Journal of Economics and Sustainable Development
Volume: 07 / N°: 01 (2024), P:98-115
ISSN : 2661-7986 EISSN: 2773-2606

Measuring the degree of financial linkage between financial markets and their potential impact on the feasibility of international portfolio diversification.
- A case study of the Arab financial markets for the MENA region -

SAADI Larbi [1] [*], Satouri Djoudi [2]

[1] Mohamed Bachir Ibrahimi University Bordj Bou Arreridj (Algeria),Larbi.saadi@univ-bba.dz
Economic studies laboratory on industrial zones in light of the new role of the university - the case of Bordj Bou Arreridj (LEZINRU)
lezinru.2015@univ-bba.dz

[2]Mohamed Bachir Ibrahimi University Bordj Bou Arreridj (Algeria),Djoudi.satouri@univ-bba.dz
Economic studies laboratory on industrial zones in light of the new role of the university - the case of Bordj Bou Arreridj (LEZINRU)
lezinru.2015@univ-bba.dz

Received:19/12/2023 ***Accepted:11/02/2024*** ***Published:01/03/2024***

Abstract:

The study aims to measure the degree of correlation between financial markets and assess its impact on the feasibility of international portfolio diversification. The study focuses on a sample of Arab financial markets in the Middle East and North Africa region, abbreviated as MENA. The sample includes six financial markets representing Jordan, Lebanon, Palestine, Egypt, Morocco, and Tunisia.

The study concludes that there is no integration or correlation between these markets, as revealed by the DCC-GARCH model. Consequently, there is potential for international portfolio diversification.

Keywords: International diversification, financial integration, internatinal financial market, portfolio investing, indices.

JEL Classification: G19; F30; G15; G11; G10

[*] ***Corresponding author.***

Introduction

The significant wave of globalization, which has accelerated rapidly over the past decades, compelled countries to align themselves with its trends, particularly in the financial aspect. This led them to pursue legislative and institutional reforms that favor freeing capital from constraints and geographical boundaries, opening doors to financial liberalization, and embracing the regional approach. Countries recognized the need for such reforms, understanding that developmental opportunities cannot be achieved solely through the efforts of individual states. Financial markets, in particular, have been at the forefront of the transformations occurring in the international environment, directing their efforts towards the concept of financial integration.

Financial integration is the objective of every financial market, due to its benefits, as it strongly supports opportunities to diversify international risks and immunize its economy from local shocks. Contrarily, financial integration limits the opportunities for international portfolio diversification gains, which requires investors to search for less integrated financial markets as the latter are not as advanced.

The Arab financial markets vary in their degree of progress, whether located in the Gulf or the Middle East and North Africa. Where the degree of efforts and reforms varied in order to raise their efficiency, which made them a subject of interest in terms of the degree of linkage between them and the feasibility of international diversification in portfolios.

The Arab financial markets are considered diverse in terms of their level of development, whether in the Gulf or the Middle East and North Africa region. The degree of efforts and reforms aimed at enhancing their efficiency varies, making them a subject of interest concerning the degree of correlation between them and the feasibility of international portfolio diversification in these markets.

Considering what has already been said, the following problematic emerges:

Is there a possibility of achieving gains from international portfolio diversification in the selected Arab financial markets in this study?

Subsidiary questions derived from this problem are:

1. Is there an impact of shocks on the volatility of financial market indicators in this study?

2. What is the degree of correlation between returns of Arab financial market indicators in this study?
3. Are the returns of financial market indices influenced by the volatility of one of the financial markets studied?
4. Are there potential future effects that may hinder the implementation of optimal international portfolio diversification in the studied financial markets?

In order to answer these subsidiary questions, the following hypotheses are formed:

1- There is an impact of shocks on the volatility of financial market indicators in the study.

2- Considering that the studied financial markets are diverse in terms of efficiency and size, it is not possible for the index of one financial market to be influenced by another financial market.

3- Given the diversity of the studied financial markets in terms of efficiency, size, and other characteristics, the existence of a correlation relationship between them is considered close to non-existent.

4- In light of the existing deficiencies in legislative and institutional reforms for the studied financial markets, the possibility of integration between these markets and the failure to create opportunities for international diversification is not possible.

Importance and aim of the study:

The importance of the study is evident in its exploration of contemporary concepts in financial markets such as financial integration and international diversification. The study addresses the significance of these concepts in light of current developments in the international economic and financial environment. The focus of the study is to measure the degree of correlation between Arab financial markets in the Middle East and North Africa, highlighting their distinctive characteristics, given their diversity in terms of size and mechanisms.

Methodology of the study:

Given the nature of the study, which is based on economic and financial literature, the methodology employed aligns with this literature. The study adopts a descriptive approach to encompass the theoretical aspects of the research. Additionally, an analytical methodology is applied, relying on statistical methods for data collection, organization, and analysis. The study involves processing data through the analysis of time series and corresponding statistical tests.

Moreover, advanced models are utilized in the analysis of time series, specifically employing one of the non-linear models, DCC-GARCH. This model aids in accurately measuring the behavior of variables in financial markets. The statistical software outputs, generated by programs such as

EVIEWS 12 and Oxmetrics7, contribute to the analysis of the study's findings.

Limitations of the study:

The aim is to achieve accurate results that genuinely reflect the selected phenomenon under study.

To attain this goal, the Arab financial markets located in the Middle East and North Africa region were chosen due to their previously mentioned diverse characteristics. The study's boundaries are defined as follows:

A- Time frame-based Boundaries: The daily returns of the financial market indicators were observed from January 2, 2014, to August 2, 2023, encompassing 2500 observations.

B- Location-based Boundaries: The study focuses on Arab financial markets in the Middle East and North Africa, including Jordan, Palestine, Lebanon, Egypt, Morocco, and Tunisia.

C- Terminological Boundaries: The study fine-tunes its terminologies to concentrate on measuring the phenomenon accurately. The chosen terminology revolves around the sequence of returns as a variable indicating the degree of financial market integration or separation.

This research has been divided into three chapters for better organization and presentation:

1- The First axis: Theoretical Literature
2- The Second axis: Methodology and Study Tools
3- The Third axis: Presentation of Study Results

1- Theoretical Literature

In this axis, the most important concepts related to financial integration will be addressed, its motives, and the key benefits that financial markets achieve as a result of this integration.

1-1 The financial integration concept for capital markets

Jang as defines the financial integration concept for capital markets: "An advanced communication process between separate national financial markets, driven by market forces. Through this process, these markets compete with each other, gradually forming a unified market characterized by harmonized prices and products, as well as efficiency and similar returns among various financial service providers. Several apparent channels, such as cross-border mutual ownership and strengthening mutual supervision, can enhance the degree of integration")Hong(2011 ،

While Abbas and Trichilli have divided the concept of financial market integration into two parts : "The first is the pricing of assets, where, in integrated stock markets, identical securities have identical prices, thus

eliminating the benefits of diversification in these markets. The second concept is that well-integrated markets tend to move together and have a long-term relationship" (BOUDJELBENE & TERICHILI, 2015)

From the aforementioned information, it is concluded that that the concept of financial market integration refers to the condition in which identical securities in different financial markets are priced at the same rate. This is attributed to the absence of risk premiums among similar securities, and there is a very strong correlation between their transactions.

1- 2. Motives for Moving Towards Capital Market Integration:

The phenomenon of capital market integration has garnered significant attention among investors due to the benefits it brings, with some of the most important ones outlined by including (BENSETHON, 2016):

- Expansion of market reach and access to economies of scale, which contributes to achieving operational efficiency through subscription methods and information technology, reducing information costs, and enhancing competitiveness in capital markets.
- Expansion and growth in trading volume and diversity of financial instruments achieves operational efficiency and provides diverse alternatives to investors beyond those available in the local market.
- Development and diversification of financial products by financial brokerage companies which protects investors from the fluctuations of returns and risks by providing diversified alternatives when forming their financial portfolios.
- Enhancement of service quality for financial brokerage companies due to the large trading volume and the number of participants in the financial market.

The financial integration of capital markets offers several benefits, as highlighted by (بن فريحة، 2021):

- Safeguards capital from abrupt fluctuations in local financial markets and enables prompt responses to developments in global financial markets.
- Attraction of local capital from foreign investments and stimulating economies in developing countries.
- Encouragement of new investments and enhancement of market performance.

2- Study Methodology

Before delving into the testing phase, it is essential to examine the study data, which consists of the daily returns of financial market indices for Egypt, Morocco, Tunisia, Jordan, Palestine, and Lebanon. A total of 2500 observations were collected to conduct the tests.

Note that the data was obtained from the website [https://sa.investing.com], and Eviews 12, Xlstat19, and Oxmetrics7

software programs were employed to obtain the results of test calculations and model estimations.

Additionally, to model the volatility of index returns, the following mathematical relationship was used:

$$R_t = lnP_t - lnP_{t-1}$$

In order to test the degree of correlation between financial markets, a set of steps was adopted based on standard financial literature, including:

2-1. Determining the Optimal Lag:

The optimal lag was determined using the VAR model to test the stability of the time series, which is given by the following relationship (Carlos enrique, Rienaldo, & Osmani, June 2007):

$$Y_t = A_0 + A_1 Y_{t-1} + A_2 Y_{t-2} + A_P Y_{t-p} + \varepsilon_t$$

Or in its matrix form:

$$Y_t = \begin{pmatrix} y_t \\ y_{2;t} \\ \vdots \\ y_{k;t} \end{pmatrix}; A_p = \begin{pmatrix} \alpha_{11;p} & \alpha_{12;p} & \cdots & \alpha_{1k;p} \\ \alpha_{21;p} & \alpha_{22;p} & \cdots & \alpha_{2k;p} \\ \vdots & \vdots & \ddots & \vdots \\ \alpha_{k1;p} & \alpha_{k2;p} & \cdots & \alpha_{kk;p} \end{pmatrix}; \varepsilon_t = \begin{pmatrix} \varepsilon_{1;t} \\ \varepsilon_{2;t} \\ \vdots \\ \varepsilon_{k;t} \end{pmatrix}$$

Where:

- A_p is the matrix of coefficients with dimensions KxK
- A_0 is the constant vector.
- ε_t is the white noise vector.
- $\begin{matrix} y_t \\ y_{2;t} \\ \vdots \\ y_{k;t} \end{matrix}$ represents stable time series.

To estimate the optimal lag order, the Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), Hannan-Quinn (HQ), and Schwarz (SC) criteria are used. The relationships for these criteria are as follows: (Carlos enrique, Rienaldo, & Osmani, June 2007)

$$AIC_p = ln\left|\overline{\sum p}\right| + \frac{2}{T}pn^2$$

$$BIC_p = ln\left|\overline{\sum p}\right| + \frac{lnT}{T}pn^2$$

$$HQ_p = ln\left|\overline{\sum p}\right| + \frac{2\ln(lnT)}{T}pn^2$$

$$AIC_p = ln\left|\overline{\sum p}\right| + \frac{n^2 p ln(T)}{T}pn^2$$

2-2. Testing Time Series Stationarity:

The objective of testing for unit roots is to detect the stability of the time series under study and the extent to which its values oscillate around a constant arithmetic mean with variance unrelated to time. In our study, we relied on the ADF test, PP test, KPSS test, and Elliott-Rothenberg-Stock (ERS) test with a constant only, a general trend only, and a constant with a general trend.

The time series is considered stable if the critical values for both ADF and PP tests are less than 5%, leading us to reject the null hypothesis of the existence of a unit root and accept the alternative hypothesis. On the other hand, for the KPSS test, the time series is stable if the critical values for the test are greater than 5%, leading us to accept the null hypothesis that the series is stable and reject the alternative hypothesis.

As for the last test, the ERS test proposed by Elliott, Rothenberg, and Stock is based on an extended Dickey-Fuller statistic. They generalized the simple Dickey-Fuller test, taking into account the disturbances in the assumptions of the three models.

2-3. Estimating GARCH Model for Variables:

GARCH models allow for modeling time-varying volatilities and capturing patterns of changing variance in financial data. GARCH models combine two components: the autoregressive component, which represents the persistence of volatilities, and the ARCH component, which models the impact of squared previous errors on current volatilities. The autoregressive component ensures that the model adapts to changes in volatilities over time, while the ARCH component captures the clustering of large and small volatilities. It is formulated as follows (R.Engel, 1982):

$$r_t = \mu + \varepsilon_t$$

$$\varepsilon_t = \sigma_t z_t$$

$$\sigma_t^2 = \omega + \alpha\varepsilon_{t-1}^2 + \beta\sigma_{t-1}^2$$

Where:

r_t The return in period t

μ The expected return rate

ε_t The fluctuations in period t

z_t The parameter follows a standard normal distribution with a mean of zero and a standard deviation of 1.

σ_t^2 The conditional variance for one period, which is related to the square of the residuals from the previous period (information about fluctuations in the previous period).

β; ω; α; Model parameters.

The GARCH model has been expanded to model conditional variance with a lag of q periods for squared errors and a lag of p periods for conditional variance, as follows:

$$\sigma_t^2 = \omega + \sum_{i=1}^{q} \alpha \varepsilon_{t-1}^2 + \sum_{i=1}^{q} \beta \sigma_{t-1}^2$$

2-4. Estimating DCC-GARCH Model:

It is a model used to measure integration in financial markets. This model is used to analyze and estimate the common variance (integration) among various financial assets. Integration here serves as a measure of the strength of the correlation between changes in prices or returns over time.

The DCC-GARCH model is modeled by estimating a Univariate GARCH model separately for each index with m models. Then, the resulting standardized residuals are taken, and the estimated volatilities from the first step are used to calculate the conditional variances and correlations. This is done through maximum likelihood estimation, and the model is estimated according to the following steps (Caterini , Adrian, & Marcu, 2013):

$$Q_t = D_t R_t D_t$$
$$R_t = diag(\sigma_{1,t}; \sigma_{2,t}) A_t diag(\sigma_{1,t}; \sigma_{2,t})$$
$$A_t = (1 - \lambda) A^{-} + a_t a_t'$$

Where:

Q_t The integration matrix in period t

D Diagonal matrix of the square root of variance values

Rt Dynamic correlation matrix

$\sigma_{i,t}$ Variance of variable *i* in period *t*

At Arrangements matrix

λ Reinforcement factor

a_t Random variable

There are several formulations for the DCC-GARCH model, and in this study, the focus will be on the model proposed by Engle, which estimates the parameters using the maximum likelihood method. The equation is presented as follows (خياري و عبد الجليل، 2016):

$$I_t(\theta;\Phi) = \left[-\frac{1}{2}\sum_{t=1}^{t}(nlog(2\pi) + log|D_t|^2) + \varepsilon_t' D^{-2}\varepsilon_T \right] + \left[-\frac{1}{2}\sum_{t=1}^{t}\big(log(2\pi)\big) + log|D_t|\mu_t' R_t^{-1}\,\mu_t - \mu_t'\mu_t \right]$$

3- Presentation of the study results

Before estimating the model, we will begin by providing descriptive statistics for the study variables.

Table 01: Statistics descriptives

	AMGNRLX	EGX30	LIB	MASI	PLE	TUNINDEX
Mean	0,00010	0,00048	0,00108	0,00004	0,00014	0,00023
Median	-0,00002	0,00070	-0,0007	0,0001	0,00000	0,00014
Maximum	0,02713	0,07057	2,0097	0,05305	0,03448	0,02678
Minimum	-0,04587	-0,0981	-2,053	-0,0923	-0,0654	-0,04186
Std.dev	0,00504	0,01341	0,0654	0,0068	0,0048	0,00441
Skewness	0,00764	-0,3453	-0,673	-1,568	-1,127	-0,90501
Kurtosis	8,87383	7,47582	745,78	27,296	22,985	13,25173
Jarque-Bera	3 594	2 136	57 472	62 517	42 143	11 289
Probability	0,00000	0,00000	0,0000	0,0000	0,0000	0,0000

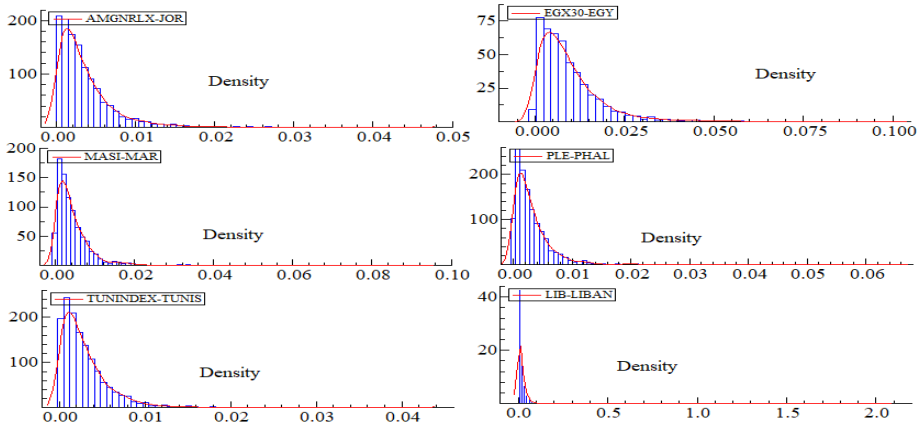
Source: Prepared by researchers based on the results of Eviews 12

The statistical results reveal significant fluctuations in the returns of the stock market indices under study, indicating a relative instability of these markets during that period. The Moroccan financial market index, Casablanca Stock Exchange, achieved the lowest average return at -0.00074, while the highest average return was recorded for the Lebanese market index at 0.00108. The results also show that investment in the Lebanese financial market is more exposed to risk, as highlighted by the high standard deviation. On the other hand, the Tunisian Stock Exchange exhibits the least volatility, with a low standard deviation.

The negative values of the skewness coefficients related to the returns of the indices indicate a leftward skewness in the distribution of returns, suggesting a high probability of obtaining low returns in these markets, except for the Jordanian Amman Stock Exchange index, which showed positive skewness. Additionally, it is observed that the distribution of returns across all markets has a leptokurtic shape, explaining the presence of the fat-tail problem, where the kurtosis coefficient exceeds the value of three, which corresponds to a normal distribution. This deviation indicates that the returns deviate from a normal distribution by clustering more

around the mean. This is further supported by the large value of the Jarque-Bera test, indicating that returns in all markets do not follow a normal distribution during the study period. The following figure illustrates this:

Figure (01): Results of the normal distribution test for the daily series of returns of stock indices



Source: Prepared by researchers based on the results of Oxmetrics 7

3-1. Determining Optimal Lags:

After conducting the VAR test to determine the optimal lags, based on the aforementioned criteria, with a preference for the SC and AIC criteria due to their strictness and rigor in testing conditions, the optimal lags were as follows:

Table 02: Optimal Lags

Indice	AMGNRLX	EGX30	MASI	PLE	TUNINDEX	LIB
Lag	6	3	2	2	1	2

Source: Prepared by researchers based on the results of Eviews 12

3-2. Stationarity Test for Time Series:

Four tests were adopted to measure the stationarity of the time series

3-2-1. Stationarity test without constant and without trend:

The stationarity test was measured at a significance level of 0.05, where the hypotheses were formulated as follows:

$Probat\ t > 0{,}05: H_0$ There is a unit root, and the time series is not stationary.

$Probat\ t < 0{,}05: H_1$ There is no unit root, and the time series is stationary.

Table 03: ADF and PP tests without Constant and Trend

	ADF test			PP test		
	Q-stat	c-value	Proba t	Q-stat	c-value	Proba t

AMGNRLX	-12,371	-3,392	0,0001	-41,841	-1,941	0,0001
EGX30	-12,195	-3,392	0,0001	-42,674	-1,941	0,000
MASI	-11,536	-3,392	0,0001	-44,656	-1,941	0,0001
PLE	-11,571	-3,392	0,0001	-38,721	-1,941	0,0001
TUNINDEX	-11,732	-3,392	0,0001	-38,721	-1,941	0,0001
LIB	-15,649	-3,392	0,0001	-77,058	-1,941	0,0001

Source: Prepared by researchers based on the results of Eviews12.

From the extended Dickey-Fuller test, it is evident that all variables are less than 0.05, meaning the rejection of the null hypothesis stating the existence of a unit root and acceptance of the alternative hypothesis, indicating no unit root, and hence the series is stationary. The same applies to the Phillips-Perron test, where all variable values have statistical significance, leading to the rejection of the null hypothesis and acceptance of the alternative hypothesis, indicating the stability of the series.

3-2-1. Stationarity Test of the Time Series with a Constant and No Trend:

The stationarity test for the time series with a constant and no trend is measured based on two hypotheses:

- $Probat\ t > 0{,}05$: H_0 There is a unit root; the series is non-stationary.
- $Probat\ t < 0{,}05$: H_1 No unit root; the series is stationary.

Table 04: ADF and PP tests Constant without and Trend

	ADF test Constant without T			**PP test Constant without T**		
	Q-stat	**c-value**	**Proba t**	**Q-stat**	**c-value**	**Proba t**
AMGNRLX	41,33	-2,863	0,0001	-41,841	-2,863	0,0001
EGX30	-40,26155	-2,863	0,0001	-40,445	-2,863	0,0001
MASI	-30,22608	-2,863	0,0001	-42,667	-2,863	0,0001
PLE	-30,47216	-2,863	0,0001	-44,664	-2,863	0,001
TUNINDEX	-38,45772	-2,863	0,0001	-38,752	-2,863	0,0001
LIB	-45,35479	-2,863	0,0001	-77,179	-2,863	1,000

Source: Prepared by researchers based on the results of Eviews12.

From the extended Dickey-Fuller test, it is evident that all variables are less than 0.05, meaning the rejection of the null hypothesis that there is a unit root and the acceptance of the alternative hypothesis, indicating no unit root and thus the series is stable with a constant and no general trend. The same applies to the Phillips-Perron test, where all variable values are statistically significant, leading to the rejection of the null hypothesis and the acceptance of the alternative hypothesis, indicating stability with a constant and no trend.

Table 05: KPSS and EPS tests Constant without and Trend

	KPSS test Constant without T	**ERS test Constant without T**

	Q-stat	c-value	Proba t	Q-stat	c-value	HAC
AMGNRLX	0,197	0,465	0,277	-19,6922	1,940951	0,000045
EGX30	0,132	0,465	0,449	-23,1670	1,940951	0,000172
MASI	0,109	0,465	0,539	-9,82534	1,940951	0,000004
PLE	0,093	0,465	0,624	-30,4648	1,940951	0,0000196
TUNINDEX	0,071	0,465	0,753	-38,4649	1,940951	0,0000182
LIB	0,951	0,465	0,004	-70,8205	1,940951	0,004518

Source: Prepared by researchers based on the results of Eviews12.

According to the KPSS test results, it is evident that all variables are greater than 0.05, indicating acceptance of the null hypothesis that the series is stable with a constant and no general trend, and rejection of the alternative hypothesis. Thus, the series is stable.

As for the Stock-Rothenberg-Elliott statistics calculated with the absolute value, they are entirely larger than the critical values of Mackinnon at a 5% level. Therefore, the null hypothesis is rejected, which assumes unit root, and the alternative hypothesis is accepted, indicating that the series under study is stable with a constant and a trend.

3-2-2. Test of Time Series Stationarity with a Constant and Trend:

Table 06: ADF and PP tests Constant and Trend

	ADF test Constant and Trend			PP test Constant and Trend		
	Q-stat	**c-value**	**Proba t**	**Q-stat**	**c-value**	**Proba t**
AMGNRLX	-41,33739	-3,411606	0,0001	-41,836	-3,412	0,0001
EGX30	-40,25818	-3,411606	0,0001	-40,437	-3,412	0,0001
MASI	-30,23078	-3,411606	0,0001	-42,664	-3,412	0,0001
PLE	-30,46650	-3,411606	0,0001	-44,649	-3,412	0,0001
TUNINDEX	-38,45004	-3,411606	0,0001	-38,738	-3,412	0,0001
LIB	-45,51335	-3,411606	0,0001	-77,857	-3,412	1,000

Source: Prepared by researchers based on the results of Eviews12.

From the expanded Dickey-Fuller test, it is evident that all variables have less than 0.05 value. This implies rejecting the null hypothesis, which states that there is a unit root, and accepting the alternative hypothesis, indicating the absence of a unit root. Therefore, the time series is stable with a constant and trend.

Similarly, for the Phillips-Perron test, all variable values show statistical significance, leading to the rejection of the null hypothesis and acceptance of the alternative hypothesis. Consequently, the time series is stable with a constant and trend.

Table 07: KPSS and EPS tests Constant and Trend

	‹KPSS test			ERS test		
	Q-stat	**c-value**	**Proba t**	**Q-stat**	**c-value**	**HAC**
AMGNRLX	0,153	0,147	0,042	-40,6326	-2,8900	0,000045
EGX30	0,096	0,147	0,178	-23,2866	-2,8900	0,000172
MASI	0,066	0,147	0,383	-16,2634	-2,8900	0,000004
PLE	0,087	0,147	0,226	-30,4765	-2,8900	0,0000196
TUNINDEX	0,071	0,147	0,335	-38,4614	-2,8900	0,0000182
LIB	0,088	0,147	0,221	-43,8441	-2,8900	0,004518

Source: Prepared by researchers based on the results of Eviews12.

Through the results of the KPSS test, it is evident that all variables are greater than 0.05, which means accepting the null hypothesis stating that the series with a constant and a general trend is stable and rejecting the alternative hypothesis. Therefore, the series are stable except for the Oman index for the country of Jordan, where the test confirmed the results of the Phillips-Perron test, as its probability is less than 0.05, meaning rejecting the null hypothesis that the series is stable and accepting the alternative hypothesis. Therefore, the series is unstable with a constant and a general trend.

As for the Stock-Rothenberg-Elliott statistics calculated with the absolute value, they are completely greater than the critical values of Mackinnon at the 5% level. Consequently, we reject the null hypothesis, which is the unit root hypothesis, and accept the alternative hypothesis, meaning that the study series is stable with a constant and a stable trend.

3-3. Estimation of the GARCH Model for the Variables:

After ensuring the stability of the time series in the study, we now proceed to estimate the GARCH model for the variables, as illustrated in the following table:

Table 08: GARCH 1.1 Estimation Results on Exchange Indices Returns

		AMGNRLX	**EGX30**	**MASI**	**PLE**	**TUNINDEX**	**LIB**
C	**Coeff**	0,00312	0.00851	0,00382	0,002939	0,002716	0,013605
	STD	0,00010	0.00023	0,00011	0,0001	0,000143	0,00115
	T-stat	29,68	36.43	33,76	14,98	18,96	11,77
	Prob-t	0,0000	0.0000	0,0000	0,0000	0,0000	0,0000
AR(1)	**Coeff**	0,2318	0.170539	0,1814	0,1820	0,234272	0,3883
	STD	0,0266	0.0266	0,0286	0,0453	0,033470	0,1719
	T-stat	8,694	6.407	6,325	4,015	6,999	2,258
	Prob-t	0,0000	0,0000	0,0000	0,0001	0,0000	0,0240
	Coeff	2,0444	15,90	2,2352	3,2053	1,77618	0,44098

ω	**STD**	1,6998	3,52	1,2134	2,1889	4,6759	0,42092
	T-stat	1,203	4,51	1,842	1,464	0,3799	1,048
	Prob-t	0,2292	0,0000	0,0656	0,1432	0,7041	0,2949
ARCHα	**Coeff**	0,195019	0,288	0,1657	0,1927	0,201300	1,902608
	STD	0,12393	0,071	0,0715	0,1070	0,28649	0,79798
	T-stat	1,574	4,008	2,319	1,801	0,7026	2,384
	Prob-t	0,0115	0,0001	0,0205	0,0718	0,0482	0,0172
GARCHβ	**Coeff**	0,6472	0,547	0,72878	0,6071	0,595442	0,3925
	STD	0,23659	0,0607	0,1136	0,143	0,84014	0,1341
	T-stat	2,736	9,014	6,410	4,242	0,7087	2,927
	Prob-t	0,0063	0,0000	0,0000	0,0000	0,0478	0,0035
LogLikelihood		10804,84	8401.89	10235,50	10617,45	11244,38	5894,883
$\alpha + \beta$		**0,84231**	**0.88058**	**0,89458**	**0,79991**	**0,79674**	**2,29513**

Source: Prepared by researchers based on the results of oxmetrics 7

The arithmetic mean equation with the estimation of the autoregressive correlation AR 1) suggests that returns in previous periods play a significant role in determining future returns for all stock markets.

From the above table, it is evident that the GARCH (1,1) model is statistically acceptable at a 5% significance level. The significant value of the α coefficient indicates the ARCH effect on the conditional volatilities of the financial market indices (AMGNRLX, EGX30, MASI, TUNINDEX), meaning that volatilities are highly sensitive to any events in the financial market. The LIB index has the highest coefficient, indicating a faster impact and response of the Lebanese financial market to shocks in the short term, followed by the Egyptian financial market. The other markets have varying coefficients, with the MASI index of the Moroccan financial market having the lowest responsiveness to shocks compared to other markets. The PLE index for the Palestinian financial market is an exception, as its significance level is greater than 5%, indicating no impact of shocks on conditional volatilities in the Palestinian financial market.

The GARCH effect suggests that the variance resulting from the high value of volatility in the index will be followed by another high variance in the subsequent period. The sum of ARCH and GARCH coefficients decreases to less than 1 in the indices (AMGNRLX, EGX30, MASI, PLE, TUNINDEX), meaning that the impact of shocks decreases over time. The MASI index achieves the highest coefficient, indicating that the variance

resulting from the high value of volatility in the Casablanca Stock Exchange will be followed by another high variance in the subsequent period. On the other hand, the LIB index exceeds 1, indicating that the unconditional variance is undefined, and the shock effect continues indefinitely.

3-4. Estimation of the DCC-GARCH Model:

After estimating the GARCH model for the variables, we now proceed to the DCC-GARCH test to study the integrative relationship between the movements of financial market indices in the study. The following figure illustrates the dynamic conditional correlations, as estimated using OxMetrics7 outputs:

Table 9: Dynamic Conditional correlation

rho	**21**	**31**	**41**	**51**	**61**	**32**	**42**
R	-0,16%	0,103%	1,716%	-1,061%	-0,087%	-0,073%	-1,090%
rho	**52**	**62**	**43**	**53**	**63**	**54**	**65**
R	1,436%	-1,166%	-1,154%	-0,374%	3,511%	-3,048%	-3,640%

Source: Prepared by researchers based on the results of oxmetrics 7

The results of the Dynamic Conditional Correlation (DCC)-GARCH model between the return volatilities of the studied stock market indices have been obtained. The Engle methodology was followed, utilizing the Student's distribution due to the absence of a normal distribution for the series and the presence of fat tails. The findings reveal that there are no dynamic conditional correlations over time, including both negative and positive correlations between the return volatilities of the stock market indices.

In other words, there is no sensitivity in returns among the studied financial markets, implying that events affecting the return changes of one market index do not impact the return changes of the other market indices in the same direction. The sensitivity between the financial markets studied was weak.

Table 10: DCC-GARCH Estimation Results on Exchange Indices Returns

	Coefficient	**Std.Error**	**t-value**	**t-prob**
α	0,005015	0,0020648	2,429	0,0152
β	0,947642	0,019093	49,63	0,0000
Hosking(5)			219,132	[0,1939830]
Hosking(10)			418,512	[0,1500840]
Hosking(20)			674,168	[0,8776710
Li-McLeod(5)			219,151	[0,1935750]
Li-McLeod(10)			418,427	[0,1511780]
Li-McLeod(20)			674,703	[0,8746603]

Source: Prepared by researchers based on the results of oxmetrics 7

Through the coefficients α and β, it becomes evident that the weak degree of correlation between the financial markets studied persists in the long term. The associated probability values for the Li and McLeod, and Hosking tests were greater than the 5% significance level, indicating no autocorrelation in the error squares at lag periods of 5, 10, and 20. The forecasting results for the future effects of the integration degree between the studied financial markets were as follows:

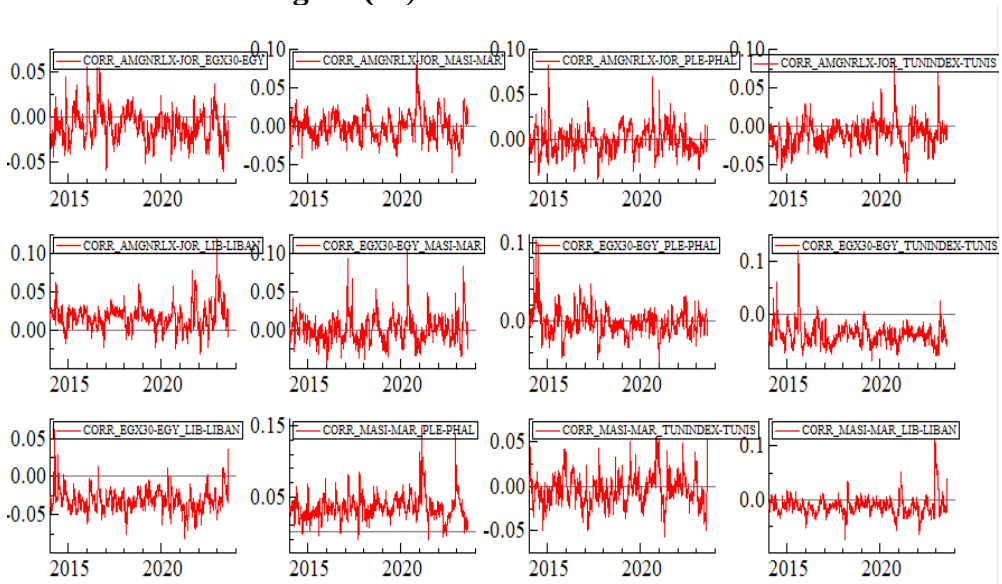
Table 11: Conditional Correlation Forecast**.**

	AMGNRLX	EGX30	MASI	PLE	TUNINDEX	LIB
AMGNRLX	1,0000	0,0231	0,0063	-0,009	-0,0017	-0,005
EGX30	0,0231	1,0000	-0,004	-0,015	-0,0099	-0,031
MASI	0,0063	-0,0045	1,0000	-0,011	0,0063	-0,020
PLE	-0,0089	-0,0148	-0,011	1,0000	-0,0511	0,001
TUNINDEX	-0,0017	-0,0099	0,0063	-0,051	1,0000	0,005
LIB	-0,0056	-0,0312	-0,021	0,0012	0,0048	1,000

Source: Prepared by researchers based on the results of oxmetrics 7

From the table above, it is evident that the degree of conditional correlation between financial markets remains weak, as observed through the weak correlation coefficients among the financial market indices under study. To illustrate, we can refer to the following figure:

Figure (02): Conditional correlation



Source: Prepared by researchers based on the results of oxmetrics 7

Conclusion:

Through this study, the aim was to assess the degree of correlation between Arab financial markets in the Middle East region, represented by Jordan, Lebanon, Palestine, Egypt, Morocco, and Tunisia. The objective was to understand the gains and challenges associated with financial integration in the region and to comprehend its potential impacts on the feasibility of international portfolio diversification. The study relied on daily data of index returns for the studied financial markets from January 2, 2014, to August 2, 2014. The study yielded the following results:

1. None of the return series of the studied stock market indices followed a normal distribution during the study period. All of them exhibited a distribution with a tail on one side, and the return series demonstrated stability.
2. The results showed a significant impact of shocks on the conditional volatilities of the financial market indices (AMGNRLX, EGX30, MASI, TUNINDEX), with a more pronounced response in the Lebanese financial market and a lower response in the Moroccan financial market. The Palestinian financial market, however, did not show any impact of shocks on its financial market.
3. The sum of ARCH and GARCH coefficients decreased to less than 1 in the indices (AMGNRLX, EGX30, MASI, PLE, TUNINDEX), indicating that the shock effect diminishes over time. On the other hand, the LIB index exceeded 1, suggesting that the unconditional variance is unknown, and the shock effect persists indefinitely.
4. The results indicated a very weak conditional correlation, meaning that the degree of correlation between the financial markets is very weak. This implies opportunities and feasibility for international portfolio diversification in these financial markets
5. After conducting forecasts for conditional correlation, the coefficients remained weak, indicating that the potential effects on the feasibility of international portfolio diversification in the future are uncertain.

Hypothesis Testing:

1. Accepting the first hypothesis, stating that there is an impact of shocks on the volatilities of the return indices of the studied financial markets, which is supported by the second and third results.
2. Accepting the second hypothesis, which asserts that the studied financial markets are diverse in terms of efficiency and size, implies that the

likelihood of one financial market index being affected by another is not possible. This is confirmed by the fourth result.

3. Accepting the third hypothesis, stating that the studied financial markets are diverse in terms of efficiency, size, and other characteristics, indicates that the existence of a correlation relationship between them is weak. This is affirmed by the fourth result.

4. Accepting the hypothesis: "Given the existing deficiencies in legislative and institutional reforms in the studied financial markets, the possibility of integration between these markets and the absence of opportunities for international diversification is not feasible," which is supported by the fifth result.

Bibliography

1- BENSETHON, E. (2016). Integration financieère; efficience informationelle et crise mondiale: cas des marchés développés et émergents africains. *International Journal and Strategie Management of Business Process*, 7-1.

2- BOUDJELBENE, M. A., & TERICHILI, Y. (2015). slamic stock market and potentiel deversification benfite. *Borsa istanbul Review*, 93.

3- Carlos enrique, C. G., Rienaldo, C. S., & Osmani, T. (June 2007). Selection Of Optimal lag length in cointegrated VAR models with form of common Cylical features. *Banco central do Brazil*, 1-35.

4- Caterini , M., Adrian, G., & Marcu, N. (2013). DCC-GARCH model To Estimate the risk to the capital market in Romania. *Romanian Journal of Economic Forecasting*, 136-148.

5- Hong, B. J. (2011). Financial Integration and Cooperation in East Asia: Assessment of Recent Developments and Their Implications. *IMES Discussion Paper Series*, 01.

6- R.Engel. (1982). Autoregressive conditional heteroskedasticity with estimates of variance of UK inflation. Econometrica 50. *Econometrica*, 987-1008.

7- بن فريحة ,ح (2021). بناء وتسيير المحافظ الاستثمارية في إطار الكفاءة غير الكاملة لأسواق رأس المال . *أطروحة دكتوراه جامعة الجيلالي اليابس سيدي بلعباس -الجزائر*.86 ,

8- خياري ,إ ,.و عبد الجليل ,ب .(2016) .تقدير العلاقة التكاملية بين أسواق الأوراق المالية-دراسة حالة S&P 500و NASDAQ. *مجلة المالية والأسواق*.43-25 ,