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## Article

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# Diaspora investments in low & high interest rate environments

Idris A. Adediran<sup>a,\*</sup>, Solomon O. Okunade<sup>b</sup>, Raymond L. Aor<sup>c</sup>

<sup>a</sup> Centre for Econometrics and Applied Research, Ibadan, Nigeria

<sup>b</sup> Department of Economics, Chrisland University, Abeokuta, Nigeria

<sup>c</sup> Department of Economics, Benue State University, Makurdi, Nigeria

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## ABSTRACT

Diaspora investment flows measured as foreign direct investments represent one of the major outcomes of the activities of diaspora investors, entrepreneurs, and venture capitalists in the economy. This paper contributes to the literature with distinct analysis of diaspora investment flows in low interest rate environments (Canada, Denmark, Euro area, Japan, Korea Republic, Sweden and the US) and high interest rate environments (Brazil, China, Colombia, India, Indonesia, Mexico and Turkey). First, we employ the Bounds cointegration analysis to investigate whether diaspora investment integrates either of the two groups of economies. Second, we apply the Toda-Yamamoto causality approach to examine whether the interest rate environment causes diaspora investment inflows. Third, we employ the Autoregressive Distributed Lag-Mixed Data Sampling (ADL-MIDAS) technique to evaluate the role of macroeconomic performance for attracting diaspora investments. We find proof of financial integration of diaspora investments in all the low interest rate economies, whereas the evidence is limited to three countries in the high interest rate environment. We also find that the low interest rate environment (more than the high interest rate environment) engenders diaspora investment inflows and also enhances the positive impact of macroeconomic performance in attracting diaspora investments. We highlight some insightful investment and policy implications from the findings.

## 1. Introduction

This study sets out with the objective to highlight the role of monetary policy environment in the dynamics of diaspora investment flows in the recipient countries.<sup>1</sup> There is strong motivation to study diaspora investment flows given the evidences in the literature that transnational flows of investment (especially through foreign direct investments in existing or new ventures) promote economic growth in both the origin and destination economies (Neto & Veiga, 2013; Kotabe, Riddle, Sonderegger, & Täube, 2013; Sahoo & Bishnoi, 2021). This is due to the role of globalization that has aided the way diaspora investors interact better with their host countries through more efficient transportation and communication systems, diffusion of technological innovations, and improved movement of financial capital, entrepreneurs, and human capital resources. This has led to rethinking the gravity model (see Tinbergen, 1962), which indicates that transnational trade and

investment flows reduce with physical distance between the origin and destination economies. Thus, with globalization, there is greater opportunity for financial integration among countries through the activities of diaspora members via direct investments, portfolio investments, establishment of new ventures or equity ownership across businesses, regions and nationalities (Kotabe et al., 2013; Rabbiosi, Gregorič, & Stucchi, 2019).

Given the foregoing background information, we hypothesize that the destination country's monetary policy environment has a role to play in the dynamics of transnational flows of diaspora investments. This hypothesis has support in the study of Auer (2019) which shows that monetary policy is relevant in driving both gross foreign investment flows as well as net foreign investment flows through the foreign balance-sheet channels. The study went ahead to specify distinctions in the ways monetary policy affect foreign investment flows across different instruments or assets based on the macroeconomic

\* Corresponding author.

E-mail address: [ia.adediran@cear.org.ng](mailto:ia.adediran@cear.org.ng) (I.A. Adediran).

<sup>1</sup> We conceive the measurement of diaspora investment as foreign direct investment flows based on the idea that that members of diaspora (investors, entrepreneurs, venture capitalists) mainly promote foreign direct investment flows among countries (Kishi, 2003; Javorcik, Özden, Spatareanu, & Neagu, 2011).

environment of the reference economy and whether foreign assets of the reference country is denominated in domestic currency. We therefore conduct distinct analysis of diaspora investment flows in low interest rate environment and high interest rate environment<sup>2</sup> based on the argument that diaspora investment flows may be influenced differently, whether the recipient economy is characterized as a low or high interest rate economy.<sup>3</sup>

We explore three research objectives. The first relates to whether diaspora investments integrate or disintegrate groups of economies (low and high interest rate environments). Here, we employ the Bounds cointegration analysis to investigate whether diaspora investment integrates either of the two groups of economies. The second goal of this study focuses on whether there are evidences of causal relationships in the groups of low and high interest rate environments. To achieve this objective, we apply the Toda-Yamamoto causality approach to examine whether the interest rate environment causes diaspora investment inflows. The third explicitly captures the role of macroeconomic factor (i.e. stock returns in line with Narayan & Bannigidadmath, 2017; Salisu & Ndako, 2018; Dong & Yoon, 2019; Phan & Narayan, 2020) to examine the extent to which the performance of the economy is a good determinant of diaspora investment in the low and high interest rate economies. For this purpose, we employ the Autoregressive Distributed Lag-Mixed Data Sampling (ADL-MIDAS) technique using the exponential Almon lag polynomial weighting scheme (see He & Lin, 2018; Salisu & Ogbonna, 2019) to evaluate the role of macroeconomic performance in attracting diaspora investments.

The three types of analysis of diaspora investments (cointegration, causality and impact analysis) assist us to tell a beautiful story around the dynamics of diaspora investments and the monetary policy environment of the countries. The outcome of the analyses help to reveal the preferred destination of diaspora investment (foreign direct investment) between the low and high interest rate environments. Particularly, the evidence in favour of cointegration and granger causality in any of the interest rate environment combine to suggest that the group of countries in reference are more financially linked and can take advantage of financial integration among them than the other. In other words, cointegration and causality (cointegration being a special case of causality) suggest whether diaspora investment helps to bring the countries together in terms of financial integration. Further, if there is evidence of cointegration and causality, we can establish that the interest rate environment matter in driving in diaspora investment into the economy. The impact analysis complements the other two since the impact analysis helps to show whether the interest rate environment enhances or weakens the impact of macroeconomic performance in attracting diaspora investments into either of the low or high interest rate environment.

We explore a number of ideas to ensure robustness of the findings. For instance, we test different model variants where either the constant or trend term is included in the test equation for the cointegration analysis. We also compare results with and without the trend component in the causality analysis and as well compare findings for the estimations with and without inclusion of control variables. We also employ the mixed frequency approach (using the ADL-MIDAS technique) that is consistent with the data generating process of the variables. The

foregoing differentiates our study from earlier ones. Previous studies that also implements cointegration and Granger causality approaches such as Sunde (2017) and Goh, Sam, and McNown (2017) have been directed to the nexus between foreign direct investment and economic growth.<sup>4</sup> Our study also offers a different perspective to Auer (2019) by analyzing the countries according to the monetary policy environment. In all, we find that the low interest rate environment (more than the high interest rate environment) engenders greater financial integration of diaspora investments and also enhances the positive impact of macroeconomic performance in attracting diaspora investments.

In what follows after the introduction, we discuss the methodology in details in Section 2. We follow it up with stylized facts and other preliminary analysis in Section 3. Section 4 contains the results with discussion of findings. The last section, Section 5 concludes the study with investment and policy implications of the findings.

## 2. Methodology

Recall that the motivation for this study is rooted in the argument that the monetary policy arrangement/environment is important to the transnational flows of diaspora investments among countries. This is reflective of the argument that foreign direct investment (FDI) inflows may be influenced differently whether the recipient economy is characterized as a low or high interest rate economy, otherwise advanced or emerging economy respectively. We produce model specifications in relation to the three research objectives raised in the introductory section of the study. The first relates to whether diaspora investments lead to financial integration or otherwise among the groups of economies (low and high interest rate environments). The second goal of this study bothers on whether there are evidences of causal relationships in the groups of low and high interest rate environments. The third explicitly captures the role of a macroeconomic factor to examine the extent to which the performance of the economy is a good determinant of diaspora investment in the low and high interest rate economies. We take each approach in turn.

### 2.1. Model specification of cointegration analysis

We employ the Bounds cointegration approach (see Pesaran, Shin, & Smith, 2001) to address the first research goal of the study as to whether diaspora investments leads to financial integration or otherwise of the groups of economies (Salisu & Adediran, 2020 offer extensive details of the specification procedure). This allows us to explore the cointegration analysis (long run relationship) of the diaspora investments in each of the low & high interest rate economies. We specify the Bounds test equation that proceed from the ARDL (1,1) model to the generic ARDL (p,q) as follows:

$$y_t = \alpha_0 + \theta y_{t-1} + \beta_0 z_{i,t} + \beta_1 z_{i,t-1} + \varepsilon_t \quad (1)$$

$$\Delta y_t^{low} = \alpha_0^{low} + (\theta - 1) y_{t-1}^{low} + \alpha_1^{low} z_{i,t-1}^{low} + \sum_{j=1}^p b_{1j}^{low} \Delta y_{t-j}^{low} + \sum_{j=0}^q b_{2j}^{i,low} \Delta z_{i,t-j}^{low} + \varepsilon_t^{low} \quad (2)$$

$i = 1, 2, \dots, k.$

<sup>2</sup> We base the classification of the countries into high and low interest rate environments on the study of Salisu and Vo (2021) as specified by distinction of interest rate series for the two groups of countries. In the study, the average interest rates are 0.91 and 6.99 for the low and high interest rate categories respectively.

<sup>3</sup> Interestingly, the distinction into low and high interest rate environments allows us to "kill two birds with one stone" since the former qualify as advanced economies (Canada, Denmark, Euro area, Japan, Korea Republic, Sweden and the US), while the latter can be rightly described as emerging economies (Brazil, China, Colombia, India, Indonesia, Mexico and Turkey).

<sup>4</sup> Several other studies adopt similar cointegration, causality, and impact analysis approaches to explain the foreign direct investment-economic growth nexus based on the intervening roles of control variables such as financial development, human capital development, green finance, electricity consumption, etc. (for example, Kumari & Sharma, 2018; Osei & Kim, 2020; Saidi, Mani, Meftteh, Shahbaz, & Akhtar, 2020; Dankyi, Abban, Yusheng, & Coulibaly, 2022; Wei, Mohsin, & Zhang, 2022; Asafo-Agyei & Kodongo, 2022).

$$\Delta y_t^{high} = \alpha_0^{high} + (\theta - 1)y_{t-1}^{high} + \alpha_1^{high}z_{i,t-1}^{high} + \sum_{j=1}^p b_{1j}^{high}\Delta y_{t-j}^{high} + \sum_{j=0}^q b_{2j}^{high}\Delta z_{i,t-j}^{high} + \varepsilon_t^{high}; i = 1, 2, \dots, k. \quad (3)$$

where  $y_t$  is the particular country's diaspora investment (say China),  $z_{i,t}$  represents the vector of remainder  $i$ th diaspora investments (excluding  $y_t$ ) in either the low or high interest rate economies,  $\alpha_0$  is the constant,  $\theta$  is the autoregressive parameter expected to be less than one for convergence (in that case, we exclude  $\theta \geq 1$ ), the term  $\sum_{j=1}^p b_{1j}\Delta y_{t-j} + \sum_{j=0}^q b_{2j}\Delta z_{i,t-j}$  corrects for any possible endogeneity bias in the specifications (hence precludes the need for an instrumental variable regression),  $p$  &  $q$  are the lag orders of the regressand and regressors respectively,  $\varepsilon_t$  are the residuals,  $k$  is the number of low & high interest rate countries (7 countries each).

Equations (2) & (3) are lagged models, hence the parameters ( $\alpha_0$  &  $\alpha_1$ ) are short run parameters. To conduct the Bounds cointegration test, we specify the joint null hypotheses for the F-test based on the long run parameters as follows:

$$H_0^{low} : \alpha_0^{*low} = \alpha_1^{*low} = 0 \quad (4a)$$

$$H_0^{high} : \alpha_0^{*high} = \alpha_1^{*high} = 0 \quad (4b)$$

where the long run parameters are defined as follows:  $\alpha_0^{*low} = \alpha_0^{low} / (1 - \theta)^{low}$ ,  $\alpha_1^{*low} = \alpha_1^{low} / (1 - \theta)^{low}$ ,  $\alpha_0^{*high} = \alpha_0^{high} / (1 - \theta)^{high}$ ,  $\alpha_1^{*high} = \alpha_1^{high} / (1 - \theta)^{high}$ . The rejection of the null hypotheses defined in Eqs. (4a) and (4b) indicate cointegration among the interest rate environments, suggesting that diaspora investments integrate the countries, otherwise, it does not.

Further upon establishing cointegration, we re-specify the models in error correction form as follows:

$$\Delta y_t^{low} = \theta^{low} ECT_{t-1}^{low} + \sum_{j=1}^p b_{1j}^{low} \Delta y_{t-j}^{low} + \sum_{j=0}^q b_{2j}^{low} \Delta z_{i,t-j}^{low} + v_t^{low} \quad (5)$$

$$\Delta y_t^{high} = \theta^{high} ECT_{t-1}^{high} + \sum_{j=1}^p b_{1j}^{high} \Delta y_{t-j}^{high} + \sum_{j=0}^q b_{2j}^{high} \Delta z_{i,t-j}^{high} + v_t^{high} \quad (6)$$

where  $\theta$ , the coefficient of the error correction term, is obtained from the autoregressive (persistence) parameter as  $[\theta = \theta - 1 = -(1 - \theta)]$ , it defines the rate of convergence to run equilibrium, that is, the proportion of errors that the system will absorb in the short in the process of achieving the long run relationship.

## 2.2. Model specification of causality analysis

We deploy the Toda and Yamamoto (1995) granger causality approach to examine whether the group settings cause diaspora investments inflows to the individual countries in the low and high interest rate economies. We begin with the specification for the low interest rate environment excluding control (macroeconomic) variables in Eq. (7) and the specification with the macroeconomic variable included as a strict regressor in Eq. (8) as follows:

$$y_t^{low} = \alpha_0^{low} + \sum_{i=1}^p \beta_i^{low} y_{t-i}^{low} + \sum_{j=p+1}^{\rho+d_{\max}} \gamma_j^{low} y_{t-j}^{low} + \varepsilon_t^{low} \quad (7)$$

$$y_t^{low} = \alpha_0^{low} + \sum_{i=1}^p \beta_i^{low} y_{t-i}^{low} + \sum_{j=p+1}^{\rho+d_{\max}} \gamma_j^{low} y_{t-j}^{low} + \theta x_t + \varepsilon_t^{low} \quad (8)$$

Also, we explore similar specifications for high interest rate environment excluding control (macroeconomic) variable in Eq. (9) and the specification with macroeconomic variable as a strict regressor in Eq.

(10) as follows:

$$y_t^{high} = \alpha_0^{high} + \sum_{i=1}^p \beta_i^{high} y_{t-i}^{high} + \sum_{j=p+1}^{\rho+d_{\max}} \gamma_j^{high} y_{t-j}^{high} + \varepsilon_t^{high} \quad (9)$$

$$y_t^{high} = \alpha_0^{high} + \sum_{i=1}^p \beta_i^{high} y_{t-i}^{high} + \sum_{j=p+1}^{\rho+d_{\max}} \gamma_j^{high} y_{t-j}^{high} + \theta x_t + \varepsilon_t^{high} \quad (10)$$

where  $y_t$  is the vector of diaspora investments across either of the two groups of countries considered,  $\alpha_0$  is the vector of constants,  $\beta_i$  are the coefficients of interest to be tested using Wald restriction (as found in the null hypothesis for Granger noncausality),  $\rho$  is the optimal lag order of the respective vector autoregressions (VARs) using the Akaike Information Criteria (AIC),  $d_{\max}$  is the highest order of integration of the diaspora investment series obtained from the classic Augmented Dickey Fuller (ADF) test,  $x_t$  is the strict exogenous (macroeconomic) variable (US federal funds rate as a proxy for global interest rate) in the VAR system (see Azad & Serletis, 2021),  $\varepsilon_t$  are the residuals, low & high represent low & high interest rate countries respectively.

The specifications in Eqs. (7)–(10) follow a pairwise approach such that in practice, each of the  $y_t$ 's stand as a vector of seven countries' diaspora investment series of either the low or high interest rate environment. Note that this approach allows us to explore the causality irrespective of whether the diaspora investment series are integrated (in statistical sense) or cointegrated of an order of at most 2 (see Toda & Yamamoto, 1995). Although there are three possible outcomes from the Toda-Yamamoto Granger non-causality test,<sup>5</sup> we are interested in direction of causality from the group as a whole (the low or high interest rate environment) to each of the constituent countries.

## 2.3. Model specification of impact analysis [ADL-MIDAS regression]

For the impact analysis, we highlight the role of stock returns as a measure of macroeconomic performance (Narayan & Bannigidadmath, 2017; Salisu & Ndako, 2018; Dong & Yoon, 2019; Phan & Narayan, 2020), and examine whether same attracts diaspora investment (i.e. FDI inflows) into the countries. We specify the model for macroeconomic performance (stock returns) as a determinant of diaspora investment (FDI inflows) in the low and high interest rate economies based on the statistical properties of the series as follows:

$$fdi_t^{A,low} = \alpha^{low} + \rho^{low} fdi_{t-1}^{A,low} + \beta^{low} r_t^{M,low} + v_t^{low} \quad (11)$$

$$fdi_t^{A,high} = \alpha^{high} + \rho^{high} fdi_{t-1}^{A,high} + \beta^{high} r_t^{M,high} + v_t^{high} \quad (12)$$

where  $fdi_t^A$  is the recipient country's diaspora investment observed in annual frequency (A),  $r_t^M$  represents the stock returns obtained in monthly frequency (M) for each of the low or high interest rate economies considered individually,  $\alpha$  is the constant,  $\rho$  is the autoregressive parameter expected to be less than one for convergence (i.e. we exclude  $\rho \geq 1$ ),  $v_t$  are the residuals.

The Mixed Data Sampling (MIDAS) approach assumes some weighting scheme to average the high (monthly) frequency data to the date structure for the annual frequency data. We adopt the exponential Almon lag polynomial based on He and Lin (2018) and Salisu and Ogbonna (2019) and specify the ADL-MIDAS regression model as follows:

<sup>5</sup> The three options are: 1) unidirectional causality between diaspora investment flows of a certain interest rate environment (excluding reverse causality), (2) two-way (reverse) causality between diaspora investment flows of a certain interest rate environment, and 3) the non-rejection of the non-causality null hypothesis between diaspora investment flows of a certain interest rate environment.

$$fdi_t^{A,low} = \alpha + \rho^{low} fdi_{t-1}^{A,low} + \beta^{low} \sum_{i=0}^{q_r^M-1} * \sum_{j=0}^{N_M-1} w_{N_M-i+j}^{low} * N_M(\phi_1^{M,low}) r_{N_M-j,t-i}^{M,low} + \zeta_t^{low} \quad (13)$$

$$fdi_t^{A,high} = \alpha + \rho^{high} fdi_{t-1}^{A,high} + \beta^{high} \sum_{i=0}^{q_r^M-1} * \sum_{j=0}^{N_M-1} w_{N_M-i+j}^{high} * N_M(\phi_1^{M,high}) r_{N_M-j,t-i}^{M,high} + \zeta_t^{high} \quad (14)$$

where  $fdi_t$  is the recipient country's diaspora investment,  $r_t$  represents the stock returns for each of the low or high interest rate economies considered individually,  $\alpha$  is the constant,  $\rho$  (rho) is the autoregressive parameter expected to be less than one for convergence (i.e. we exclude  $\rho \geq 1$ ),  $\beta$  is the main coefficient of interest which defines the effect of the monthly frequency variable (stock returns in monthly frequency) on the low frequency variable (FDI inflows in annual frequency). There is only 1 lag of the dependent (annual frequency) variable on the right hand side, while  $q_r^M$  is the lag of the stock returns series,  $N_M$  represent the number of months in a year given the mixture of monthly and annual frequencies.

### 3. Preliminaries

#### 3.1. Data issues and preliminary analyses

In line with the study of Salisu and Vo (2021), the scope of this study is divided into high and low interest rates environments as specified by distinctions in the short-term interest rate series for the two groups of countries. The low interest rate environment comprises six advanced industrialized countries and Euro area as a unit. These are Canada, Denmark, Japan, Korea Republic, Sweden and US, and Euro area. On the other hand, the high interest rate environment includes seven emerging economies, namely, Brazil, China, Colombia, India, Indonesia, Mexico and Turkey. In order to ensure a clear distinction, Salisu and Vo (2021) used the interest rate figures to differentiate the two categories of countries with 0.91 against 6.99 in the low and high interest rate categories respectively. By design, the low interest rate environment can also be regarded as advanced economies while the high interest rate environment can be thought of as a group of emerging economies. The growth rates of the countries are testament to these facts where we expect the former to have lower growth rate than the latter. The latest World Bank data shows that the high interest rate environment economies have higher GDP growth rates (China, 5.95 %, Indonesia, 5.02 %, India, 4.04 %, and Colombia, 3.28 %) than the low interest rate environment economies (Japan, 0.27 %, Euro, 1.52 %, Canada, 1.86 %, Sweden, 1.99 %, Denmark, 2.15 %, US, 2.16 %).

We proxy diaspora investment the net foreign direct investment flows. The FDI data measures cross border investment leading to a stake in the ownership of an enterprise by nonresidents in a reporting economy. The net FDI inflows captures the differences in the capital transactions between inward and outward direct investors. The data for high and low interest rates environments as sourced from World Development Indicator spanning the period of forty-nine year from 1971 to 2019, except China in high interest rate environment which cover only forty-one years. The World Bank database defines the data as: *foreign direct investment, net inflows (% of GDP)*. In order to conduct the impact analysis contained in the third objective of the study, we obtain the stock market indices for the countries and compute the stock returns as the logged first differences in the stock price series. The stock returns serves as a measure of the macroeconomic performance of the economies in line with several studies such as: Narayan and Bannigidadmath (2017), Salisu and Ndako (2018), Dong and Yoon (2019), Phan and Narayan (2020).

We present the statistical features of our data in Table 1, especially both the mean and standard deviation of the variables considered under

**Table 1**

Summary statistics of net foreign direct investment inflows (% of GDP).

Country	Mean	Std. Dev.	Min	Max	Obs.
<b>Low interest rate environment</b>					
Canada	2.3089	1.7516	0.0287	9.1710	49
Denmark	1.4656	3.7306	-4.9976	21.938	49
Japan	0.1341	0.1982	-0.0520	0.8184	49
Korea	0.7257	0.7480	0.0102	4.5662	49
Sweden	2.6310	4.0803	-1.4819	22.953	49
US	1.1780	0.8519	0.0661	3.4053	49
Euro	2.3670	2.5078	-0.1724	9.9629	49
<b>High interest rate environment</b>					
Brazil	1.9517	1.4423	0.1286	5.0341	49
China	2.5865	1.7612	0.0000	6.1868	41
Colombia	2.2785	1.6908	0.1629	7.0288	49
India	0.7564	0.8802	-0.0296	3.6205	49
Indonesia	1.1975	1.3346	-2.7574	4.2412	49
Mexico	1.9174	0.9796	0.3946	3.9856	49
Turkey	0.8095	0.8601	0.0195	3.6235	49

**Note:** The mean are the average values, Std. Dev. are the standard deviation values, Min & Max are the minimum and maximum values.

the country-specific basis. Following the results presented in the Table 1, the average of the variable is highest in Sweden and Canada with the average net foreign direct investment flows of 2.63 % and 2.31 % of GDP respectively, and the least being Japan (with average of 0.13 %) in the panel of low interest rate economies. In the high interest rate environment, China and Colombia have the highest average FDI net inflows of 2.58 % and 2.28 % of GDP respectively, while India has the least (at 0.76 % of GDP). In terms of variability, Sweden portrays the most volatile net FDI flows over the sample period with the standard deviation of 4.08 while Japan's data has the least variability with standard deviation of 0.20 in the low interest rate environment. In the high interest environment, China (1.76) and Turkey (0.86) represent the countries with the most fluctuations and least variability respectively.

We present the results of unit root analysis on the FDI inflows, the main variable of interest which measures diaspora investment in Table 2. We employ the Augmented Dickey Fuller approach which is based on the null hypothesis that the series of interest is nonstationary and contains unit root in the form expressed. Mathematically, the ADF test statistic is expected to be negative since the null is tested against zero (it would have been expected to be less than one in the case of the Dickey Fuller where the null is against one). The statistical significance of the ADF test statistic indicates the rejection of the null hypothesis of unit root, otherwise, the series is nonstationary at the specified form.

The results in Table 2 show that the variables are stationary in three of the seven cases in low interest rate group while the rest are stationary only after taking their first differences. The cases where we observe stationarity are Canada, Denmark and Sweden. The FDI inflows data for the rest of the countries (Euro Area, Japan, Republic of Korea, and the United States) are nonstationary. In high interest rate environment, Indonesia is the only exception where we reject the null of unit root in the FDI inflows series. The remaining six countries turn up with cases of unit roots. In all, the series are combinations of stationary and integrated series, hence, the techniques of analysis adopted in this study take care of this salient data feature.

#### 3.2. Some stylized facts on diaspora investments

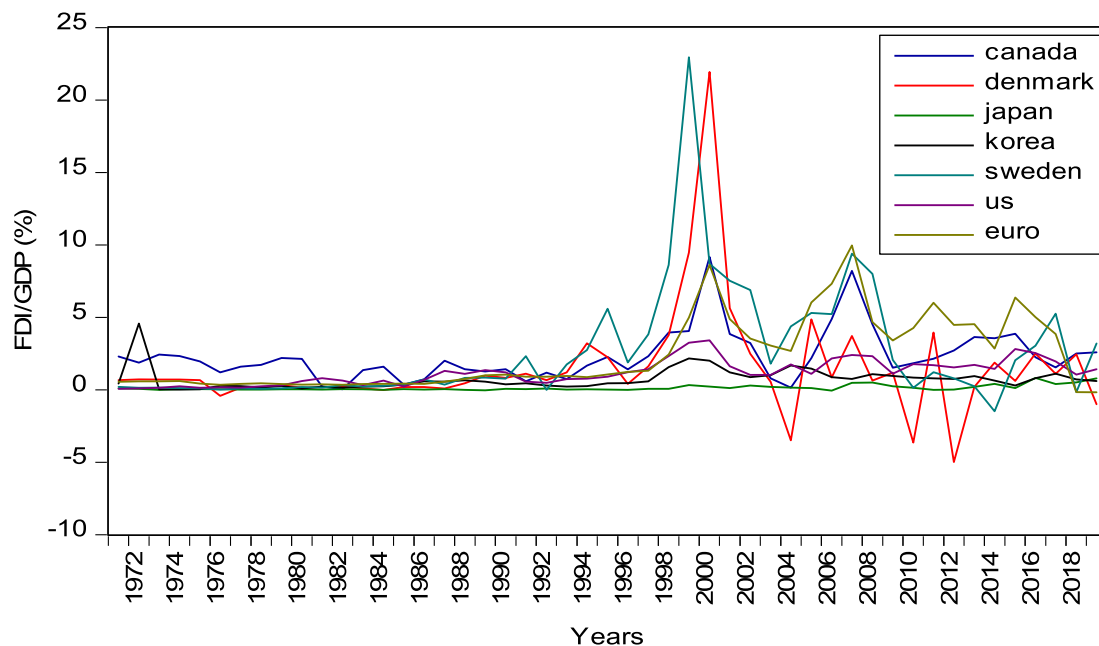
The FDI is an investment from a company in one country into a company or entity located in another country. In the low interest rate environment (see Fig. 1), the Japanese diaspora investment in terms of foreign direct investment abroad has started growing in the 1980s, and has significantly boomed over the past decade as many Japanese companies have set up production facilities abroad. FDI outflows from Japan to other countries have been much larger than the inflows, and this has



**Table 2**  
Unit root tests.

Low interest rate environment			High interest rate environment		
Country	At level	First diff.	Country	At level	First diff.
Canada	-3.5978*** [0.0094]	–	Brazil	-1.4667 [0.5417]	-7.0279*** [0.0000]
Denmark	-4.4846*** [0.0007]	–	China	-1.7254 [0.4111]	-4.9715*** [0.0002]
Euro area	-2.2933 [0.1782]	-6.8439*** [0.0000]	Colombia	-2.3804 [0.1525]	-7.6074*** [0.0000]
Japan	-1.0879 [0.7130]	-10.624*** [0.0000]	India	-1.4749 [0.5376]	-7.8730*** [0.0000]
Korea	-2.4918 [0.1240]	-8.8017*** [0.0000]	Indonesia	-3.4390** [0.0143]	–
Sweden	-3.3900** [0.0162]	–	Mexico	-1.2695 [0.6358]	-9.6311*** [0.0000]
US	-2.5321 [0.1144]	-6.7695*** [0.0000]	Turkey	-2.1140 [0.2402]	-6.4858*** [0.0000]

**Note:** The unit root test results displayed is the Augmented Dickey Fuller (ADF) test conducted on the net FDI inflows series in their level form and after taking the first difference. The ADF statistic presented is expected to be negative. The probability values of the ADF statistics are in square brackets. The statistical significance of the ADF statistic indicates rejection of the unit root null hypothesis. \*\*\*, \*\*, \* indicate 1%, 5%, & 10% statistical significance respectively..



**Fig. 1.** Trends of FDI inflows as a share of GDP in low interest rate environment.

stirred speculations that Japan's productive capacity is moving abroad and diminishing domestic growth and employment (Bayoumi & Lipworth, 1997). Thus, the net flow of FDI as a share of GDP reduces from 0.09 % in 1971 to 0.0008 % in 1984, 0.0007 % in 1996, but grows to 0.118 % in 2015 and 0.78 % in 2019 respectively (WDI, 2021). The FDI inflows from America still account for a significant share of FDI into Japan.

Similarly, the amount of FDI into the United States has doubled in the last two decades. In 2000, FDI was 1.26 trillion U.S. dollars and in 2020 it had risen to 4.63 trillion U.S. dollars. Nevertheless, while the US received large influx of FDI in the last decade, it also invested greater amounts in other countries (Statista Research Department 2021, 2021). While some low interest environments like Japan and Sweden experienced an unprecedented level of inflows, others countries like Denmark recorded historically high outflows (Maiko & Magdolna, 2000). Although about one-third (31 %) of economic activity (GDP) in Denmark depends on foreign markets in 2014, comparable to the level in Sweden. However, Denmark's FDI outflows was equivalent to 57 % of GDP in 2015, and was substantially larger than the FDI inflows of about 33 %,

therefore casting doubts on the real effect on growth and employment in Denmark (OECD, 2017). The flows of FDI in Canada reached the highest ever in 2019, total FDI in Canada reached \$67.2 billion, a 19.3 % increase over the previous year.

In the high interest rate environments, Brazil has come a long way in terms of its FDI policies and has become the country that attracts the second largest foreign investments in the world from being virtually wiped off the FDI. This is evident in her "Import substitution" policy which was the hallmark of Brazil's government policies in the 80's (Nandi, 2012). The inflows of FDI in terms of equity capital to Brazil are majorly from low interest rate environments, and the countries that majorly invest in Brazil are Netherlands, United States, Spain and Japan in the last decade (Nandi, 2012). Among the high interest rate environments and emerging countries, China has attracted the largest amount of FDI over the last three decades having progressively reformed its FDI policies since the early 90's. This is evident in the upsurge from 1992 (see Fig. 2). China has also started surpassing many low interest rate environments, including the US in the amount of FDI inflows since 2002 (Kim, 2004). In Indonesia, several policies have succeeded in

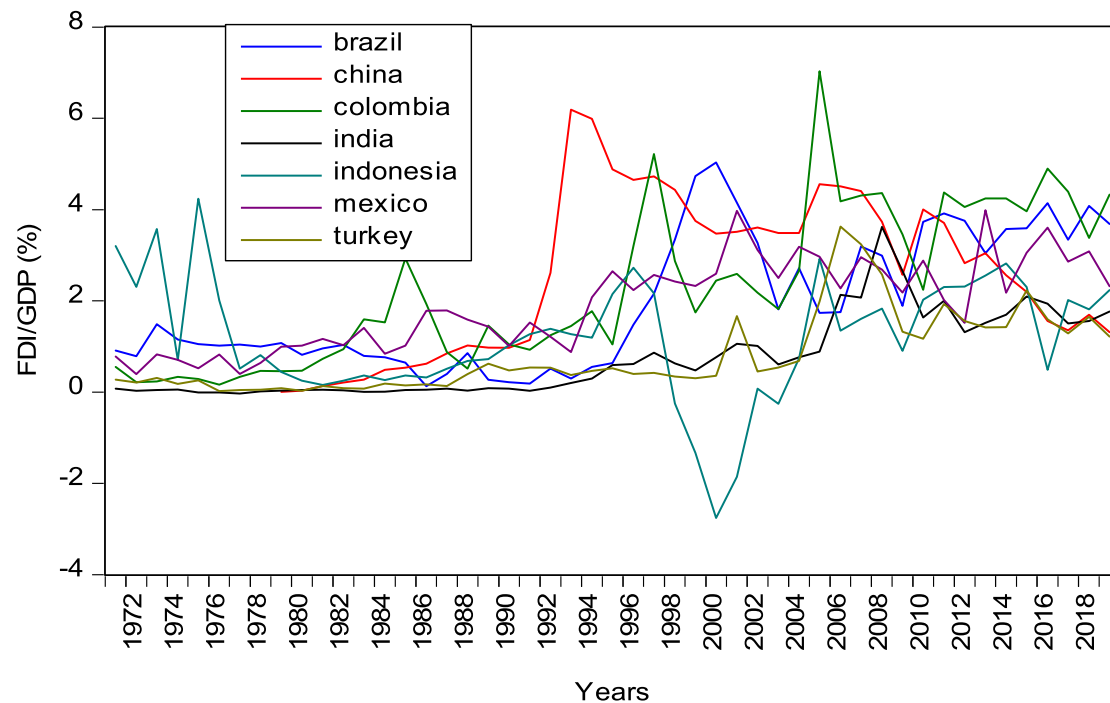


Fig. 2. Trends of FDI inflows as a share of GDP in high interest rate environment.

increasing FDI since the 1970s. Until 2016, the biggest recipient of FDI inflows is Indonesia among all ASEAN countries, which reached \$5.7 billion in 2016 (Widia, Ridwan, & Muharja, 2018).

Among the high interest rate environments, Turkey continues its impressive growth performance orchestrated by structural reforms implemented over the past two decades, and this has put it on the radar of many international investors. Despite the devastating effects of Covid-19, Turkey became the 9th most popular FDI destination, after Poland, with 160 projects in overall Europe in 2020, increasing its share in overall Europe from 3 % in 2019 to 3.1 % in 2020. Before 2002, total FDI inflows into Turkey was only at USD 15 billion, however, the country has since attracted around USD 225 billion of FDI between 2003 and 2020. Mexico is another emerging country most open to FDIs, being the world's 9th largest FDI recipient. In 2020, the FDI inflows to Mexico was relatively low compared to the rest of the region, due to recession in 2019. FDI inflows fell to USD 29 billion in 2020 from USD 34 billion in 2018, representing about 15 % decrease. Yet, 60 % of inflows were generated during the first quarter of the year, and the total stock of FDI is estimated at USD 597 billion in 2020 (UNCTAD's World Investment Report, 2021).

#### 4. Results

We present the results of cointegration analysis, causality analysis, and impact analysis of diaspora investment distinctly among countries in the low and high interest rate environments. The attractions to the two groups of countries is premised on the possible role of monetary policy environment in the dynamics of transnational investment flows. The low interest rate environment appears to fit the description of advanced economies (Canada, Denmark, Euro Area, Japan, Republic of Korea, Sweden, US) whereas the high interest rate environment are close to the description of emerging economies (Brazil, China, Colombia, India, Indonesia, Mexico, Turkey). The study involves cointegration analysis which helps to bring to fore the response to the research question whether diaspora investments integrate or disintegrate the low and high interest rate groups of economies. With the choice of Bounds cointegration approach, evidence of cointegration indicates that the country of focus is integrated with the rest of the group. The causality

analysis explains whether the low or high interest rate environment causes diaspora investment flows into the constituent economies. The impact analysis shows the influence of the measure of macroeconomic performance to drive-in diaspora investments.

The results of cointegration analysis are presented in Tables 3 & 4 for the main results and robustness respectively. The analysis are conducted by considering FDI inflows for a particular country (say Canada) as the regressand, and the rest of the countries in the low interest rate environment as the regressor series. The main analysis estimates the underlying ARDL regression model with 'restricted constant' option, indicating that the constant parameter is part of the bounds cointegration test (long run). The robustness considers other alternative ('restricted trend' option) where the long run part contains the trend component. The coefficients of error term (ECT(-1)) for all the country models are well-behaved with values sufficiently negative, less than 1 in absolute values, and statistically significant. The models also pass relevant diagnostic tests with statistical insignificance of the serial correlation and heteroscedasticity tests. However, the interest is mainly on the F-Bounds test with the null hypothesis of no cointegration, or by implication, no financial integration among the low interest rate group FDI flows or the high interest rate group FDI flows. The statistical significance of the F-test indicate evidence of cointegration (statistically speaking) and evidence of financial integration (theoretically speaking).

Taking the indications in Tables 3 & 4 together, we see evidence of cointegration for each of the countries in the low interest rate environment. This gives resounding proof of financial integration of diaspora investments in the advanced (low interest rate) economies. The evidences are however less compelling in the high interest rate group. Unlike the low interest rate environment which returns evidence of cointegration in all the seven countries, the high interest rate environment only report same for three countries (Colombia, India, and Mexico) at the 5 % conventional significance level. The results indicate that the low interest rate environment are more financially linked than the countries in the high interest rate environment. This conclusion is valid since the series of interest in the cointegration analysis is the net foreign direct investment inflows which constitute net outflows from other countries.

We present the results of causality analysis in Table 5 for the main

**Table 3**

Cointegration analysis (Main analysis).

Low interest rate environment					High interest rate environment				
Country	ECT(-1)	F-Bounds	s. corr.	hetero	Country	ECT(-1)	F-Bounds	s. corr.	hetero
Canada	-0.8126*** (0.0817)	10.502*** {3.99}	1.6179 [0.2117]	1.0341 [0.4230]	Brazil	-0.2847*** (0.0979)	0.8714 {-}	0.0782 [0.9249]	1.8481 [0.1108]
Denmark	-0.9283*** (0.1075)	7.9209*** {3.99}	0.9152 [0.4091]	0.0013 [0.9710]	China	-0.0708*** (0.0227)	0.9975 {-}	2.0318 [0.1171]	0.5716 [0.7733]
Euro area	-0.5302*** (0.0626)	7.6239*** {3.99}	1.4226 [0.2536]	1.3606 [0.2485]	Colombia	-0.7954*** (0.1227)	4.3310*** {3.99}	1.5796 [0.2222]	1.1845 [0.3383]
Japan	-0.4606*** (0.1018)	2.1779 {-}	1.3786 [0.240]	1.4953 [0.1968]	India	-0.4658*** (0.0641)	5.4427*** [3.99]	0.5019 [0.479]	1.1682 [0.3472]
Korea	-0.9458*** (0.1381)	4.9878*** {3.99}	0.1106 [0.8955]	0.3303 [0.9355]	Indonesia	-0.4396*** (0.0989)	2.0336 {-}	0.0887 [0.9153]	1.7180 [0.1389]
Sweden	-0.8315*** (0.1350)	4.0358*** {3.99}	0.3190 [0.7288]	3.2932* [0.0762]	Mexico	-0.8323*** (0.1407)	3.6062** {3.28}	2.3949 [0.1079]	1.4272 [0.2278]
US	-0.6793*** (0.1009)	4.8157*** {3.99}	2.2465 [0.1196]	1.6670 [0.1451]	Turkey	-0.6701*** (0.1441)	2.2278 {-}	1.1246 [0.289]	1.0000 [0.3236]

**Note:** the model estimates the '*restricted constant variant*'. The major coefficients of interest for the cointegration analysis are those of the Bounds test which test the null hypothesis of 'no cointegration', that is, no integration among the countries within the groups. Values in "{...}" are the upper bound critical values at which the F-Bounds statistics is statistically significant. The ECT(-1) values are the coefficients of error correction which shows the speed at which the country of interest adjusts to the equilibrium. Standard errors are in round brackets "{...}". The diagnostic tests conducted are the serial correlation and heteroscedasticity tests with the p-values in square brackets "[...]". \*\*\*, \*\*, \* indicate 1%, 5%, & 10% statistical significance respectively.

**Table 4**

Cointegration analysis (Robustness).

Low interest rate environment					High interest rate environment				
Country	ECT(-1)	F-Bounds	s. corr.	hetero	Country	ECT(-1)	F-Bounds	s. corr.	hetero
Canada	-0.8441*** (0.0804)	11.666*** {4.39}	0.2462 [0.620]	1.0693 [0.4040]	Brazil	-0.5139*** (0.1378)	1.4251 {-}	0.5654 [0.5741]	1.2589 [0.2989]
Denmark	-0.9120*** (0.1036)	8.1983*** {4.39}	1.2653 [0.2941]	0.0542 [0.8169]	China	-0.0665*** (0.0210)	1.0150 {-}	0.5969 [0.4458]	0.7725 [0.6294]
Euro area	-0.5940*** (0.0680)	8.0668*** {4.39}	1.0501 [0.3601]	1.1970 [0.3259]	Colombia	-0.7916*** (0.1244)	4.1521** {3.62}	0.5192 [0.4766]	1.1378 [0.3658]
Japan	-0.7426*** (0.1207)	4.0077** {3.62}	0.5514 [0.5808]	1.2192 [0.3136]	India	-0.4545*** (0.0638)	5.2035*** {4.39}	0.6627 [0.416]	1.4786 [0.2038]
Korea	-0.9352*** (0.1369)	4.9390*** {4.39}	0.1180 [0.8890]	0.5671 [0.7980]	Indonesia	-0.5826*** (0.1009)	3.4165* {3.25}	0.2213 [0.6413]	1.0616 [0.4134]
Sweden	-0.7691*** (0.1138)	4.8380*** {4.39}	0.2445 [0.7843]	1.3809 [0.2583]	Mexico	-0.9448*** (0.1470)	4.2334** {3.62}	3.1663* [0.0565]	1.6185 [0.1585]
US	-0.8965*** (0.1112)	6.8874*** {4.39}	1.8730 [0.1679]	1.2330 [0.3062]	Turkey	-0.6728*** (0.1471)	2.1448 {-}	1.6545 [0.1560]	1.0489 [0.3122]

**Note:** the model estimates the '*restricted trend variant*'. The major coefficients of interest for the cointegration analysis are those of the Bounds test which test the null hypothesis of 'no cointegration', that is, no integration among the countries within the groups. Values in "{...}" are the upper bound critical values at which the F-Bounds statistics is statistically significant. The ECT(-1) values are the coefficients of error correction which shows the speed at which the country of interest adjusts to the equilibrium. Standard errors are in round brackets "{...}". The diagnostic tests conducted are the serial correlation and heteroscedasticity tests with the p-values in square brackets "[...]". \*\*\*, \*\*, \* indicate 1%, 5%, & 10% statistical significance respectively.

analysis and Table 6 for robustness. The main analysis presents the Toda-Yamamoto granger causality analysis with and without the trend component in the estimation. The robustness conducts the same analysis but accounts for the role of a macroeconomic variable that is consistent with the idea of monetary policy environment under investigation, that is, the US federal funds rate as a strict exogenous variable in the regression and a measure of global interest rate (see Azad & Serletis, 2021). The causality analysis constructs a VAR-type framework for the FDI flows for either of the low or high interest rate environment. The results appear to show that the low interest rate environment cause diaspora investment inflows to five of the seven countries (with the exception of Sweden and the US) but the high interest rate environment only granger causes diaspora investment in three countries (Brazil, India, and Mexico). The results appear to support the findings of cointegration analysis, which technically imply-one-way causality with greater evidence in low than high interest rate environment. Hence, we may conclude that there is greater integration of investment flows among the low interest rate environment.

We further explore the impact analysis to see whether stock returns as a measure of macroeconomic performance influence inflows of

diaspora investment. This involves the use of Mixed Data Sampling technique (the ADL-MIDAS approach) that allows us to use all the available information by treating the variables in the model in their available data frequency. The dependent variable (net FDI inflows as a measure of diaspora investment) comes in annual frequency as obtained from the World Bank database whereas the regressor series (stock returns obtained from share price indices) are included in monthly frequency as obtained from the Federal Reserve database (FRED). We therefore estimate the model with mixed data frequency with the Autoregressive Distributed Lag-Mixed Data Sampling (ADL-MIDAS) approach based on the Almon lag polynomial weighting scheme.

The results are displayed in Table 7 for the low and high interest rate environments. In four out of the seven cases in the low interest rate environment, the performance of stock market appears to encourage higher net FDI inflows into Canada, Denmark, Euro Area, and the United States. In these cases, the slope parameter is both positive and statistically significant. The evidence is however mild in Sweden where the slope coefficient is positive but not statistically significant. The reverse is the case in the Asian representatives (Japan & Korea) where the coefficient is both negative and insignificant. None of the countries in the



**Table 5**  
Causality analysis (Main analysis).

Low interest rate environment			High interest rate environment		
Country	No trend	With trend	Country	No trend	With trend
Canada	28.826*** [0.0001]	28.623*** [0.0001]	Brazil	60.530*** [0.0000]	60.937*** [0.0000]
Denmark	129.328*** [0.0000]	117.374*** [0.0000]	China	4.4419 [0.9741]	5.9938 [0.9164]
Euro area	15.396** [0.0174]	12.452* [0.0526]	Colombia	19.199* [0.0838]	10.180 [0.6001]
Japan	17.574*** [0.0074]	14.616** [0.0235]	India	58.431*** [58.431]	45.752*** [0.0000]
Korea	33.498*** [0.0000]	23.854*** [0.0006]	Indonesia	12.975 [0.3708]	24.071* [0.0199]
Sweden	6.2235 [0.3986]	4.2725 [0.6398]	Mexico	22.532** [0.0320]	23.829** [0.0215]
US	3.0330 [0.8047]	6.7845 [0.3412]	Turkey	14.220 [0.2868]	12.204 [0.4294]

**Note:** the table presents results of Toda-Yamamoto granger causality with and without the trend component in the estimation model. The FDI inflows series for each of the countries serve as the dependent variables in the estimations. The null hypothesis is that the excluded variables (the rest of the low or high interest rate FDI series) do not granger cause the dependent variable. The probability values are in square brackets "[...]". \*\*\*, \*\*, \* indicate 1%, 5%, & 10% statistical significance respectively.

**Table 6**  
Causality analysis (Robustness).

Low interest rate environment			High interest rate environment		
Country	No trend	With trend	Country	No trend	With trend
Canada	27.940*** [0.0001]	27.582*** [0.0001]	Brazil	66.265*** [0.0000]	56.080*** [0.0000]
Denmark	127.421*** [0.0000]	113.205*** [0.0000]	China	7.9572 [0.7885]	4.5874 [0.9704]
Euro area	14.866** [0.0213]	11.940* [0.0633]	Colombia	15.283 [0.2263]	9.1361 [0.6913]
Japan	17.461*** [0.0077]	12.689** [0.0482]	India	59.940*** [0.0000]	46.778 [0.0000]
Korea	33.976*** [0.0000]	24.137*** [0.0005]	Indonesia	13.091 [0.3624]	22.450** [0.0328]
Sweden	6.1885 [0.4024]	3.9449 [0.6841]	Mexico	18.997* [0.0886]	23.306** [0.0252]
US	3.1865 [0.7851]	7.0707 [0.3144]	Turkey	12.951 [0.3726]	14.845 [0.2500]

**Note:** the table presents results of Toda-Yamamoto granger causality with and without the trend component in the estimation model. The estimation process accounts for the role of macroeconomic factor as a strict exogenous variable. This captures global interest rate proxy with the US federal funds rate. The FDI inflows series for each of the countries serve as the dependent variables in the estimations. The null hypothesis is that the excluded variables (the rest of the low or high interest rate FDI series) do not granger cause the dependent variable. The probability values are in square brackets "[...]". \*\*\*, \*\*, \* indicate 1%, 5%, & 10% statistical significance respectively.

high interest rate environment present strong evidence that better stock market performance drives diaspora investment inflows. There are however weak evidence from China, India, Mexico and Turkey from high interest rate environment where the slope parameter is positive but statistically insignificant. Evidence from Brazil, Colombia, and Indonesia show that the coefficients are negative and statistically insignificant. Overall, the findings indicate that the low interest rate environment enhances the positive impact of macroeconomic performance in attracting diaspora investments than their high interest rate environment counterparts.

## 5. Concluding remarks

This study conducts a distinct analysis of the integration of diaspora

investment flows among low and high interest rate economies, which are summarized as advanced/industrialized countries on one hand and the fast-growing emerging economies on the other. The low interest rate environment appears to fit the description of advanced economies, this includes Canada, Denmark, Euro Area, Japan, Republic of Korea, Sweden, and the US, whereas the high interest rate environment closes to the description of emerging economies comprises Brazil, China, Colombia, India, Indonesia, Mexico, and Turkey. We explore three research objectives as follows: one, investigate whether a country in low and high interest rate environment is integrated with the rest of the economies in the same group in terms of diaspora investment proxied by net FDI flow; two, investigate whether the low or high interest rate environment causes diaspora investment flows into the constituent economies differently; three, conduct the impact analysis to explore the influence of the measure of macroeconomic performance in attracting diaspora investments in low and high interest rate environment.

We proxy diaspora investment by the net foreign direct investment flows as a share of GDP, and the data for high and low interest rates environments as sourced from World Development Indicator spanning the period of forty-nine year from 1971 to 2019, except China in high interest rate environment which cover only forty-one years. Also, to conduct the impact analysis contained in the third objective of the study, we obtain the stock market indices for the countries in monthly data frequency and compute the stock returns as the logged first differences in the stock price series to serve as a measure of the macroeconomic performance of the economies.

We report significant findings that are instructive to policy making and future researches. One, we find evidence of cointegration for each of the seven countries in the low interest rate environment, indicating a resounding proof of financial integration of diaspora investments in the advance (low interest rate) economies, whereas only three countries (Colombia, India, and Mexico) are cointegrated in the high interest rate environment. Thus, we conclude that the low interest rate environments are more financially linked than the countries in the high interest rate environment. Two, we show that the low interest rate environment causes diaspora investment flows to five of the seven countries (except Sweden and the US), and three countries (Brazil, India, Mexico) in the high interest rate environment. The results indicate a one-way causality with greater evidence in low than high interest rate environment. Hence, we conclude that there is greater integration of investment flows among the low interest rate environment. Three, we find that the macroeconomic performance of stock market encourages higher net FDI inflows into four out of the seven cases in the low interest rate environment; namely, Canada, Denmark, Euro Area, and the United States. The evidence is however mild in Sweden, and the reverse is the case in the Asian representatives (Japan & Korea). Nevertheless, none of the countries in the high interest rate environment present strong evidence that better stock market performance drives investment inflows. Therefore, we also conclude that the low interest rate environment enhances the positive impact of macroeconomic performance in driving in diaspora investments than their high interest rate environment counterparts. Finally, this distinction between low and high interest rate environments is shown irrespective of whether the underlying model is estimated differently or accounts for the intervening roles of macroeconomic performance of stock returns obtained from share price indices.

These findings have implications to guide both policy makers in shaping foreign investment policies and informative to international investors in targeting profitable investment decisions. The findings indicate that the low interest rate environments are preferred investment hubs for long term investments which foreign direct investment represents. Investors can therefore take advantage of the better opportunities offered by the relative financial stability offered in the low interest rate environment. These economies are also better financially linked with each other unlike the high interest rate environment. Thus, the high interest rate countries may require monetary policy rule that

**Table 7**

Impact analysis with ADL-MIDAS regression.

Low interest rate environment				High interest rate environment			
Country	Rho	Slope	Constant	Country	Rho	Slope	Constant
Canada	0.6911*** (0.1085)	0.3907*** (0.1258)	0.4787 (0.3472)	Brazil	0.7078*** (0.1118)	-0.0235 (0.0160)	1.0050*** (0.3648)
Denmark	0.4172*** (0.1522)	0.5377** (0.2248)	0.9580 (0.7829)	China	0.8686*** (0.1412)	0.0562 (0.0405)	0.2815 (0.4612)
Euro area	0.6685*** (0.1159)	0.2930*** (0.0908)	0.8228 (0.4995)	Colombia	0.4423*** (0.1610)	-0.0673 (0.0435)	2.0897*** (0.5838)
Japan	0.6335*** (0.1350)	-0.0086 (0.0060)	0.0703** (0.0299)	India	0.9233*** (0.0853)	0.0635 (0.0670)	0.0434 (0.1790)
Korea	0.7628*** (0.1091)	-0.0052 (0.0084)	0.2026** (0.0970)	Indonesia	0.7244*** (0.1414)	-0.0988 (0.0663)	0.6616** (0.3208)
Sweden	0.5912*** (0.1200)	0.0465 (0.0812)	1.1296** (0.5733)	Mexico	0.7276*** (0.0971)	0.0086 (0.0145)	0.5699*** (0.2138)
US	0.7924*** (0.0839)	0.1508*** (0.0530)	0.1949 (0.1324)	Turkey	0.7958*** (0.1783)	0.0529 (0.1992)	0.4236 (0.3326)

**Note:** this table presents the result of Autoregressive Distributed Lag–Mixed Data Sampling [ADL-MIDAS] where diaspora investment, the dependent variable, is observed in low (annual) frequency and stock returns, the exogenous variable, is observed in high (monthly) frequency. The stock returns are obtained from FRED database's monthly "Total Share Prices for All Shares" for the countries included. The major coefficients of interest are the slope coefficients of the high frequency variable (i.e. 'slope'), and the coefficient of lagged low frequency variable (i.e. 'Rho'). Standard errors are in round brackets "(...)" . \*\*\*, \*\*, \* indicate 1%, 5%, & 10% statistical significance respectively.

supports foreign investment in the economy. The emerging economies can take a cue from the advanced economies who have systematically pursued deliberate low interest rate policy that appear to favor foreign investment and businesses by removing uncertainties as the clog in the wheel of investment.

#### CRedit authorship contribution statement

**Idris A. Adediran:** Conceptualization, Methodology, Data curation, Formal analysis, Investigation, Resources, Software, Supervision, Writing – original draft, Writing – review & editing. **Solomon O. Okunade:** Conceptualization, Data curation, Formal analysis, Writing – original draft, Writing – review & editing. **Raymond L. Aor:** Project administration, Resources, Validation, Visualization, Writing – review & editing.

#### Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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