD foreign exchange rates is 11.14% while the percentage change in the Main Index is -5.31% (see Table 2). Conversely, between 2016 and 2017, the percentage change in the USD/JMD foreign exchange rates is 2.55% while the percentage change in the Main Index is 49.98% (see Table 2). Consequently, the study revealed that the relationship between the Main Index movements and USD/JMD foreign exchange rates do not share a statistically significant inverse relationship such that $p = 0.3 > 0.05$ (see Figures 6).

		FXRatepercent	MainIndReturn
FXRatepercent	Pearson Correlation	1	-.344
	Sig. (2-tailed)		.300
	N	11	11
MainIndReturn	Pearson Correlation	-.344	1
	Sig. (2-tailed)	.300	
	N	11	11

Figure 6: Product Moment Correlation Coefficient and the statistical significance level for the USD/ JMD foreign exchange and the Main Index annual percent changes between 2012 and 2022

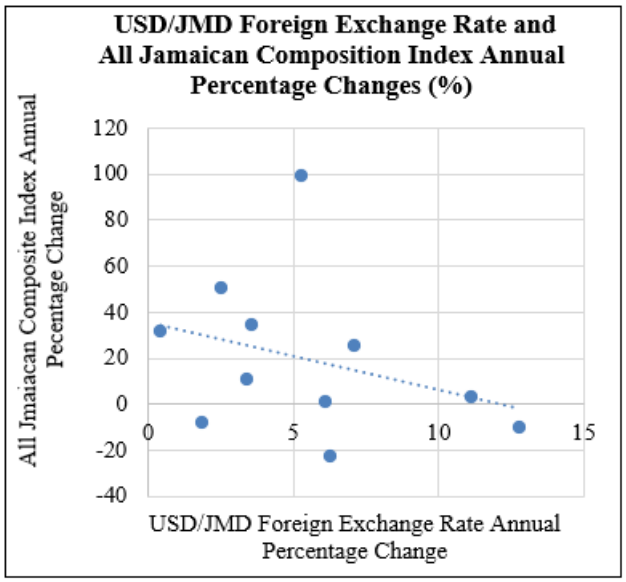

Figure 7: Scatterplot of the All Jamaican Composite Index and the USD/ JMD foreign exchange rate annual percentage changes between 2012 and 2022

		FXRatepercent	AllJamComReturn
FXRatepercent	Pearson Correlation	1	-.326
	Sig. (2-tailed)		.328
	N	11	11
AllJamComReturn	Pearson Correlation	-.326	1
	Sig. (2-tailed)	.328	
	N	11	11

Figure 8: Product Moment Correlation Coefficient and the statistical significance level for the USD/ JMD foreign exchange and the All Jamaican Composite Index annual percent changes between 2012 and 2022

The study also uncovered that the calculated Pearson Product Moment Correlation Coefficient $[\gamma = -0.326]$ of the USD/JMD foreign exchange rates and the All Jamaican Composite Index is pretty close to the correlation coefficient of the Main Index and the USD/JMD foreign exchange rates (see Figures 6 and 8). Similarly, the relationship was found to be an inverse relationship because they both move in opposite directions. Consequently, there exist no statistically significant relationship between the USD/JMD foreign exchange rates and the All Jamaican Composite Index, $p = 0.328 > 0.05$, (see Figures 7 and 8). This is also seeming attributed to the combined fluctuations reflected in the percentage changes of both the All Jamaican Composite Index and the USD/JMD foreign exchange rates (see Figure 9).

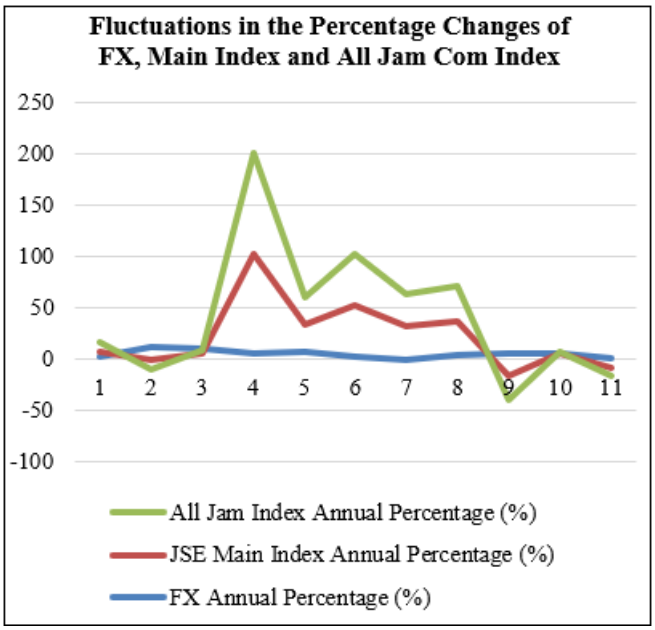

Figure 9: Fluctuations of the All Jamaican Composite Index, JSE Main Index, and the USD/ JMD foreign exchange rate annual percentage changes (%) between 2012 and 2022

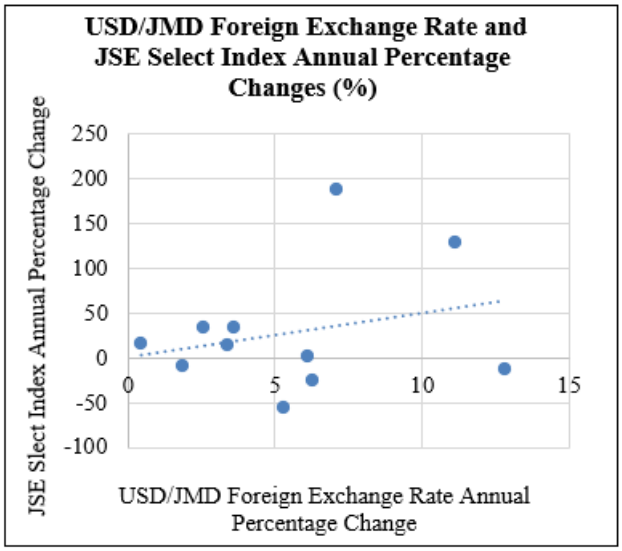

Figure 10: Scatterplot of JSE Select Index and USD/JMD Foreign Exchange Rate Annual Percentage Changes between 2012 and 2022

The findings showed as well that the calculated Pearson Product Moment Correlation Coefficient, $\gamma = 0.259$, of the USD/JMD foreign exchange rates and the JSE Select Index is a low moderate positive correlation (see Figure 11). Therefore, both the USD/JMD foreign exchange rates and the JSE Select Index move in the same direction, thereby sharing a positive relationship (see Figure 10). However, their combined fluctuations as seen in Figure 10 were reflected such that the percentage changes of the JSE Select Index are far more monumental than the percentage changes of the USD/JMD foreign exchange rates.

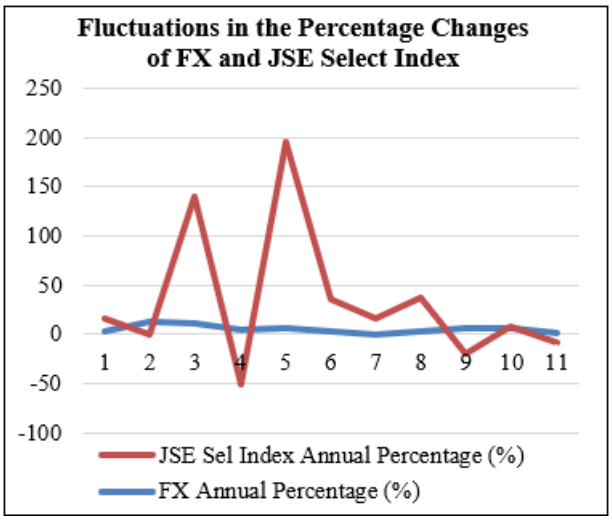

Figure 11: Fluctuations of the JSE Select Index and USD/JMD Foreign Exchange Rate Annual Percentage Changes (%) between 2012 and 2022

		FXRatepercent	JSESelectReturn
FXRatepercent	Pearson Correlation	1	.259
	Sig. (2-tailed)		.443
	N	11	11
JSESelectReturn	Pearson Correlation	.259	1
	Sig. (2-tailed)	.443	
	N	11	11

Figure 12: Product Moment Correlation Coefficient and Statistical Significance Level for the USD/JMD Foreign Exchange and JSE Select Index Annual Percent Changes between 2012 and 2022

At a closer glance, it is noticed mostly that whenever there is an increase in percentage change in the JSE Select, the exchange rate percentage change increases but at a much slower pace. Nevertheless, it was discovered that there is no statistically significant positive relationship between the USD/JMD foreign exchange rates and the JSE Select Index since $p = 0.443 > 0.05$ (see Figure 12).

The study revealed that the annual percentage changes of policy interest rates and the USD/JMD foreign exchange rates are [low] moderately negatively correlated as seen in Figure 13. This indicates that they both move in opposite directions. Moreover, the relationship is not statistically significant because $p = 0.244 > 0.05$. This emphasized that the relationship amongst the USD/JMD foreign exchange rates, All Jamaican Composite Index and the Main Index could not have been statistically significant positive relationship when policy interest rates have little to no effect on the USD/JMD foreign exchange rates. It was also implied as seen Figure 12 and Figure 13 that with the interest rates having hardly any effect on the foreign exchanges, then there would also be hardly any effect of the exchange rates on the JSE Select Index, even though they move in the same direction.

		AnnualPolicypercent	FXRate
AnnualPolicypercent	Pearson Correlation	1	-.384
	Sig. (2-tailed)		.244
	N	11	11
FXRate	Pearson Correlation	-.384	1
	Sig. (2-tailed)	.244	
	N	11	11

Figure 13. Product Moment Correlation Coefficient and Statistical Significance Level for the Annual USD/JMD Foreign Exchange and Annual Policy Interest Rates Percent Changes between 2012 and 2022

4.2 Results Based on Research Question 2

Do economic sectors on the JSE respond differently to the appreciation and depreciation of the local currency?

This research question looked at categorizing the JSE indices into relevant economic sectors such as conglomerate, communications, and manufacturing & distribution, as seen in Table 1 during the period of 2012 to 2022. Table 1 above outlines the components of the JSE indices into economic sectors. However, within each of the JSE indices, there are multiple overlaps of economic sectors. For instance, all the companies listed on the All Jamaican Composite Index are on the Main JSE Market Index, while some of the financial companies listed on the JSE Financial Index are also on the Main JSE Market Index. The study analyzed how different sectors' indices respond to the appreciation and depreciation of the local currency. It also compared the calculated Product Moment Correlation Coefficients between the USD/JMD exchange rate changes and sectoral index and movements. It identified the sectors as well that are more resilient or sensitive to exchange rate fluctuations.

Based on the stock market review in 2012, it was revealed that the Jamaican economy experienced a challenging year. The country's local currency JMD declined by 7.36% against the USD, so by December 31, 2012, the foreign exchange was US$1:00 to J$92.97 [12]. During that time all the JSE indices declined in value points (see Table 2). Within that year, some companies on the Main JSE Market Index experienced a decline in trading activities such as Caribbean Cement Company (a manufacturing & distribution company declined by 66.67%), Hardware & Lumber Limited (a retail company declined by 42.37%), Barita Investments Limited (by 41.40%), Gleaner Company Limited (communications sector declined by 36.36%) [12]. There were only 6 of the 33 ordinary shares on the Main JSE Market Index advanced (experienced increase in stock performance). However, there are no signs of the USD/JMD exchange rate to have caused it but the adjustment of the annual policy interest rate percentage change between 2011 and 2012, seemingly impacted along with the increased inflation rate by 2% and the increased tax rates [3]. Since both the All Jamaican Composite Index and the JSE Select Index are both subsidiary of the Main JSE Market Index then they would have also been impacted adversely. Note, however that between 2011 and 2012, the percentage change in the All Jamaican Composite Index showed 10.78% increase while the JSE Select Index showed 13.37% increase but they were all negative between 2012 and 2013 (see Table 2). It is noticeable to mention that over the entire 11

years, both the All Jamaican Composite Index and Main JSE Market Index behaved the same way (see Figure 9).

Table 1: Components (Economic Sectors) of the JSE Indices

JSE Indices	Components (Economic Sectors)
Main JSE Market Index	Business sectors such as business and finance; communications; retail; marketing; conglomerate; insurance; real estate; services; manufacturing & distribution; and leisure.
All Jamaican Composite Index	Only Jamaican companies are listed on the Main Market: business and finance, communications, retail, marketing, conglomerate, insurance, real estate, services, and leisure.
JSE Select Index	Sub-index of Main JSE Market Index and Junior Market Index. Fifteen most liquid ordinary shares listed: energy company; conglomerate; business and finance; manufacturing & distribution.
JSE Financial Index	Sub-index of Main JSE Market Index and Junior Market Index: financial companies [banks, insurance companies, and other financial institutions].
JSE Manufacturing & Distribution Index	Sub-index of Main JSE Market Index and Junior Market Index: manufacturing and distribution.

**Note: Both the JSE Financial Index and JSE Manufacturing & Distribution Index were introduced in 2020.

In 2013, the country was still in economic turmoil with a further increase of inflation rate by 1.5% and an increase of the USD/JMD exchange rate percentage change to 12.82%, as seen in Table 2, where the JMD depreciated where the exchange rate was recorded as US$1:00 to J$106.3777 [12], [14]. All the JSE indices declined and indicated negative percentage changes which further explains that the economic sectors were not performing well because of the economic conditions (Table 1). The market capitalization in the Main Market decreased by $98.46 billion [12]. During this year, Caribbean Cement Company at the top advancer (advanced by 250%), while Hardware & Lumber Limited advanced by 79.41% within the Main Index. It was noticeable that most of the ordinary stocks that declined related to the banking and financial, and communications sectors. The banking and financial sector therefore was gravely affected that year as National Commercial Bank declined by 34.67%, Sagicor Investments Jamaica declined by 27.73%, First Caribbean International declined by 20.35%, Mayberry Investments declined by 20.00% and Scotia Investments Jamaica declined by 17.48%. The communication sector saw a 34.67% decline in radio activities at Radio Jamaica and by 21.43% in newsprint online and physical (The Gleaner Company) [13]. This decline was reflected in the decline of the Main Index Annual Percentage of 12.45%. However, by the end of the year the country secured an IMF four-year agreement.

Table 2: Data collected on annual percentage (%) changes of policy interest rates, USD/JMD foreign exchange rates and JSE indices between 2012 and 2022

Date	Policy Interest Rates Annual Change (%)	USD/JMD Foreign Exchange Rates Annual Change (%)	JSE Main Index Annual Change (%)	JSE All Jamaican Combined Market Index Annual Change (%)	JSE Select Index Annual Change (%)
2012	1379.81	3.40	3.35	10.78	13.37
2013	-94.56	12.82	-12.45	-10.21	-12.59
2014	1751.12	11.14	-5.31	2.73	128.83
2015	-94.29	5.31	97.36	99.04	-55.41
2016	-7.00	7.12	27.6	25.56	188.42
2017	-18.11	2.55	49.98	50.62	32.99
2018	-44.95	.45	31.7	31.7	15.2
2019	-62.01	3.60	34.26	34.31	34.33
2020	609.20	6.31	-22.42	-22.57	-25.43
2021	-85.90	6.10	0.14	1.11	1.44
2022	517.24	1.87	-10.16	-8.04	-9.98

During the years 2017, 2018 and 2019, it was observed that the annual percentage increase of the USD/JMD foreign exchange rates were mostly low at 2.55%, 0.45%, and 3.60% respectively. This illustrated that the JMD was almost [somewhat] stable, particularly in 2018 when it appreciated. Even though, there is no evidence that the low increase of USD/JMD foreign exchange rates influence the JSE indices relatively stable performance [slight increase] between 2017 and 2019, they both moved in the same direction (see Figures 14, 15 and 16).

		FXRatepercent	MainIndReturn
FXRatepercent	Pearson Correlation	1	.314
	Sig. (2-tailed)		.796
	N	3	3
MainIndReturn	Pearson Correlation	.314	1
	Sig. (2-tailed)	.796	
	N	3	3

Figure 14: Product Moment Correlation Coefficient and Statistical Significance Level for the USD/JMD Foreign Exchange and Main Index Annual Percent Changes between 2017 and 2019

		FXRatepercent	AllJamComReturn
FXRatepercent	Pearson Correlation	1	.312
	Sig. (2-tailed)		.798
	N	3	3
AllJamComReturn	Pearson Correlation	.312	1
	Sig. (2-tailed)	.798	
	N	3	3

Figure 15: Product Moment Correlation Coefficient and Statistical Significance Level for the USD/JMD Foreign Exchange and All Jamaican Composite Index Annual Percent Changes between 2017 and 2019

		FXRatepercent	JSESelectReturn
FXRatepercent	Pearson Correlation	1	.964
	Sig. (2-tailed)		.172
	N	3	3
JSESelectReturn	Pearson Correlation	.964	1
	Sig. (2-tailed)	.172	
	N	3	3

Figure 16: Product Moment Correlation Coefficient and Statistical Significance Level for the USD/JMD Foreign Exchange and JSE Select Index Annual Percent Changes between 2017 and 2019

The country recorded an increase in revenues, grants, and tax collection, even indicating that Jamaica earned more than what was initially budgeted for in 2017 [15]. This helped to improve the country's credit rating, and the institutional reforms set by BOJ were also evident as the investment climate improved. During 2017, the JMD appreciated by 2.55% with an exchange rate of US$1.00 to J$125.09. The Main Index increased that year by 49.98% because it was positively impacted by the economic activities, which reflected earnings [market capitalization] growing to $1.048 trillion [15]. It was also noticeable that investments, retailers, and leisure activities advanced, such as Pulse Investments Limited by 203.37%, Berger Paints Limited by 195.54%, and Palace Amusement Company Limited by 187.18% [15]. Also, most of the economic sectors of the Main Index [along with the All Jamaican Composite Index and JSE Select] performed well, but there was still no sign that there is a statistically significant relationship between JSE indices and USD/JMD exchange rates.

Between 2020 and 2022, during the COVID-19 pandemic, Jamaica was in turmoil, particularly in 2020 when the country went in full shutdown more since March 2020 for most of the year. Consequently, the economy slowed as business operations were either halted or performed at a minimum. In 2020, all the JSE indices performed poorly [Main Index by 22.42%, All Jamaican Composite Index by 22.57% and JSE Select Index by 25.43%] while the USD/JMD foreign exchange rates increased annually to 6.31%. The tourism sector was heavily affected, particularly the cruise ship stopover arrivals, which declined by 81.8% [16].

		FXRatepercent	MainIndReturn
FXRatepercent	Pearson Correlation	1	-.092
	Sig. (2-tailed)		.941
	N	3	3
MainIndReturn	Pearson Correlation	-.092	1
	Sig. (2-tailed)	.941	
	N	3	3

Figure 17: Product Moment Correlation Coefficient and Statistical Significance Level for the USD/JMD Foreign Exchange and Main Index Annual Percent Changes between 2020 and 2022

		FXRatepercent	AllJamComReturn
FXRatepercent	Pearson Correlation	1	-.172
	Sig. (2-tailed)		.890
	N	3	3
AllJamComReturn	Pearson Correlation	-.172	1
	Sig. (2-tailed)	.890	
	N	3	3

Figure 18: Product Moment Correlation Coefficient and Statistical Significance Level for the USD/JMD Foreign Exchange and All Jamaican Composite Index Annual Percent Changes between 2020 and 2022

		FXRatepercent	JSESelectReturn
FXRatepercent	Pearson Correlation	1	-.128
	Sig. (2-tailed)		.918
	N	3	3
JSESelectReturn	Pearson Correlation	-.128	1
	Sig. (2-tailed)	.918	
	N	3	3

Figure 19: Product Moment Correlation Coefficient and Statistical Significance Level for the USD/JMD Foreign Exchange and JSE Select Index Annual Percent Changes between 2020 and 2022

There were hardly any tourists who came to the island, whether for carnivals, cruises, or even to stay over at hotels. Locals, however, were heavily encouraged to visit the hotels through the encouragement in the offering of low USD/JMD exchange rates. Consequently, the exchange rates and the JSE indices moved in opposing directions, indicating a weak negative relationship (see Figures 17, 18, and 19). However, there was no statistical significance of the relationship.

		FXRatepercent	FInanIndReturn
FXRatepercent	Pearson Correlation	1	1.000**
	Sig. (2-tailed)		.
	N	2	2
FInanIndReturn	Pearson Correlation	1.000**	1
	Sig. (2-tailed)	.	
	N	2	2

**. Correlation is significant at the 0.01 level (2-tailed).

Figure 20: Product Moment Correlation Coefficient and Statistical Significance Level for the USD/JMD Foreign Exchange and JSE Financial Index Annual Percent Changes between 2021 and 2022

		FXRatepercent	ManDisIndReturn
FXRatepercent	Pearson Correlation	1	1.000**
	Sig. (2-tailed)		.
	N	2	2
ManDisIndReturn	Pearson Correlation	1.000**	1
	Sig. (2-tailed)	.	
	N	2	2

**. Correlation is significant at the 0.01 level (2-tailed).

Figure 21: Product Moment Correlation Coefficient and Statistical Significance Level for the USD/JMD Foreign Exchange and JSE Manufacturing & Distribution Index Annual Percent Changes between 2021 and 2022

Also, there was an introduction of the two new indices on the market in 2020, the JSE Financial Index and the JSE

Manufacturing & Distribution Index sub-indices of the Main Index. The Financial Index focused on stocks of companies within the sector of banking and finance, while the JSE Manufacturing & Distribution Index considered stocks related to the manufacturing and distribution of goods and services. The study revealed that the relationship of the Financial Index and the USD/JMD exchange rates based on the Product Moment Correlation Coefficient [+1] indicated that the variables share a perfectly positive relationship (see Figure 20). This indicated that if the Financial Index increases by 1 unit, then the USD/JMD exchange rates also increase by 1 unit. Also, their relationship was found to be statistically significant. Consequently, the banking and financial sector [businesses such as Pulse Investments and National Commercial Bank] is highly sensitive to currency movements in some circumstances due to its reliance on customer services, including investments and other services. For example, a depreciation of the local currency is likely to lead to increased repayment of loans by borrowers denominated in USD [at banks such as National Commercial Bank] because the local currency earnings may no longer be sufficient to cover the higher cost of repaying foreign currency-denominated debt. As such, banks may experience an increase in non-performing loans [decreased liquidity] and a deterioration in their asset quality. However, the banking and financial sectors overall mostly have lower sensitivity to currency movements due to their diverse revenue streams. On the other hand, the relationship between the Manufacturing & Distribution Index moved in the same direction [one-to-one] as the USD/JMD foreign exchange rates and was found to be statistically significant (see Figure 21). This relationship indicated that the manufacturing and distribution sector is strongly sensitive to currency movements, particularly because of international trade, indicating that the country has invested more in encouraging the exportation of goods and services. The study revealed that in 2021, when the local currency JMD weakened in comparison to 2020, investors make more investments in the stock market which indicated that exports were made more competitive in the international markets which led to slight increase of demand and production.

4.3 Further Discussions and Implications

The study showed that both the Main Index and the All Jamaican Composite Index moved in the opposite direction as the USD/JMD foreign exchange rates, but the relationship among them was found to be not statistically significant. This was conveyed through computations of the Pearson correlation coefficients of -0.344 and -0.326 for the Main Market Index and the All Jamaican Composite Index, respectively. This revealed that there were other [macroeconomic] factors, including inflation, investor sentiments, fiscal adjustments, and interest rate changes, other than the USD/JMD foreign exchange rates that affected these indices. For instance, in 2012, there was a downturn of the Jamaican economy, which resulted in 26 of the stocks in the Main Index declining, indicating that quite a few companies in the economic sectors performed poorly mostly towards the ending of the year, while the annual percent increase of the exchange rate was 3.40. While there was a rise in the USD/JMD exchange rate by 12.82% in 2013, when all the JSE indices significantly declined, coupled with a fall in the market capitalization of at least $98 billion. Since the stocks within the All Jamaican Composite Index are also within the Main Index, there is also a ripple effect indicating a decline in the stocks as well.
It was found that when there is an increase in the performance of the ordinary [most liquid] stocks within the JSE Select Index that the USD appreciated while the JMD depreciated. It appeared that both the increase in liquidity assets influenced the appreciation of currency, however, Jamaican currency did not benefit from that increase throughout the period of 2012 and 2022. Consequently, it was uncovered that there existed a low [moderately] positive relationship ($\gamma = 0.259$, $p = 0.443$) between the JSE Select Index and the USD/JMD foreign exchange rates because the JMD depreciates when the performance of stocks of the index decreases. The study revealed that the relationship is statistically insignificant; however, in 2012, when the JMD declined, investments in the banking and financial sector [Pulse Investments declined by 59.18%] also declined [12].

Based on the economic sector analysis done, it was revealed that even throughout the years of 2012 to 2022, there were fluctuations of the JSE stock market indices and the USD/JMD, and therefore, the economic sectors' performance also fluctuated. However, most of the time, it was revealed that the economic sectors performed poorly, mainly during economic downturns such as the COVID-19 pandemic and the recovery from Hurricane Sandy. These external activities seemingly influence investors' speculation of the JSE stock market activities and their decision to invest or not. Consequently, one economic sector might perform better under a particular economic factor but when other factors arise it performs poorly. Take for example, prior to the COVID-19 pandemic the tourism sector was booming because entertainment activities across the island such as stage shows and carnivals were happening but with the whole world in chaos, almost everyone was in their home countries particularly with the flight restrictions, amongst other factors.

The study also noticed that some sectors have varying degrees of sensitivity to currency fluctuations based on their characteristics, market integration, and consumer behaviour. For instance, both the manufacturing and distribution, and banking and finance sectors seemed to be stronger sensitive to currency movement. For example, the manufacturing and distribution sector is influenced by its reliance on imported raw materials, consequently, the purchase of the materials is based on the cost guided by the foreign currency. Jamaica often struggles with this because the local currency JMD tends to depreciate, so manufacturing companies are often faced with increased costs, thereby impacting their profitability.

Moreover, investors in sectors with strong sensitivity to currency movements, such as banking and finance, might need to monitor the exchange rate trends closely to gauge potential impacts on their investments. This may lead to increased volatility in these sectors. Consequently, the government would need to identify suitable initiatives aimed at promoting the sectors that can benefit from monitoring and managing exchange rate fluctuations to maintain the sector's growth trajectory.

This study will contribute greatly to the existing body of knowledge about the relationship between exchange rates and sectoral indices. This study will significantly contribute to the understanding of the dynamic relationship between the USD/JMD exchange rates and the JSE indices. While prior research has explored the impact of currency fluctuations on financial markets, this study, through its analysis, will offer sector-specific insights that can shed light on varying degrees of sensitivity across industries. Also, the study will provide sectoral insights revealed through the examination of some of the JSE indices between 2012 and 2022, which can be extended beyond the aggregate market perspectives. This study is also very applicable in the real world to facilitate real-life examples based on recent global and local events.

The study also has implications for policymakers looking to bolster specific sectors during economic uncertainties at the central bank and within the wider financial sector in Jamaica. Moreover, investors having this wealth of knowledge can seek sectoral diversification that may leverage these insights to optimize their portfolios based on different sectors' varying degrees of sensitivity to currency movements.

5. Conclusion

In summary, this study finds that exchange rate fluctuations exert minimal influence on major JSE indices between 2012 and 2022, suggesting other macroeconomic variables play a stronger role. However, newly introduced indices — particularly in manufacturing and finance — show higher sensitivity to currency shifts. This divergence highlights the importance of sector-specific strategies in managing investment risk and economic planning in Jamaica.

6. Limitations

While this study provides a comprehensive assessment of sectoral response to currency movements, it invites further exploration particularly since the availability of data was challenging. The study could have used models such as the Granger Causality tests to identify the causation factors of the relationships established in the studies as well as the SARIMA models to provide forecast of the data that may help investors to have future insights into JSE indices to better speculate the happenings in the both the economic sectors and JSE indices. For instance, global supply chain integration could be researched by investigating how global supply chain dynamics impact sectoral responses to external factors. For example, disruptions in key trading partners might have varying effects on different sectors' supply chains, thus affecting their sensitivities.

7. Recommendations

The study recommends that the Jamaican policymakers incorporate a multi-pronged strategy to address the negative impacts that exchange rate volatility has on key sectors. For instance, adopting targeted fiscal incentives and tax relief measures to cushion the rising input costs and foreign debt obligations associated with the Manufacturing & Distribution, and Financial sectors. Moreover, based on the fluctuations in the exchange rates, the Bank of Jamaica needs to expand its use of hedging strategies to manage the risks companies may be exposed to effectively. Additionally, in the long run, BOJ needs to integrate macro-stabilization policies, sector-specific support, and increased financial literacy that encourage economic growth and stock market stability while experiencing continued foreign exchange fluctuations.

Acknowledgements
The author would like to thank the JSE stock market personnel who assisted in guiding the data collection process on the indices and all other persons involved, including her previous academic advisor at Atlantic International University (AIU).

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