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FOREIGN EXCHANGE MARKET EFFICIENCY: CASE STUDY ON INDONESIA

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ABSTRACT

This research examines the foreign exchange market efficiency in Indonesia using currency pairs chosen based on Indonesia's largest international trading partner by volume, namely, China, United States and Japan. Consequently, the currency pairs used for this research are IDR/USD, IDR/JPY, IDR/CNY. The test utilizes the Augmented Dickey Fuller procedure in determining whether the datasets contain any unit roots in which case foreign exchange price movements follow a random walk movement (non-stationary), or not (stationary). The research findings show that historical data for all three currencies follow a random walk process or the market is weak-form efficient.

1.0 INTRODUCTION

Efficient Market Hypothesis (Fama, 1970) tries to explain whether the value of an asset at any periods of time reflects all available information. A market that's efficient is indicated by assets value that reflects all available information. Because the occurrence of new information cannot be predicted (random), asset's values should, in consequence, follow random walk movement or, in other words, unpredictable.

There are 3 forms of efficiency based on the type of information used as the predictor, namely, weak form, semi-strong form, and strong form. Weak form utilizes historical data as the predictor of the current market value, semi strong form utilizes available public information as the predictor of the current market value. Whereas, strong form utilizes all information, both public and private, as the predictor of the current market value (CFA Level I, Equity Investment – Efficient Market Hypothesis, 2020).

According to the Bank for International Settlements April 2019, foreign exchange market has a daily transaction of US$6.6 billion, making it the largest financial market in the world (BIS, 2019). This research, in particular, examines the foreign exchange market, specifically in Indonesia using currencies of the three Indonesia's largest international trading partners according to the World Bank: China, United States and Japan (World Bank, 2020).

As the foreign currency market is the largest financial market in the world in terms of transaction volume, it makes it interesting to study the possibility of gaining profits in the market. Specifically, within the spot market where it is the most direct: using the spot price and is settled within two business days. As the value of spot price fluctuates each day, partly influenced by the economic and geopolitical situation of a country, at the time of pandemic and the relatively uncertain geopolitical situation with the ongoing war, it becomes important to

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take a look at whether the currency market is efficient in order to construct a better strategy within the spot market. Traders that look to make profits in the market, importers and exporters who are transacting with different currencies can benefit from this study by understanding the efficiency of the currency market in Indonesia in general. Therefore, they can construct a more appropriate and beneficial strategy when it comes to currency-related decisions to reduce fluctuation risks that will be reflected in their gains/losses from their transactions.

According to the BIS (2019), the volume of the trading market for Indonesian Rupiah has grown over the last decade. The main foreign exchange instruments used in the market are foreign exchange swaps and spot deals. In the case of resident IDR trading, both financial and non-financial participants have an increased volume in their transactions. In terms of dominance, offshore trading activities dominate the market transactions.

2.0 LITERATURE REVIEW

Efficient Market Hypothesis (Fama, 1970) explains that an efficient market has asset value that reflects all available information. There are three types of efficiencies: weak form, semi-strong form, and strong form. Weak form utilizes historical prices as the predictor when studying asset price movements, semi-strong form utilizes all publicly available information, meanwhile strong form utilizes all available information both public and private. The study of efficiency in the weak form can be done through serial correlation tests or unit root tests among other tests, while in semi-strong form can be done with the study of events and through comparing records of mutual funds and index funds (Ross, 2013). As for the strong form, it can be done through dynamic models such as Kyle's model (1985).

If a market is weak-form efficient, it means that asset price follows a random walk process and past data cannot be used as a predictor for future prices. This makes technical analysis ineffective to be done in order to gain abnormal return. If a market is semi-strong form efficient, it means that fundamental analysis cannot be used to generate above average return. If a market is strong-form efficient, it means that investors cannot beat the market utilizing both public and private information as it is already reflected in the price of the asset.

Previous EMH researches done with various financial instruments, such as stock, bond, and commodity, come up with various results. The research done by Caporale & Plastun (2020) on the currencies EUR/USD, USD/JPY, USD/CAD, AUD/USD, and EUR/JPY proves that there is evidence of inefficiency in the foreign exchange market using the trading simulation approach. There is a possibility for market participants to generate abnormal profits.

Other than that, the research done by Huszar, Tan and Zhang (2016) found that the renminbi market is inefficient. This research examines the presence and relative strength of offshore and onshore renminbi forward markets, by examining the covered interest rate parity (CIRP) conditions and CIRP deviation in both markets, and consider the role of market frictions and government interventions. The research found significant deviation from CIRP conditions which indicates that Renminbi forward market is inefficient.

Whereas, research done by Ibrahim, Long and Ghani (2011) found that foreign exchange price movements of OECD countries follow a random walk movement (efficient). The research

utilizes Augmented Dickey Fuller, Phillip-Perron (PP), and Kwiatkowski-Phillips-Schmidt-Shin analysis to examine the unit root, while using the data from 2000-2007.

The research done by Kallianotis (2018) also found that foreign exchange market is relatively efficient. The research measures inefficiency in foreign exchange market using currencies USD/EUR, USD/GBP, CAD/USD, and JPY/USD in weak-form and semi-strong form. In the weak-form efficiency aspect, the research found that the currencies follow a random walk process, or the market is efficient.

Phiri (2021) studies the efficiency of BRICS currency markets during the COVID pandemic and found that there is changing market efficiency during the pandemic. This research uses data from 3 February 2020 to 31 August 2021. Other than that, the research done by Azzam, El-Masry, Yamani (2023) examines the foreign exchange market before and during the COVID pandemic. The result shows that currency markets are generally efficient before the COVID pandemic and then market efficiency fails to hold during COVID period. This research uses the sample of 26 developed and emerging market currencies spanning from 30 November 2018 to 29 November 2019. These researches show that market efficiency can change as the global situation changes.

3.0 METHODOLOGY

Datasets are derived from bankindonesia.go.id, accessed on 5 June 2021. Datasets comprise of daily spot price of three currency pairs IDR/USD, IDR/JPY, and IDR/CNY, with the exceptions of Saturday, Sunday and holiday for the year 2009 to 2020.

Methodology used in this research is the Random Walk Model (Enders, 1995), continued by the Augmented Dickey Fuller test.

3.1 Random Walk Model

$$P_t = \alpha_0 + \alpha_1 P_{t-1} + \varepsilon_t \quad \text{.....3.1}$$

The equation above can be translated for the purpose of this spot rate research into the following.

$$S_t = \alpha_0 + \alpha_1 S_{t-1} + \varepsilon_t \quad \text{.....3.2}$$

Where,

S_t refers to the spot rate on day t

St-1 refers to the spot rate on the day before day t.

Equation 3.2 is specified as AR(1). If $\alpha 1 \geq 1$, then St is a time series process that is non-stationary, if $\alpha 1 = 1$, then St is considered a random walk process. Therefore, the foreign exchange market efficiency test is done through examining whether data series St shows random walk movement by testing the parameter $\alpha 1$ utilizing the Augmented Dickey Fuller procedure.

For the case AR (1) (without drift), equation (3.2) can be written as follows:

$$s_t = \alpha_1 s_{t-1} + \varepsilon_t \ldots\ldots\ldots (3.3)$$

Applying lag one and two periods:

$$s_{t-1} = \alpha s_{t-2} + \varepsilon_{t-1} \quad \ldots\ldots (3.4)$$

$$s_{t-2} = \alpha s_{t-3} + \varepsilon_{t-2} \quad \ldots\ldots\ldots (3.5)$$

Substituting equation (3.4) to equation (3.3) results to:

$$s_t = \alpha(\alpha s_{t-2} + \varepsilon_{t-1}) + \varepsilon_t \quad \ldots\ldots (3.6)$$

$$s_t = \alpha^2 s_{t-2} + \alpha\varepsilon_{t-1} + \varepsilon_t \quad \ldots\ldots\ldots (3.7)$$

Substituting St-2 or the equation (3.5) to equation (3.7) results to:

$$s_t = \alpha^2(\alpha s_{t-3} + \varepsilon_{t-2}) + \alpha\varepsilon_{t-1} + \varepsilon_t \quad \ldots\ldots (3.8)$$

$$s_t = \alpha^3 s_{t-3} + \alpha^2\varepsilon_{t-2} + \alpha\varepsilon_{t-1} + \varepsilon_t \quad \ldots\ldots\ldots (3.9)$$

In general, equation (3.9) can be written as follows:

$$s_t = \alpha^{T+1} s_{t-(T+1)} + \alpha\varepsilon_{t-1} + \alpha^2\varepsilon_{t-2} + \alpha^3\varepsilon_{t-3} + \ldots + \alpha^T\varepsilon_{t-T} + \varepsilon_t \ldots\ldots (3.10)$$

There are three case possibilities for property data St in the equation (3.10) above.

Case 1:

$\alpha 1 < 1 \rightarrow \alpha 1^T$ *will approach zero value when* $T \rightarrow \infty$; Therefore, the shock that happens to the system will disappear as the time goes by. This is a case of stationary data or non-random walk.

Case 2:

$\alpha 1 = 1 \rightarrow \alpha 1^T = 1 \quad \forall\ T$; shock is persistent in the system and the effect will not recede. This is a case of unit root or random walk.

Case 3:

$\alpha > 1 \rightarrow$ the effect of shock gets bigger as $\alpha 1 > 1 \rightarrow \alpha 1^3 > \alpha 1^2 > \alpha 1$, $etc.$. This is a case where the data series is considered explosive.

Augmented Dickey Fuller Test

ADF test procedure is used to examine whether the data generating process for St has unit root (random walk/non-stationary) or stationary. The purpose is to test whether the value of $\alpha 1 = 1\ or\ \alpha_1 < 1$ for the equation $S_t = \alpha_1 S_{t-1} + u_t$.

Dickey Fuller test procedure is based on the equations below:

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$$y_t = \varphi y_{t-1} + u_t \quad \ldots\ldots(1)$$

$$y_t - y_{t-1} = \varphi y_{t-1} - y_{t-1} + u_t \Delta y_t$$

$$= (\varphi - 1) y_{t-1} + u_t \Delta y_t$$

$$= \psi y_{t-1} + u_t \; where \; \psi = \varphi - 1 \quad \ldots\ldots\ldots(2)$$

Stationary test is done indirectly to equation (1) through equation (2), therefore $=1 \; is \; equivalent \; to \; \psi = 0$

Consequently, the hypothesis tested in the Augmented Dickey Fuller test is as follows:

$$H_0: \; data \; series \; contains \; unit \; root \; (random \; walk) \rightarrow \psi = 0 \rightarrow market \; is \; efficient$$

$$H_1: data \; series \; is \; stationary \; \rightarrow \psi < 0 \rightarrow market \; is \; inefficient$$

4.0 RESULTS

Chart 4.1. Price fluctuations of currency pair

IDR/USD

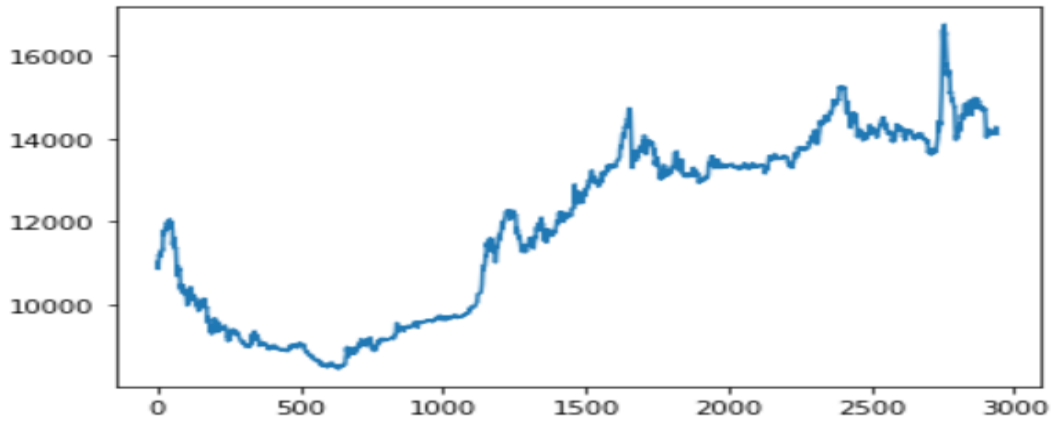

Chart 4.2. Price fluctuations of currency pair IDR/JPY

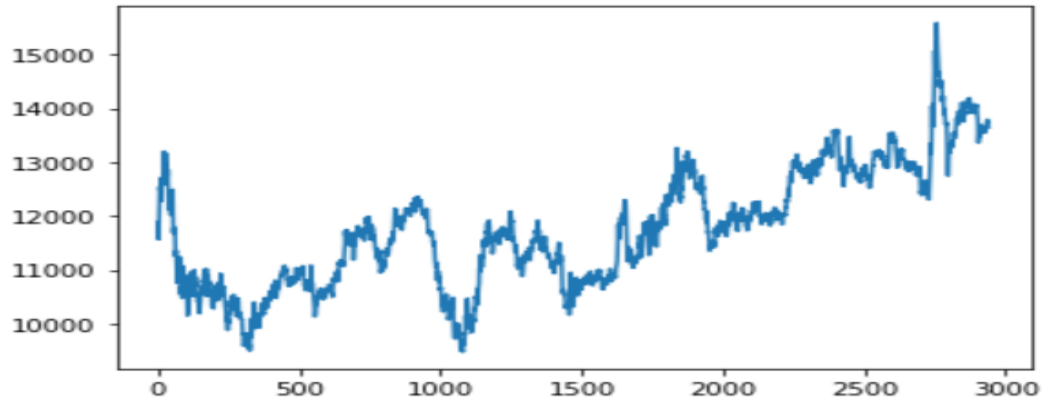

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Chart 4.3. Price fluctuations of currency pair IDR/CNY

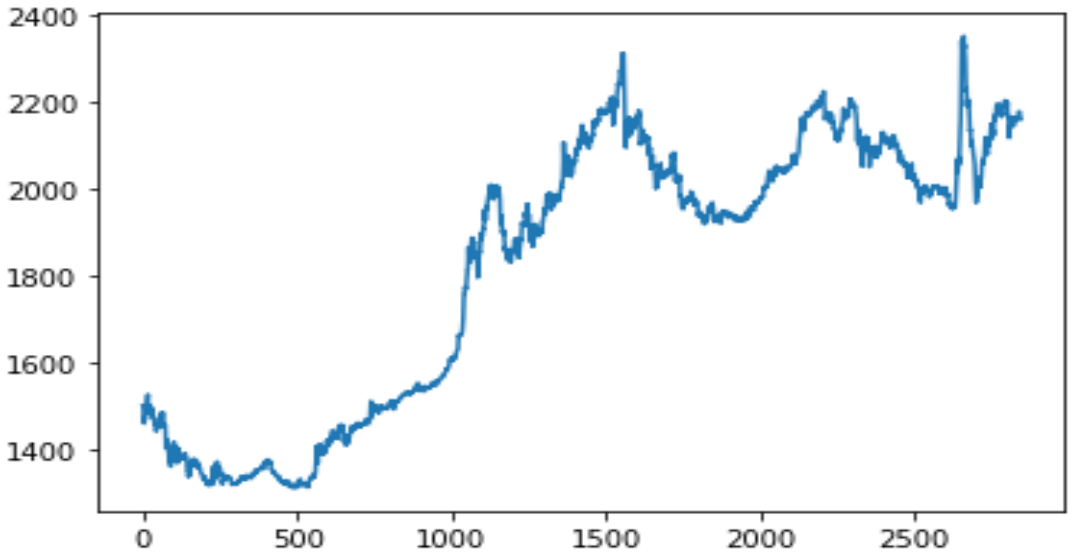

Table 4.1. Results

Currency Pairs	IDR/USD	IDR/JPY	IDR/CNY
ADF statistics	-0,630	-1,781	-0,77
p-value	0,864	0,390	0,827
Critical Values 5%	-2,863	-2,863	-2,863
Observations	2940	2940	2841
Result (p-value to critical value of 5%)	Fail to reject the null hypothesis	Fail to reject the null hypothesis	Fail to reject the null hypothesis

All three currency pairs results fail to reject the null hypothesis, meaning that historical data follows a random walk process or the market is weak-form efficient. This finding has shown a different result than other researches to other foreign exchange markets such as the one done by Caporale & Plastun (2020), Huszar, Tan and Zhang (2016), Katusiime, Shamsuddin, and Agbola (2015) as well as Abunoori, Shahrazi and Rasekhi (2012). However, the finding is similar like the research done by Kallianotis (2018) that examines USD/EUR, USD/GBP, CAD/USD, JPY/USD, and the one done by Ibrahim, Long and Ghani (2011) that examines foreign exchange market in 30 OECD countries.

Based on this research findings, foreign exchange market participants cannot gain abnormal return by predicting price based on historical data JPY/IDR, IDR/CNY, IDR/USD. In relation to this, technical analysis is not effective to be done because the price movement follows a random walk process. With that in mind, investment strategy can be done passively. With passive investing, investors can expect a stable return in a longer period of time.

5.0 CONCLUSIONS

The case of foreign exchange market in Indonesia with currency pairs IDR/USD, JPY/IDR, and IDR/CNY shows weak-form efficiency. Therefore, historical data cannot be used as a predictor for future prices, and technical analysis becomes ineffective to be done to gain abnormal return.

Because IDR/USD, IDR/JPY, and IDR/CNY are proven to be weak-form efficient, therefore activities such as forecasting or budgeting for companies cannot be done based on historical value. Due to the unpredictability of foreign exchange price movements (random walk), it is important to build optimistic and pessimistic scenarios as an anticipation measure in forecasting and budgeting activities. Other than that, foreign exchange market participants are encouraged to consider hedging through derivatives to alleviate price fluctuation risk.

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