



Informational Efficiency of Parallel and Official Exchange Markets in Libya

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Abstract:

This paper empirically examines the efficiency of the Libyan parallel and official exchange markets, using a daily dataset ranges from 1 of April 2016 to 30 of December 2017. Through multiple Random Walk tests; namely, unit root tests and variance ratio tests, the paper finds that official exchange rate strongly consistent with the efficient market hypothesis. Whereas the Libyan parallel market is informational inefficient. Our findings highlight the role of the Libyan exchange rate regime and the Central Bank of Libya's dominant foreign currencies supply.

Keywords: Efficiency, Exchange Market, Parallel Exchange Market, Official Exchange Market.

Jel Classification Codes: F31, E26, O17.

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1. Introduction

In developing countries where a parallel (black) market exists, investigating such a market is essential. The presence of the parallel market is most likely to be in poor developing countries as rich developing countries probably can meet the costly demand on foreign currencies. Nevertheless, political instability may adversely affect the ability of rich countries to supply sufficient foreign currencies at the official rate; the Libyan economy is an example.

The activation of the Libyan parallel market since political instability that occurred in 2011ⁱ, brings about changes in economic activities. In contrast, the Central Bank of Libya, the CBL hereafter, restricts quantity sales of dollars in response to the crisis. The CBL approved transactions will get the Dollar at the official rate; otherwise, the alternative is to finalize them through the parallel market at a higher rate. The parallel market is complementary to the official market, and presumably, the more rejected transactions at the official market, the higher is the parallel market premium. Since 2014, the Libya parallel market premium has increased by over 500%ⁱⁱ.

The efficient market hypothesis (EMH) states that the current exchange rate contains all historical relevant information (Fama, 1984). In other words, no one can make use of new arrival information to consistently “beat the market” as the market rate instantly adjusts before any agent can make a move if the market is efficient. Thereby, no agent presumes that the current rate is too high or too low. Consequently, the predictability of successive exchange rates is impossible.

Testing for the efficiency of Libyan parallel markets is essential as USD/LYD rates play a crucial role in determining the government’s policy. Ordinary people are also concerned

about the purchasing power of their Libyan Dinar (LYD), especially with persistent inflation that has increased the attractiveness of holding foreign currencies since 2011. Moreover, the parallel market participants are concerned about the ability to the prediction of market exchange rates.

This study investigates the efficiency of the Libyan parallel and official exchange market and proceeds as follows: Section 2 discusses the existing literature related to the subject. Section 3 introduces the Libyan exchange market on the parallel exchange markets. Section 4 describes our data on official and parallel markets and their characteristics. In section 5, the study presents the methodologies. Section 6 presents the results. The last section concludes with the main remarks.

2. Literature Review

The literature concerns the exchange market efficiency extends to the official and parallel (black) markets. Concerning the official exchange market, Fama (1984) investigates the efficiency in official exchange markets by utilizing the OLS approach and shows that the underlying markets are inefficient. Wu and Chen (1998) examine the exchange markets of nine OECD countries. The authors find evidence on the market efficiency hypothesis. Al-Khazali and Koumanakos (2006) test the random walk hypothesis for 10 MENA currencies through multiple unit root tests and variance ratio tests. He finds most of the currencies possess informational inefficiency. Chen (2008) adopts multiple variance ratio tests testing the random walk hypothesis of the Euro/USD exchange rate market. The author finds that the market exhibits a weak-form efficient. Azad (2009) empirically tests the random walk and the efficiency exchange rate using daily and weekly data for 12 Asia-Pacific. The author finds that the markets are efficient with high frequencies data but

not with the medium or low-frequency data. Charles and Darne (2009) examine the random walk behavior of 11 main Euro exchange rates utilizing a family of variance ratio tests over the period 4 January 1999 to 30 May 2008, using daily and monthly data. Their results indicate that the Euro exchange rates for the major trading countries are significantly weak-form efficient. Sasikumar (2011) analyzes the efficiency of the Indian foreign exchange markets using a set of variance ratio tests applying monthly data through the period of April 1993 to June 2010. The author finds that Indian foreign exchange markets do not follow a weak version of market efficiency.

Building on the literature's dominant findings, informational inefficiency in exchange rate markets are probably found in less developed financial markets, controlled and distorted exchange markets (Smith et al., 2002), pegged exchange marketsⁱⁱⁱ, and existent black market (Diamandis et al., 2007). Libyan official exchange market possesses most factors that literature claims on them to cause informational efficiency. It is pegged to a fixed value, underdeveloped, restricted the sale of currencies, and experienced a growing parallel exchange market.

The literature also concerns with the efficiency of the parallel (black) market where the market exists. Dowla (1995) investigates the efficiency of the black market using monthly data of 13 countries through the period of January 1970 to March 1987. The author finds that the black markets for foreign currencies are efficient, and thus policymakers can rely on the black-market rate to set the official exchange rate. Gupta (1981) tests the efficiency of the black-market exchange rates in three countries using monthly and weekly data samples ranging from Jan 1958 to March 1976 and 7 September 1976 to 18 September 1979, respectively. The study provides evidence on the

efficiency of the black market and points out that its rates can be useful to policymakers. Speight and McMillan (2001) examine the monthly black-market dollar exchange rates to the Dollar for six East European economies, formerly socialism. The results provide support to the efficiency of the black-market exchange rates.

Cerrato (2008) studies the relationship between black and official markets in six emerging countries using monthly data through the period 1973M1-1998M1. The results point to informational inefficiency in the black market, perhaps due to the existence of transaction costs^{iv}. K. Hassanain (2005) finds that the black-market exchange rates provide more robust evidence on purchasing power parity than official exchange rates do, using annual data spans from 1964 to 1993 in thirty-seven developing countries.

Recently, Huett et al. (2014) empirically test the exchange rate markets of Belarusian ruble (BYR) on the official and black-market through the period May-Nov 2011 that experienced a balance of payment crisis. The source of the official exchange rate is the National Bank of Belarus (NBB) and the one of the black the market is created from a website source; *Prokopovi.ch*. The authors find that the black market efficiently incorporated public information in Belarus. In particular, the black market was able to contain necessary information relevant to three devaluations and exchange regime change to the Belarusian ruble official rate.

A common aspect of all of these studies is that they investigate the efficiency of the black market for non-resource developing countries. In such countries, the supply of foreign currency mainly comes from remittances and tourism. Conversely, the central banks in rich resource developing countries control the main portion of the foreign currency

supply, and so the flow of the information. Besides, most researchers rely on shared data sources (“Pick’s *Currency Yearbook or World Currency Yearbook*”); it’s worth extending the literature inquiry using new data and a new country.

3. Libyan Exchange Market

3.1. Libyan Exchange Market Overview

Since first issued in 1952, the CBL has been pursuing a policy that aims to stabilize the official exchange rate of Libyan Dinar (LYD). Several notable events occurred on the Libyan exchange market concerning the rate and the policy. In February 1973, the LYD was pegged to USD at a fixed exchange rate of LYD 1= (3.3693) USD, and the value of LYD against other major currencies varied as USD varied against those currencies. On 18 March 1986, the LYD has been pegged to SDR instead of USD. The pegged rate is (2.8) Special Drawing Rights^v, SDR hereafter, with a margin that was set for LYD to fluctuate within +_7.5%.

Two incidences that the CBL used parallel exchange rates beside the official rate; the “commercial exchange rate” through the period 1994-1999. The “the declared special exchange rate” through the period 1999-2001. Through the latter period, the CBL aimed to unify the declared special rate and the official rate that the unified exchange rate reached to (1.55) USD per 1 LD at the end of 2001.

Then there were two depreciation in the LYD pegged SDR exchange rates; the first is 50% in Jan 2002, where 1 LYD is set equivalent to (0.6080) SDR. The second is 15% June 2003, where 1 LYD is set equal to (0.5175) SDR. Since the last depreciation, along with the CBL accepting the IMF obligations, most importantly eliminating all restrictions on international

transfer and exchange discriminating rates, the LYD/USD rate varies according to SDR/USD rate.

3.2 Libyan Exchange Market After 2011

Since the last deprecation in 2003, the LYD exchange rate had remained stable with the CBL sufficient foreign reserves. However, Libya has experienced political and security instability crises since the overthrow of Gadhafi's regime in 2011. The country has suffered from instability in oil revenues that constitutes most of the country's export revenues. The situation getting even worse with clashes started again in 2014 in Tripoli, along with fighting in the East region. At the end of 2014, the parallel market of the exchange rate has notably grown as the CBL has restricted foreign currencies sales. Although the official rate of USD/LYD remains stable in between (1.3-1.4 LYD), the parallel market rates had kept diverging away since the end of 2014 and reached its peak at 9.2 LD in Nov 2017^{vi}. Unfortunately, or not, the crisis reveals the considerable cost of such distortions on the economy for many years. Typically, legalized parallel markets work under market economy forces and measure values more accurately than distorted official markets do^{vii}. Both ordinary people and officials acknowledge that the black market most likely will reveal more accurate information than the official market will do. Nevertheless, the changes in daily rates or the return which reflect the sell and buy forces are not acknowledgeable yet.

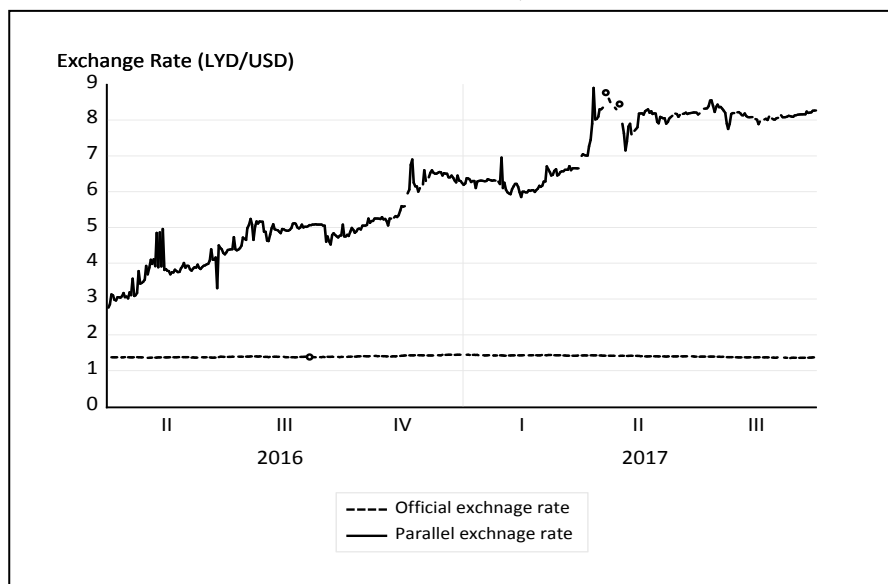
In response to the foreign currency's shortages, the CBL has started what is called "the family dollar allowance program". The program regulates the sale of Dollars to the public through providing Dollars amount at the official rates to all Libyan families based on the family members. While the program aims to ensure the quoted dollar amount to all Libyan families, it increases the participants and interest in the parallel markets.

4. Data

Along with the increasing of the parallel market premium in the Libyan economy, looking for a daily parallel exchange rate has become essential to many parties. The most two legitimate sources are *Essale App* and *Ewan Libya* website. *Essale App* is most used by buyers and sellers in the black market due to its easy accessibility and continuously updating the rate. The app updates the daily rate several times during the day. *Ewan Libya's* website is a more academic-based source; it announces a daily parallel exchange rate of LYD/USD. The web provides only one rate throughout the day and covers six days of the week, excluding Friday. The web allows us to browse the historical exchange rates, whereas *Essale App* just updates the current rates with percentage change to the previous.

We have created daily parallel exchange rates from *Ewan Libya* web during the period of 1 April 2016 through 30 September 2017. The data consists of 425 observations and represents the selling price of the US dollar in Libyan Dinar (LYD). Most sources of Libyan parallel market rates indicate that prices vary within the same day, and there must be some deviations between one source to another. Our sources indicate that there might be (+_3) Dirhams^{viii} fluctuating in the day's exchange rate with other resources due to variation in calculating the daily average.

Figure1: Parallel and Official Daily Exchange Rate (1/4/2016-30/9/2017)



We have also collected data on the Libyan official exchange rate through the same duration of the parallel market. The official exchange rate is calculated by converting the SDR/USD exchange rate to LYD/USD exchange rate using the pegged value of 1 LYD = 0.5157 SDR. The methodology is confirmed by comparing many selected values of our calculations with the CBL announced LYD/USD rates.

Table1: Summary statistics on the official and parallel exchange returns

	Mean	Median	Std. Dev.	Skewness	Kurtosis	Jarque-Bera
Official Exchange Market	1.396	1.392	0.024	0.278	1.850	24.22
Parallel Exchange Market	6.094	6.165	1.639	-0.053	1.790	21.86

In Table 1, we report the summary statistics of the daily parallel and official exchange returns. The average exchange rate

is positive in both markets. However, the daily returns on the parallel are negatively skewed, but the official daily returns are positively skewed. Daily returns on both markets are platykurtic distributed; that is, more risk-averse traders would prefer such exchange markets as they are less likely to produce extreme values.

5. Methodology

The inference of the (RWH) is twofold; a series has a unit root component, and the increments of exchange rates are serially uncorrelated. The (EMH) as an application of the (RWH) implies two things, the formation of the exchange rate is random, and the return is not predictable. If the two properties exist, the exchange rate is said to follow a random walk hypothesis. As mentioned by Azad (2009), the unit root component might exist, but the martingale property is not, or vice versa. Thus, a combination of using unit root tests and variance ratio tests work as supplement tests in examining the EMH. The study proposes to apply two tests; the Unit Root Tests & the Variance Ratio Tests.

5.1 Unit Root Tests

The Augmented Dickey-Fuller (ADF) test is a parametric test designed to determine the presence of a unit root in a series at higher order-correlation. The test formula for a time series, say y , can be expressed by the following:

$$\Delta y_t = \alpha y_{t-1} + x_t' \delta + \beta_1 \Delta y_{t-1} + \beta_2 \Delta y_{t-2} + \dots + \beta_p \Delta y_{t-p} + v_t$$

The null and alternative hypothesis are:

H_0 : Prevails a unit root for y

H_1 : No prevalence of a unit root for y

If the exchange rate series contains a unit root, it follows a random walk, which consists of the weak-form efficiency of the exchange market.

The Philips-Perron Test (PP) is non-parametric testing for the existence of the unit root in a series. The test provides an alternative method of controlling for serial correlation.

The null hypothesis and the alternative are equivalent to the ADF test. If the null hypothesis rejects the unit root in the exchange rate, the consecutive change rates over the period are random. Thereby, the exchange market is said to be a weak-form efficient.

5.2 Variance Ratio Tests

Suppose we have the following exchange rate series

$$Y_t = Y_0, Y_1, Y_2, \dots, Y_T$$

$$Y_t = Y_{t-1} + \mu + \varepsilon_t$$

Or

$$\Delta Y_t = \mu + \varepsilon_t$$

In which, Y_t is the natural logarithm of the exchange rate, μ is an arbitrary drift parameter, and ε_t is a random disturbance term satisfies $E[\varepsilon_t] = 0$, for all t and $E[\varepsilon_t \varepsilon_{t-j}] = 0$ for any positive j .

The random walk hypothesis is twofold: uncorrelated residuals and a unit root. Variance ratio test concerns with uncorrelated residuals or increments in Y_t , the variance of these increments increase linearly in the observation interval, that is;

$$Var(Y_t - Y_{t-q}) = q Var(Y_t - Y_{t-1})$$

In which q is a positive integer. The corresponding variance ratio is

$$VR(q) = \frac{\frac{1}{q} Var(Y_t - Y_{t-q})}{Var(Y_t - Y_{t-1})} = \frac{\sigma^2(q)}{\sigma^2(1)}$$

And under the null hypothesis $VR(q) = 1$.

Lo and Mackinlay (1988) provide an asymptotic distribution of the estimated variance ratios and two test statistics for random walk properties under two assumptions of the stochastic error term; homoscedastic and heteroskedastic assumptions; $Z(q)$ and $Z^*(q)$ respectively.

However, the Lo and Mackinlay (1988) formula concerns with testing individual variance ratios; however, the random walk hypothesis requires that $VR(q) = 1$ for all q .

Chow and Denning (1993) propose a procedure for the multiple comparisons of the set of variance ratio estimates with unity.

For a single variance ratio test, the null hypothesis, $VR(q) = 1$ and hence $M_r(q) = VR(q) - 1 = 0$. Considering a set of m variance ratio test, $\{ \overline{M_r(q_i)} | i = 1, 2, \dots, m \}$ associated with a set of aggregation intervals $\{ \overline{q_i} | i = 1, 2, \dots, m \}$. Under the random walk null hypothesis, there are multiple sub-hypotheses

$$\begin{aligned} H_{0i}: M_r(q_i) &= 0 && \text{for } \overline{i = 1, 2, \dots, m} \\ H_{1i}: M_r(q_i) &\neq 0 && \text{for any } \overline{i = 1, 2, \dots, m} \end{aligned}$$

Rejection of any one or more H_{0i} rejects the random walk null hypothesis. Consider a set of Lo and Mackinlay test statistics, say $Z(q)$, $\{ \overline{Z(q_i)} | i = 1, 2, \dots, m \}$. As the variance ratio restriction holds for every difference $q > 1$, it is common to evaluate the statistic at several selected values of q . To control the size of the joint test, Chow and Denning (1993) propose test statistic that examines the maximum absolute value of a set of multiple variance ratio statistics. The p-value for the Chow-denning statistics using m variance ratio statistics is bounded from above by the probability for the Studentized Maximum

Modulus (SMM) distribution with parameter m and T (sample size) degree of freedom, when $\sqrt{T} = \infty$.

Another approach for jointly testing variance ratio tests is the standard Wald statistic for the joint hypothesis that all m variance ratio statistics equal 1. Under the null hypothesis, the Wald statistic is asymptotic Chi-square with m degrees of freedom (see Fong, Koh, and Ouliaris (1997)). Kim (2006) offers a Wild bootstrap approach to improving the small properties of variance ratio tests. The approach involves computing the individual (Lo and Mackinlay) and joint (Chow and Denning, Wald) variance ratio test statistics on samples of T observations formed by weighting the original data by mean 0 and variance 1 random variable and using the results to create bootstrap distributions of the test statistics. Thus, our approach to testing the random walk hypothesis in the Libyan parallel and official exchange markets is performed on three stages: Conventional VR, Exponential VR test, and Wild bootstrap VR test^{ix}.

6. Results

6.1 Unit Root Tests

The results on the unit root tests are shown in Table 2. First, for the parallel market, results indicate that ADF and PP tests can only reject the null hypothesis when using constant and trend specification. In particular, the trend specification rejects the null hypothesis in ADF and more strongly in PP tests depicting the trend in the graph of the parallel exchange rate.

The official markets, through all test specifications, cannot reject the null hypothesis of the unit root. That indicates that the official exchange rates do not possess the characteristics of stationary time series at the level and pursue the random walk hypothesis. This result is similar to what the literature indicates regarding developed countries' exchange rates; however, this is

expected as the LYD/USD rate variations are just reflecting the variations of SDR/USD rate.

Table 2: Unit Root tests for Parallel and Official Exchange Rates

Log (USD/LYD)	ADF	ADF	ADF	PP	PP	PP
	Non Constant	Constant	Constant and trend	Non Constant	Constant	Constant and trend
Parallel Exchange P-value	(0.96)	(0.32)	(0.02)	(0.98)	(0.13)	(0.00)
Official Exchange P-value	(0.45)	(0.29)	(0.80)	(0.45)	(0.29)	(0.57)

Note: The ADF and PP are the Augmented Dickey-Fuller and Phillips unit root tests.

6.2 Variance Ratio Test

Table 3 reports the results of testing VR tests of the Libyan parallel market of the exchange rate for sampling intervals 2, 4, 8, and 16 days. The table has three main rows; conventional VR test, exponential VR test, and bootstrap VR test. Through these tests, Table 3 reports the estimate of the variance ratio $VR(q)$, and the two statistics; $Z(q)$ and $Z^*(q)$. Besides, the two multiple variance ratio tests, the $Z_{|max|}$ and the Wald tests, are reported with the null assumption of homoscedastic assumption^x.

First, consider the results for the conventional VR test of the parallel exchange rate. The VR through all periods is statistically less than 1. The null hypothesis that the parallel exchange rate follows a homoscedastic random walk is strongly rejected as the Max $|Z|$ statistic, and the Wald statistic indicate the significant as the multiple variance ratio tests indicate. The rejection of the null hypothesis of parallel exchange rate is also confirmed under the heteroskedastic condition. Thus, the random walk is rejected because of correlated increments in the Libyan parallel exchange rates.

Table 3: Parallel Exchange Estimations of the Variance Ratios Tests

		q= 2	q= 4	q= 8	q= 16
Conventional VR Test	VR (q)	0.56	0.41	0.32	0.28
	Z (q)	-9.05***	-	-	-
	Z*(q)	-2.93***	6.47***	4.68***	3.33***
	Max Z ²	9.05***	-2.28**	-1.89*	-1.66*
	Wald Test	83.85***			
Exponential VR Test	VR (q)	0.46	0.32	0.26	0.22
	Z (q)	-11.00***	-	-	-
	Z*(q)	-3.06***	7.44***	5.14***	3.64***
	Max Z ²	11.00***	-2.26**	-1.78*	-1.54
	Wald Test	126.57***			
Bootstrap VR Test	VR (q)	0.56	0.41	0.32	0.28
	Z (q)	-9.05***	-6.47**	-4.68**	-3.33*
	Z*(q)	-2.93***	-2.28**	-1.89**	-1.66
	Max Z ²	9.056***			
	Wald Test	83.85***			

Note: ***, **, * variance ratios are significantly at 1%, 5%, and 10% levels, respectively.

The results are even consistent when performing the variance ratio tests on the log-returns of the Libyan parallel exchange rate. The VR statistic is less than one and significant under the assumptions of the homoscedastic and heteroskedastic random walk. The rejection levels through both Z statistics are at 1%, as the multiple variance ratio tests show.

Finally, the results on the variance ratio test of Wild bootstrap are consistent with previous results; that is, the parallel exchange rates reject the random walk hypothesis.

Table 4: Official Exchange Estimations of the Variance Ratios Tests

		q= 2	q= 4	q= 8	q= 16
Conventional VR Test	VR (q)	0.95	1.00	0.99	0.87
	Z (q)	-0.8	0.05	-0.02	-0.47
	Z*(q)	-0.97	0.06	-0.03	-0.57
	Max z	0.80			
	Wald Test	3.11			
Exponential VR Test	VR (q)	0.96	1.01	0.99	0.87
	Z (q)	-0.67	0.17	-0.001	-0.47
	Z*(q)	-0.8	0.22	-0.001	-0.58
	Max z	0.67			
	Wald Test	3.12			
Bootstrap VR Test	VR (q)	0.95	1.01	0.99	0.87
	Z (q)	-0.8	0.05	-0.02	-0.47
	Z*(q)	-0.97	0.06	-0.03	-0.57
	Max z	0.80			
	Wald Test	3.11			

Note: ***, **, * variance ratios are significantly at 1%, 5%, and 10% level, respectively.

Now we move to the Libyan official exchange rate. Table 4 presents the results of the variance ratio tests in a similar structure to Table 3. The conventional VR test indicated that the VR(q) is not statistically different from 1, and both Z statistics failed to reject the null hypothesis of random walk assumptions as confirmed by the multiple variance ratio statistics; Z |max| and Wald test statistics.

The same result is confirmed when applying the variance ratio test on the log-returns of the official exchange rates. That is, the null random walk hypothesis is not rejected for the official

exchange market. The last variance ratio test, the Wild bootstrap VR, indicates that the random walk hypothesis is not rejected as the daily exchange rate increments are uncorrelated. The result is confirmed under the two Z statistics.

7. Conclusion

We examine the informational efficiency on the Libyan parallel and official markets using daily-level data during political instability period. Depending on *Ewan Libya* news website, we created parallel daily-level exchange rate of Dollar through the period 1 April 2016 till 30 September 2017. Restricted to the data availability of the parallel exchange rate, we calculated the official daily-level exchange rates of Dollar depending on the LYD pegged value to the SDR. The methodology to examine the efficiency of both Libyan exchange markets, parallel and official, consists of random walk tests and variance ratio tests.

The results on the variance ratio tests of the official and parallel exchange rates contradict the conventional findings. The official exchange rate operates under fixed exchange regime, political instability, and parallel market existence that previous studies claim on them as causes of informational inefficiency in financial markets; nonetheless, the market is efficient. The official exchange rate, being pegged to a specific SDR rate, simulates the movement of the SDR/USD rate and not responding to the national conditions.

The Libyan parallel exchange market with a large number of participants, long-established, and legally accepted, but it is an inefficient market. One crucial difference could highlight this contradiction with literature findings is that the previous results on the parallel (black) market efficiency related to non-resource developing countries in which the supply of foreign currency is not monopolized with one or few agents. In the Libyan parallel

market, presumably, the primary source of supply comes from the CBL mainly through the Family Dollar Allowance program. Thus, examining the parallel exchange market ability incorporating the CBL information could confirm this possibility.

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ⁱ The Libyan parallel market of the foreign currencies has been there for many years even with sufficient foreign reserves where it's been trading almost at the official rate and its customers have been those who avoiding bureaucratic procedure or those who psychologically attached to the parallel market due to the period of private sector sanctions since 1979.

ⁱⁱ Libya Joint Market monitoring Initiative, December 2017 Trend Analysis, the Coordination of Humanitarian Affairs OCHA, <https://reliefweb.int/report/libya/libya-joint-market-monitoring-initiative-jmimi-june-december-2017-trends-analysis-libya>, Libyan parallel Exchange rate retrieved from *Ewan Libya* news website <http://ewanlibya.ly>.

ⁱⁱⁱ Restrict regimes are less likely to absorb and react to the information than less restricts regimes do.

^{iv} The transaction cost most likely arises from the undeveloped internet networks and exchange rate websites at the time of their study. H. Huett et al. (2014) mentioned that internet websites on exchange rates have reduced the cost of transaction on the parallel markets and have made their rates broadly observable to the public.

^v An international reserve asset created by the International Monetary Fund (IMF).

^{vi} Market Analysis Report, Libya 2018, United Nations Office for the Coordination of Humanitarian Affairs OCHA, <https://reliefweb.int/sites/reliefweb.int/files/resources/WFP-0000101571.pdf> . Data obtained from *the Ewan Libya website*.

^{vii} If participating in black market is considered illegal there will be additional cost added to the transactions to cover this type of risk which will vary depending on the volume, rate, and premium. Such added cost deemed to be a distortion .

^{viii} One Libyan Dinar contains 1000 Dirhams.

^{ix} Wright (2000) purposes non-parametric VR tests using rank and signs; these tests are powerful if the data are highly non-normal. This is not the case on the data sample under consideration, thus we don't include such test.

^x The $Z_{|\max|}$ statistic under the heteroskedastic assumption (not reported in the table) also rejects the null hypothesis with same level of significant as with the one of homoscedastic assumption.