

# Influence of War on Currency Exchange using Jennrich's Statistics.



Tareq A. M. Atiany, Jameel J. Alawneh

**Abstract:** This study investigates the war on Middle East currencies. The Jennrich's test and Minimum Spanning Tree (MST) are utilized to examination the stability of correlation currencies construction also its reasons, respectively. In this study the degree centrality evaluation was used to filter the knowledge from MST. The results displayed that the war struck Palestine on July 2014 had increased the instability of currencies exchange and made unsteady. As of the control chart, it displays that the currencies are not steady from January 1, 2013 to December 31, 2014. Based on sample data of DEC 2014, from the analysis the JOD and AED are unstable currencies through the others.

**Keywords:** Correlation matrix, Jennrich's statistic, stability, exchange rate.

## I. INTRODUCTION

The variability of universal economic recession and political policy [1], naturalistic catastrophe such as shaking, tidal wave [2, 3] and the war Polachek and Sevastianova [4] disturb the economical achievement and evolution of nations round the world. [5] they constructed that the stock market, reassess local insurance firm values afterwards shaking.

The Israel war on Gaza started exactly 7<sup>th</sup> July 2014 where martyred from Palestinians people this most heart breaking, with great effect on the Forex exchange rate (FOREX) of most of neighbouring countries for a period of nearly a month .data collected from Pacific exchange on daily basis, each month, using excel and MATLAB with Jennrich statistic to show the relationship and stability or instability of the data and at the results and recommendation will be given.

In the past or before years ago (FOREX) which symbols for Foreign Exchange market doesn't means something to people in foreign currencies as the opinion economic analysis sometimes its big risks and others show that its benefits forex summarized by buying and selling basic foreign currency which holds the core portion of operations in the forex market. In forex market, increase or decrease of prices in Currency must be measured with other currency.

The biggest risk in market is crash stock it is supposed by

investors, as in the cases circumstances the rendering of stock can be dispelled quickly by the public trade market [3].

OCHA (UN Office for the Coordination of Humanitarian Affairs 2014) in July exactly 7<sup>th</sup> start the war on Gaza from Israel, so that many Palestinian people killed Targeted residential property destroyed and civilians and many homes damaged by airstrikes Israel.

We want to discuss the impact of war on forex exchange and the damage to infrastructure deals a huge to short-term in Economic .we focused on the further analysis in correlation matrix using Jennrich's statistic to compare.

## II. STUDY CASE

In this research, we recapture 10 currencies which are everyday data of from January 1, 2013 to 31 of December, 2014. The Middle East countries are Bahranian Dinars (BHD) Cypriot Pound (CYP) Egyptian Pound (EGP) Israeali New Shekles (ILS) Jordanian Dinar (JOD) Kuwaiti Dinar (KWD) Lebanese Pound (LBP) Saudi Arabian Riyal (SAR) Turkish New Lira (TRL) U.A. Emirates Dirham (AED). Metal precious like silver, gold and platinum and can be used for base currency [6, 7]. The consequence might be affected by the variances of the amounts of these metals [1, 6] proposed utilizing the Special Drawing Right (SDR) as a base, this is applicable clearly on the currencies of global economic. Thus, in this research the SDR has been used as the currency base. We downloaded the data from Pacific exchange rate serving Sauder School of Business (2011).

Check the stability of correlation matrices by MSPC method: In MSPC method, control chart can be used to test the stability of correlation matrices for several samples of in assured time case. Let k samples of size  $n_1, n_2, \dots, n_k$  these samples are independent and drawn from  $p$ -varite normal distributions  $N_p(\mu_1, \Sigma_1), N_p(\mu_2, \Sigma_2), \dots, N_p(\mu_m, \Sigma_m)$  and  $\Sigma_i$  indicate the covariance matrix of the  $i$ -th population where  $i = 1, 2, \dots, m$ . The formula is as follows,

$$J = \sum_{i=1}^m \left\{ \frac{1}{2} \text{Tr}(Z_i^2) - (Z_d)' W^{-1} Z_d \right\} \quad (1)$$

where:

- i.  $Z_i = n_i^{\frac{1}{2}} R_p^{-1} (R_i - R_p)$ .
- ii.  $R_i$  is the  $i$  - th Sample correlation.
- iii.  $R_p$  is the average of all samples correlation matrices.
- iv.  $W = I + R_p * R_p^{-1}$ , the \* is Hadamard product of two matrices.
- v.  $Z_d$  is a diagonal of  $Z_i$ .
- vi.  $I_p$  is the identity matrix of size  $(p \times p)$ .

$J$  is asymptotically distribute as  $\chi^2$  with  $df = \frac{1}{2} (m - 1)p(p - 1)$  degrees of freedom where  $m$  is the number of dimensions.

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The hypothesis is rejected if  $J > \chi_{\alpha,df}^2$  at the  $(1 - \alpha)^{th}$  quantile of Chi-square distribution.

### III. INVESTIGATING THE STABILITY OF CORRELATION STRUCTURE:

In this part, we examine the stability test of correlation structures and then we used network analysis in the following section.

Table 1: Jennrich statistic of Middle East currencies

| Monthly | J       | Monthly | J        |
|---------|---------|---------|----------|
| Jan-13  | 68.2384 | Jan-14  | 83.4176  |
| Feb-13  | 71.1347 | Feb-14  | 43.1862  |
| Mar-13  | 69.365  | Mar-14  | 49.6824  |
| Apr-13  | 44.3092 | Apr-14  | 149.1194 |
| May-13  | 34.2129 | May-14  | 78.6421  |
| Jun-13  | 71.1792 | Jun-14  | 45.1738  |
| Jul-13  | 30.6826 | Jul-14  | 183.1194 |
| Aug-13  | 39.4209 | Aug-14  | 99.1819  |
| Sep-13  | 72.1536 | Sep-14  | 34.3879  |
| Oct-13  | 32.2085 | Oct-14  | 147.5853 |
| Nov-13  | 91.7719 | Nov-14  | 93.0078  |
| Dec-13  | 48.9761 | Dec-14  | 264.7023 |

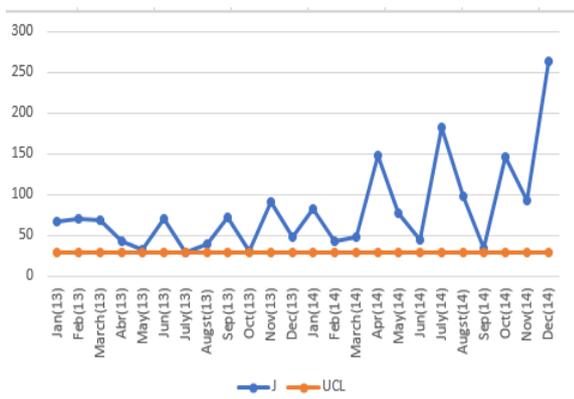


Fig. 1 control chart

In overall, the data set about 20 business days each month, 5 business days each week. To construct the conforming controls chart, we calculate Jennrich's test for each of 24 months from Jan. 2013 to Dec. 2014 to deduce the stability (instability) of correlation construction (Table 1).

In order to observe the correlation stability, the Jennrich control chart was presented where its value  $UCL = \chi_{0.05,45}^2 = 30.6123$  (red colour) in Figure 1.

The null hypothesis was reject if Jennrich statistic value falls outside the UCL. This indication displays that there is a change in correlation structures.

The value of Jennrich statistic is the vertical axis and the month from January 2013 until December 2014 is the horizontal axis. We understand from Figure 1 that an indicators of variability, of correlation structure happens at the chart, all the values in the chart are falls out of control this get more evidence about the history of procedure

inconsistency. In procedure there is a special source since all the values are outside the control limits; the procedure is

out of statistical control (unsteady).

In the following stage, we achieved the correlation diagnostic analyses to detect the most domination currency (ies) through the others to do that we used the Minimum Spanning Tree (MST). To achieve this objective, the data structure was compared. For that aim, we want compare the data structure of December 2014 through the in-control correlation matrix, that's mean, the reference sample. Next, we deliver a discussion on analysis of correlation diagnostics.

### IV. CORRELATION INVESTIGATION

Formerly, network investigation is a method of human social connections, established for evaluating social relationships to better study the relations between public construction and psychological [6]. Network analysis is utilized to decide the comparative import of node in the network [6, 8]. Sharif, Yusoff [9] suggested to utilize this procedure as a cause sources investigation in procedure monitoring variability. Neural network and Principal Component Analysis (PCA) are other methods that can be used for that purpose. MST is a type of currency chart which is utilized in financial portfolio of foreign exchange rate [6]. Network investigation becomes an essential tool is used to filter the most imperative information [6].

For investigate that network. Step one, the main information we filter it by using the MST method, step two a centrality measures is used to describe the specifics (Sharif et al., 2012). In the existing analysis, we study the interrelationship of 10 Middle East currencies by utilizing the network investigation, this method established based on correlation matrix, the correlation matrix is computed between all pairs of every currencies, the node contain  $10 * (10 - 1) / 2 = 90 / 2 = 45$  links every of their correlation among currencies. In this study, to understand the system we used MATLAB 7.10.0.499 (R2012a) and Pajek, let  $P_i$  is the currencies beneath the study. We compute the logarithmic return of exchange rate  $R_i$ :

$$R_i = \ln P_i(t + 1) - \ln P_i(t) \tag{2}$$

$\rho_{ij}$  correlation coefficient calculated from formula

$$\rho_{ij} = \frac{(R_i R_j) - (R_i)(R_j)}{\sqrt{((R_i^2) - (R_i)^2)((R_j^2) - (R_j)^2)}} \tag{3}$$

We calculate  $R_i$  where  $i$  and  $j$  are the currencies from  $i=1, 2, \dots, p$  this is the logarithmic return exchange rate. To convert the correlation matrix to a distance matrix  $D$  to investigate the network we use the equation

$$d_{ij} = \sqrt{2 * (1 - \rho_{ij})} \tag{4}$$

$d_{ij}$  is a distance between the  $i$ -th and  $j$ -th of currency there are some of properties must be conclude (i)  $d_{ij} = d_{ji}$  since  $\rho_{ij} = \rho_{ji}$  (ii)  $d_{ij} \geq 0$  and  $d_{ij} = 0 \Leftrightarrow i = j$ , because  $\rho_{ij} = 1$  (iii)  $d_{ij} \leq d_{ik} + d_{kj}$ , triangular inequality. Moreover,  $0 \leq d_{ij} \leq 2$  [6].

The correlation matrix is asymmetrical when  $i = j$  the  $\rho_{ij} = 1$  and  $\rho_{ij}$  can differ from -1 (totally anti-correlated) to 1 (totally correlated), while  $\rho_{ij} = 0$  the currencies uncorrelated [10].

We compute matrix  $D$  of distance  $d_{ij}$   $10 \times 10$ , distance matrix is used in the network to summarize the major information, to do that we use the idea of Sub-Dominant Ultrametric ( $SDU$ ) this was suggested by Mantegna and Stanley (1999). The  $SDU$  matrix  $10 \times 10$  with  $\hat{d}_{ij}$  element in  $i - th$  and  $j - th$  column where  $\hat{d}_{ij} \leq d_{ij}$  for  $i$  and  $j$  there are some of properties will be realized from ultrametric distance (i)  $\hat{d}_{ij}=0 \Leftrightarrow i = j$  (ii)  $\hat{d}_{ij} \leq \max\{\hat{d}_{ik}, \hat{d}_{kj}\}$  for all  $i, j$  and  $k=1,2,\dots,15$  (iii)  $\hat{d}_{ij} = \hat{d}_{ji}$  for all  $i$  and  $j$ . To specified MST by utilizing Kruskal algorithm [11] and the degree centrality was used to clarify the MST, the centrality can support to comprehend the importance and impact of every nodes nearby to others [12]. Degree centrality indicates the connectedness of currencies it deliver information around the amount of edges happening at a node the measurement of degree of centrality recognize as

$$c_i = \sum_{j=1}^p a_{ij} \tag{5}$$

$a_{ij}$  is the element in  $i - th$  row and  $j - th$  column in neighbouring matrix. It's definite by way of the amount of ties that the node has [6]. We analyse  $10 \times 10 = 100$  correlation elements and filter the information to  $10 \times (10-1)/2 = 45$  elements by using MST for that it require the adjacency matrix that match or agree nearly accurately to the MST. In adjacency matrix the element = 1 if the  $i - th$  and  $j - th$  nodes are linked and 0 else, and the matrix is symmetrical and the diagonal elements are 0. Depend on adjacency matrix we have  $10 - 1 = 9$  links to submitting their mutual relations.

In Table 2 we clarify the information and present Figure 2 and 3 respectively according to the colour and the magnitude importance.

Figure 2a, it appearances that JOD has 3 links. This mean JOD has the highest amount of links (red colour) in the network. In order to importance, ILS has 3 links (red colour). Whereas LBP, BHD, SAR and TRY have 2 links (green colour). Finally CYP, KWD, AED and EGP have 1 link (yellow colour) in the network. We display the JOD and ILS have the elevated amount of links which means are the most important currencies to another currencies. We learn from this figure TRY, SAR and AED are dominated by

JOD and ILS dominated CYP, TRY and KWD. We conclude in this investigation, the currencies splitting to 2 clusters wherever JOD dominates others. Besides, TRY play as a key toward the connectivity of ILS and JOD. On the other hand, after the war figure 2b displays that AED and SAR has the largest number 4 (red colour) SAR has 3 links (blue colour) while ILS, TRY and LBP has 2 links, respectively (green colour) and CYP, KWD, BHD, JOD and EGP has 1 link, respectively (yellow colour). To comprehend which currency has alteration on their centrality degree, we make comparison between two samples the reference sample and the sample of July 2014. It displays that there is an alteration in AED, ILS and BHD and other currencies are no change. Among those currencies, AED is very unstable currency in July 2014 since their links are change.

In degree centrality measure, we calculate only amount of links in the network. By seeing its weight, next we present average of weight centrality [6].

Based on mean weight centrality, ILS is the most influential (red colour) the second important are KWD and CYP (grey colour), are third vital (0.70-0.80) are JOD, SAR, LBP and TRL (blue colour) and the forth vital (0.39-0.55) are AED, EGP and BHD (yellow colour) these has the smallest average of weight. Figure 3b the most influential currency are TRL and CYP (red colour), second important is JOD (grey colour), the third important after war July 2014 is ILS (blue colour), the forth vital (0.21-0.71) are EGP, SAR and LBP (yellow colour). Furthermore, BHP, KWD and AED (green colour) are the fifth vital currencies (0.05-0.08) and it has the small mean of weights.

To realize which currency has alteration on after war July 2014, we make comparison between two samples it displays that there is an alteration in all currencies; JOD is very unstable currencies since their weights 0.71 to 1.05. It is pursued by KWD, TRL and AED.

Table 2. Degree centrality

| Currency                  | Reference sample  |                               | DEC2014           |                               |
|---------------------------|-------------------|-------------------------------|-------------------|-------------------------------|
|                           | Degree Centrality | Average of weights Centrality | Degree Centrality | Average of weights Centrality |
| BHD - Bahranian Dinars    | 2                 | 0.50                          | 1                 | 0.08                          |
| CYP - Cypriot Pound       | 1                 | 1.39                          | 1                 | 1.14                          |
| EGP - Egyptian Pound      | 1                 | 0.55                          | 1                 | 0.21                          |
| ILS - Israeli New Shekels | 3                 | 1.43                          | 2                 | 1.09                          |
| JOD - Jordanian Dinar     | 3                 | 0.71                          | 1                 | 1.05                          |
| KWD - Kuwaiti Dinar       | 1                 | 1.40                          | 1                 | 0.05                          |
| LBP- Lebanese Pound       | 2                 | 0.73                          | 2                 | 0.71                          |
| SAR- Saudi Arabian Riyal  | 2                 | 0.73                          | 3                 | 0.54                          |
| TRL- Turkish New Lira     | 2                 | 0.80                          | 2                 | 1.19                          |
| AED- U.A. Emirates Dirham | 1                 | 0.39                          | 4                 | 0.08                          |

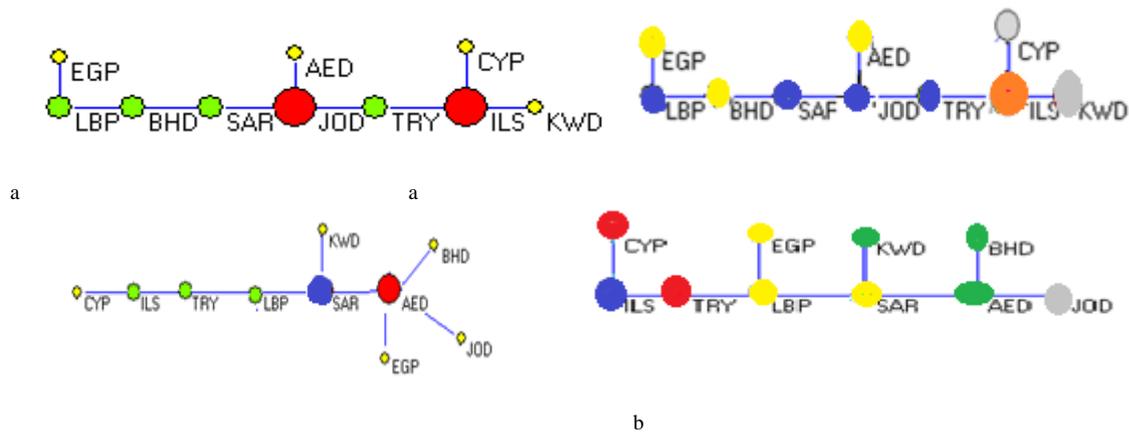


Figure 2: Centrality degree (a) MST for reference sample and (b) July 2014 after war struck Palestine

Figure 3 : Average weight (a) MST for reference sample and (b) July 2014 after war struck Palestine

## V. CONCLUDING REMARKS

In this research, the MSPC method is used to play the role of a technique for the purpose of analyzing how much the currency structure of the Middle East is stable or (instable) after war July2014. First, we construct Jennrich control to display the procedure inconsistency. It has raised the instability to currency exchanges and the currencies are unsteady from January2013 to December2014. Throughout following stage, at what time the out-of-control indication happens, network investigation is achieved to detect the important currencies. We contrast the conforming sample to the existing procedure volatility, this means the reference sample is detecting the challenging currencies. In this research, we explain the network analysis to sample of December2014, since it is value the biggest Jennrich statistic. Related to network analysis to reference sample, the minimum spanning tree produce two clusters. To explain the specifics, we used the degree centrality and mean of weights centrality. The higher this value is, the more the impact of this specific currency on other currencies. By the investigation, we accomplish that JOD and AED are the unsteady currencies.

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