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Empirical Stylized Facts of Financial Assets
A Comparative Study Between Islamic and Conventional Index
الحقائق المجردة التجريبية لمؤشرات الأسواق المالية –دراسة مقارنة بين مؤشر داو جونز الإسلامي والتقليدي–

Boumimez Fayçal

Mohammed Seddik Benyahia University - JIJEL (Algeria), f.boumimez@univ-jijel.dz

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Abstract:

This study examine whether the Dow Jones Islamic Index shares the same stylized facts with the traditional Dow Jones Index, where the most important empirical statistical characteristics of the financial market indices in question have been adopted, namely: stationarity of the two price series, autocorrelation of the series of returns and squared returns, The clustering of the volatility and normality of returns' series, we used 10-year of daily price data from 2010 to 2021 which is equivalent to 3272 observations for each index. The results showed that the traditional and Islamic Dow Jones indexes are quite non stationary by using several tests, and also the returns of the two indexes are not autocorrelated, the study also showed that the series of returns for both index witness clusters of volatility during time periods in which the market is known financial disturbances. In addition, the empirical distribution is not symmetrical and leptokurtic for the two indexes.

Keywords: Empirical Stylized Facts; Conventional Dow Jones index; Islamic Dow Jones index; Stationarity; Volatility Clustering

JEL Classification Codes: C58, E44, G15.

ملخص:

هدفت هذه الدراسة الى التحقق فيما إذا كان مؤشر داو جونز الإسلامي يتشارك في نفس الحقائق المجردة التي يتصف بها مؤشر داو جونز التقليدي، أين تم اعتماد أهم الخصائص الإحصائية التجريبية لمؤشرات الأسواق المالية محل الدراسة والمتمثلة في: خدم استقرارية سلسلتي أسعار المؤشرين، الارتباط الذاتي لسلسة العوائد ومربعات العوائد، التقلبات المتجمعة وطبيعية عوائد المؤشرات، وتم استخدام بيانات يومية خلال الفترة الممتدة من 2009 إلى 2021 أي ما يعادل 3272 مشاهدة لكل مؤشر. أظهرت النتائج بأن سلسلتي أسعار المؤشر داو جونز التقليدي والإسلامي على أنهما غير مستقرتين تماما وذلك باستعمال عدة اختبارات، وأيضا عوائد السلسلتين محل الدراسة غير مرتبطتان ذاتيا ، كما أسفرت نتائج الدراسة أيضا بأن سلسلة العوائد لكلا المؤشرين تشهد تجمعات للتقلبات خلال فترات زمنية معينة والتي يعرف فيها السوق المالي اضطرابات.، إضافة إلى أن أن التوزيع التجريبي ليس طبيعي للمؤشرين محل الدراسة.

كلمات مفتاحية: الحقائق المجردة التجريبية، مؤشر داو جونز التقليدي، مؤشر داو جونز الإسلامي، الاستقرارية، التقلبات المتجمعة

تصنيفات JEL : C58، E44، G15.

Corresponding author: Boumimez Fayçal, **e-mail:** f.boumimez@univ-jijel.dz

1. INTRODUCTION:

Financial time series modeling is a difficult and complex topic not only due to the diversity of the series used (stocks, exchange rates, interest rates, etc.) or to the importance of frequency of observations (second, minute, hour, day, etc.), or to the Availability of very big data. Rather, it is mainly because there are factors that share a large number of financial series and are difficult to reproduce artificially using stochastic models. Most of these facts were addressed in a research paper written by Mandelbrot (1963), and since then it has attracted the interests of many researchers in the field of financial econometrics, as they have documented and supplemented them in many empirical studies, and among the financial series that were adopted in most studies on these characteristics are daily financial series such as stock prices, indices, currency rates,...etc.

Interest in financial market indices has increased with time and has been used as a tool for evaluating the performance of financial markets and comparing them with other markets by following up and measuring changes in the price movements of securities traded in the market. In order to achieve high profits for them, it is also considered as measure of the degree of development of the economy in general and the market in particular, as the beginning was with the emergence of the Dow Jones Industrial Index for the first time in 1884, and it also appeared in the global financial markets Islamic stock indices, where the term has recently spread Dow Jones Islamic, which was first established in 1999 in the State of Bahrain, in order to help investors and individuals who want to invest in the financial markets in compliant with the Islamic laws and Sharia'a, and based on this the following problem can be raised:

Does the Dow Jones Islamic Index have the same empirical facts as the traditional Dow Jones Index?

In order to answer this problem, we will present some of the study literature at the beginning, then the study methodology, to discuss later on the analysis and discussion of the results of the applied study, and in the end, we end this work with a conclusion.

2. Literature review:

Econometric applications such as risk measurement, derivative pricing, margin determination, and many other financial indicators rely on proper modeling of the characteristics of the empirical probability distribution of the daily return series of stocks, indices, or other assets. A normal distribution with constant parameters is often chosen for the daily return chain model in financial theory. Following Fama's classic paper (Fama, 1965), which noted the occurrence of high spurs and severe torsions in the empirical distribution that conflict with the assumption of normality, many researchers suggested solutions to overcome this drawback, for example, Praetz (1972) and Blattberg & Gonedes (1974) suggest to use the Student distribution, while Mittnik & Rachev (1993) examine various alternative stable distributions in modeling asset returns, de Vries & Leuven (1994) and Pagan (1996) give a good review of the many methods available in the literature about the stylized facts of financial time series. As with the distributive properties, the temporal properties of the daily return's series have also been examined by many authors in the field of financial econometrics. Models that have been accepted by the majority over the past decade are in the

family of ARCH models, more details about these models can be found in Bollerslev, Chou, & Kroner (1992) or Frances & van Dijk (2000).

Other approaches to stochastic volatility models include can be found in Taylor (2007) and applied in many contexts, for example, by Koopman, Jungbacker, & Hol (2005). State space models based on the Kalman filter have been investigated by Faff, Hillier, & Hillier (2000), while Hamilton (1989; 1990), Turner et al. (1989) presented a large class of Markovian switching models.

In this research paper, we will focus on revealing the empirical stylized facts represented by the distributional properties and the stationarity problem of the daily returns' series for both the traditional and Islamic Dow Jones indexes during the study period.

3. Methodology

The study population consists of all financial market indices. The study sample consisted of only two indexes, the traditional Dow Jones Index, which is one of the oldest and most common index in the New York Stock Exchange and includes 30 of the largest leading companies in the American Stock Exchange, and the Islamic Dow Jones Index, which is the first stock market index. Islamic finance is compliant with the provisions of Islamic Sharia, as it includes about 70 types of securities such as stocks and other fixed income securities, and the Dow Jones Islamic Index is supervised by the so-called subsidiary advisory board, and the study period extended from 01/01/2009 to 31/12/2021, which is equivalent to 3272 observations for each index. As for the returns of the indexes under study, they were calculated according to: $r_t = log(p_t/p_{t-1})$, r_t refers to the value of the logarithmic return of the index during the time period, while p_t refers to the closing price of the index at time t.

In order to carry out this study, the most widely used empirical stylized facts have been relied on, which are:

3.1. N**on stationary of price series of indexes**: the price series of indexes generally takes a path that is very similar to a random walk without a derivative, and this is the result of the rapid and dynamic changes that the global economy is witnessing.

3.2. Autocorrelation in returns: In general, autocorrelation, or serial correlation, is the association between observations of a time series with observations lagging behind the same series. In index performance analysis, a first-order positive autocorrelation of period returns means that a positive (negative) return in one period will also be followed by a positive (negative) return in the following period. In general, the index returns series show very low autocorrelation coefficients (close to zero) which makes them close to the white noise series.

3.3. Autocorrelation in absolute and squared returns: The series of squared returns or absolute returns generally show positive and significant autocorrelation coefficients and decays slowly, as this characteristic does not correspond to the assumption of white noise for returns.

3.4. Volatility clustering: Large absolute returns tend to appear in clusters. This characteristic is generally very clear during periods of turmoil (economic recovery), which come after periods of calm (recession periods), which leads to the instability of the variation of these series.

3.5. Deviation of the empirical distribution of returns from the normal distribution: When we drawing the empirical distribution of returns in general, it can be noted that it is not similar to the normal distribution, and this is by calculating the skew and kurtosis coefficients. The value of the skew coefficient indicates the symmetry of the empirical distribution around the arithmetic mean (it is equal to zero in the case of a normal distribution), which is less than what we find for the series of returns, and the kurtosis coefficient refers to the degree of flatness of the distribution (which is equal to 3 in the case of a normal distribution), this characteristic we do not find at all with respect to returns, because of the gathering of the data in a very narrow range around the arithmetic mean, we also note that the tails of the experimental distribution of the series of returns are thicker than in the normal distribution, and this sees the large values of the returns in the series.

4. Analyze and discuss the results

In this part of this research paper, we will discuss the results of the study related to the empirical stylized facts of financial market indexes by focusing on a comparative study between the traditional and Islamic Dow Jones index, and in order to know whether the two indexes under study share the same aforementioned statistical characteristics of financial series, we will conduct a series of test:

4.1. Stationarity tests for the price series of the two indexes

Among the Stationarity tests we will use the Dickey & Fuller (1979), Phillips & Perron (1988) and Kwiatkowski et al. (1992) tests, and the results are shown in the following table:

Table (1): Stationarity Tests for Dow Jones Conventional and Dow Jones Islamic Indexes

Test	Model	DJIA	IMUS
ADF	Constant and linear trend Constant None	-2,6801** 0,2856** 2,3073**	-0,1907** 2,1405** 3,7366**
PP	Constant and Linear trend Constant None	-2,7110** 0,5257** 2,4951**	0,4167** 2,5899** 4,2450**
KPSS	Constant and Linear trend Constant	0,8216** 6.9072**	1,0772** 6,3221**

Source: Author's calculation using R.

** denotes the non-rejection of the null hypothesis

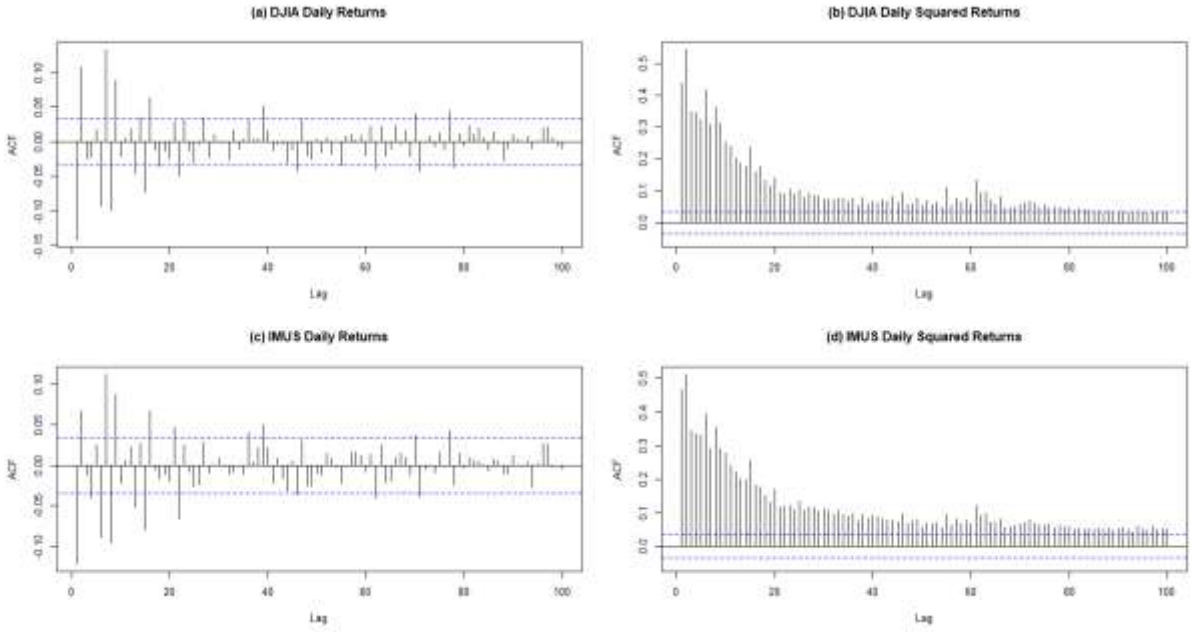
Through the above table, we note that the ADF test statistic values for the unit root of the three models are not significant for the two series, and the probability values are greater than the level of statistical significance (5%), meaning that the traditional and Islamic Dow Jones index price series involve the unit root, and this is what it indicates that they are completely non-stationary as stated in the first characteristic, and this is confirmed by both the PP test and the KPSS test.

4.2. Autocorrelation analysis of the returns' series and the squares of returns

To ensure that there is no autocorrelation in the return's series and the existence of autocorrelation in the series of squares of returns for each of the two indexes, we calculate the

autocorrelation coefficients at the various time lag (h=100) and then represent them graphically, as shown by all of the following:

Fig (1): The Autocorrelation Function of Return Series and Return Quadrants for the Dow Jones Conventional and Islamic Indices.



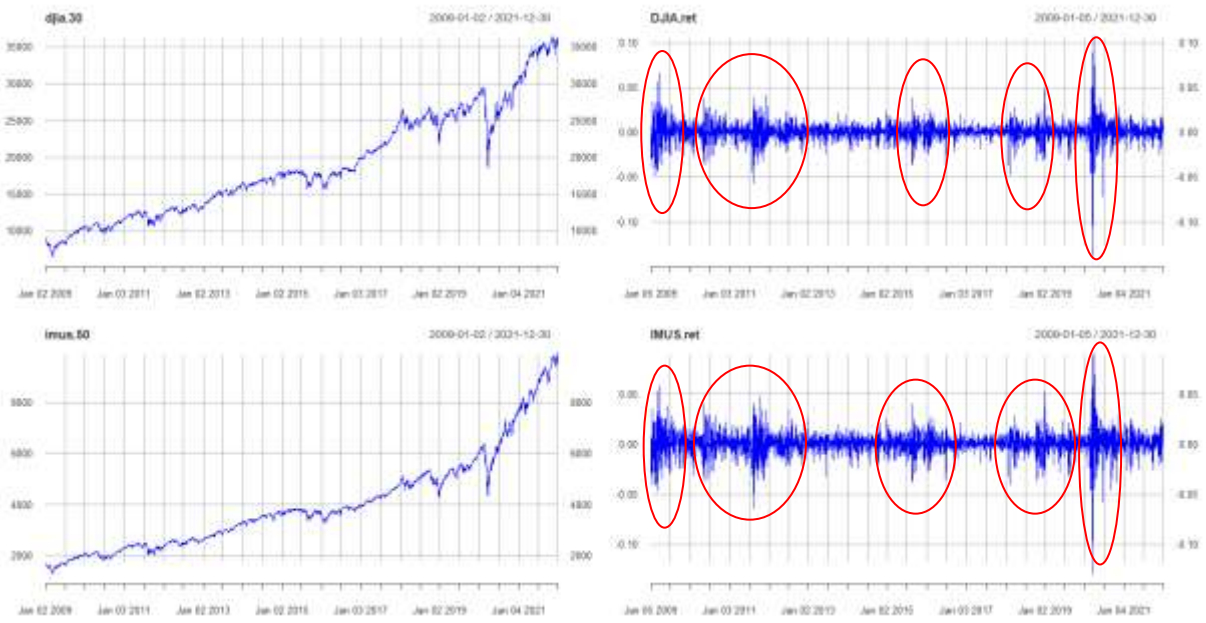
Source: Prepared by author based on R

As seen in the above figure, we notice that the autocorrelation coefficients for the series of returns of the two indicators are mostly found within the confidence interval defined by the two parallel dashed lines $\left(\pm\frac{1,96}{\sqrt{n}}\right)$ and this indicates that the returns of the two series under study are not autocorrelated, as for the series of squares of returns for the two indexes under study, the above figure suggests the existence of significant correlations for far lags, since each of the autocorrelation coefficients is outside the confidence interval.

4.3. The volatility clustering of the return' series

To study the volatility of the series of returns for the two indexes, we apply the ARCH test, which is based mainly on the Lagrangian multiple (LM) statistic.

Fig (2): Prices and return' series of the Dow Jones Conventional and Islamic indices



Source: Prepared by author based on R

It is clear from Figure (02) that the serie of returns for both indexes witness an accumulation (clusters) of volatility during certain periods of time, such as the period that came directly after the global financial crisis of 2008, which had a significant impact on the movement and performance of various global financial markets, and the year 2011 witnessed fluctuations Large as a result of the European debt crisis, which affected the American and Asian financial markets, in addition to the crisis of the decline in oil prices in 2015 (where the circles in the figure refer to the various events in the global economy). The test in the table below supports and confirms this finding.

Table (2): Heteroskedasticity Test (ARCH LM-test) for Dow Jones Conventional and Dow Jones Islamic Indices

Test	DJIA	IMUS
ARCH Test (LM)	1206 (0,0000)	1090 (0,0000)

Source: Author's calculation using R

4.4. Normality tests

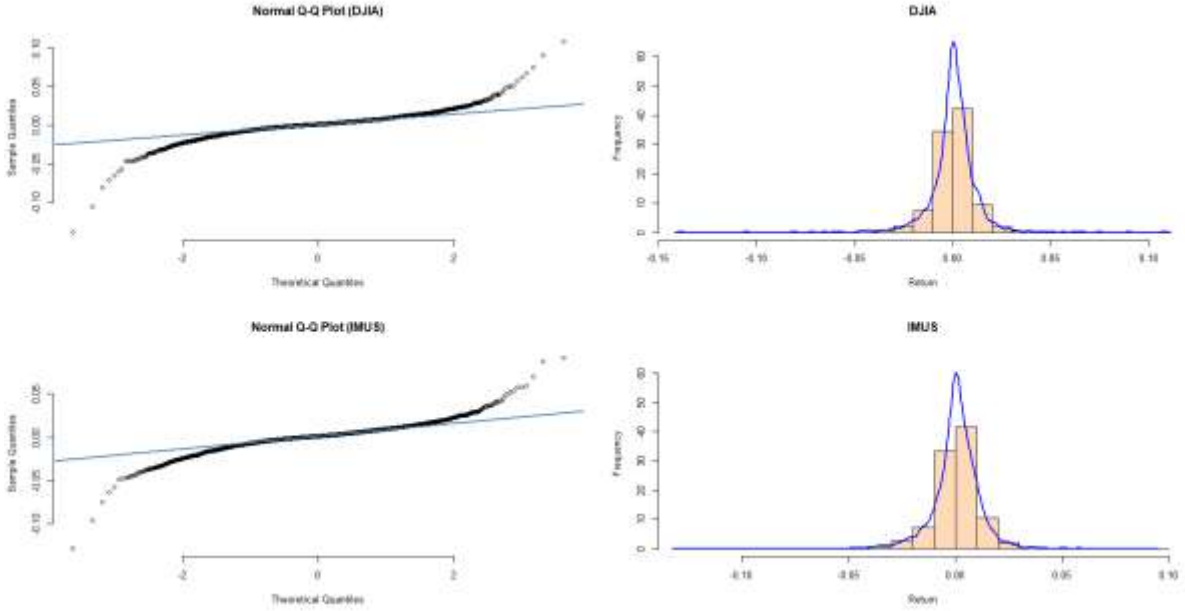
To study the characteristics of the empirical distribution of the returns' series for both indicators, we calculate the shape measures represented in: Skewness coefficient, Kurtosis coefficient in addition to the Jarque & Bera (1980) test, which is shown in the table below:

Table (3): Normality Tests for Dow Jones Conventional and Dow Jones Islamic Indices

Test	DJIA	IMUS
Skewness	-0,7692	-0,6191
Kurtosis	18,24	12,31
JB Test	45750 (0.0000)	20907 (0,0000)

Source: Author's calculation using R

Fig (3): Normal QQ plot and density of the price and yield series of the Dow Jones Conventional and Islamic indices



Source: Prepared by author based on R

As shown in table (3), the values of the skewness coefficient for both series are different to zero, indicating that the empirical distribution is not symmetric, which means that there are more negative returns than positive ones, and the value of the kustosis coefficient is much greater than 3, which means that the empirical distribution of the series returns of the two indexes is leptokurtic, and this is confirmed by JB test and the figure (3), where the value of test statistic is very large than the chi-square statistic at a degree of freedom of 2 for the level of significance 5%, which is equal to 5,99.

The results that we reached through this study confirm that both series of indexes of the conventional and the Islamic Dow Jones share the same stylized empirical facts, and this is in line with Bouchaud & Potters (2001), Krivoruchenko and others (2004) and Restocchi and others (2019) Concerning the traditional Dow Jones Index, as for the Islamic Dow Jones Index, there is no study yet - to our knowledge - that addresses the empirical stylized facts of this type of financial series.

Conclusion:

In this research paper, we have studied the empirical stylized facts of financial market indexes, and we have proceeded to compare a conventional index with it counterparts of an Islamic index, and for that we chose the traditional Dow Jones index to ensure that it achieves these facts for the first group of indicators, and the Dow Jones Islamic Index for for the second group of indicators.

Among the most important results that we reached during this study is that each of the two indexes' returns series is characterized by the stationarity characteristic, this finding is in concordance with the studies of Lee and others (2010), this is generally due to "stock market overreaction" hypothesis according to De Bondt & Thaler (1985) and Shefrin & Statman (1985), which asserts that stock prices have temporary swings away from their fundamental values due to either optimism or pessimism

We also found that the volatility of returns of the two indexes are high and aggregated, especially in the periods of time that witness great activity in the financial markets and rapid changes in economic conditions. Among the results that we reached through this study is that the empirical distribution of the series under study is skewed and far from the normal distribution, especially in highly volatile time periods, and this is confirmed by various modern and old studies.

Finally, these stylized facts should be viewed as constraints for the study and modeling of financial series as they need to be verified in order to find suitable models for the data and accurately reproduce the statistical properties. Unfortunately, most of the currently available models fail to reproduce all these stylized facts simultaneously, which indicates it is already very restrictive.

We also point out many issues that we have not discussed here. One important question is whether stylized facts are economically relevant, in other words, can these empirical characteristics be used to confirm or rule out some of the modeling methods used in economic theory? Can these stylized facts be used to implement a more effective method for measuring and managing risk?

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