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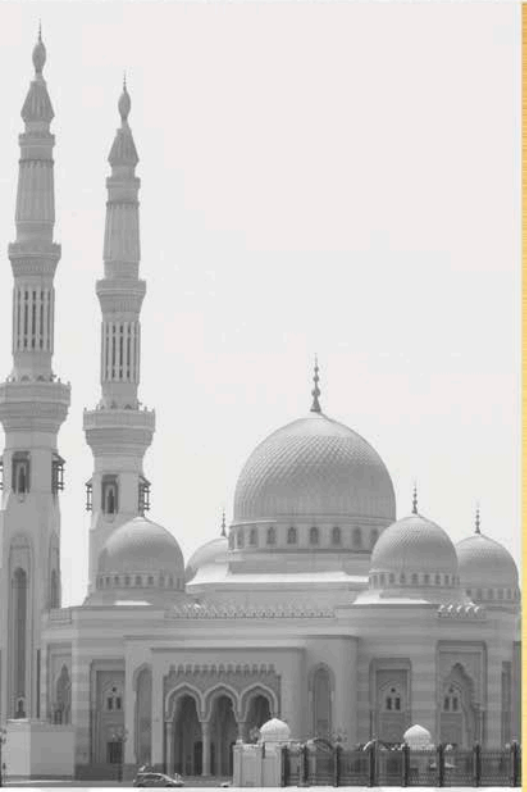

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التعامل مع أزمات العملة: كيف تضمن الدول المتقدمة السيولة، وما الذي يمكن أن تتعلمه إندونيسيا؟ دور التمويل الإسلامي

NAVIGATING CURRENCY CRISES: HOW DEVELOPED NATIONS ENSURE LIQUIDITY AND WHAT INDONESIA CAN LEARN? THE ROLE OF ISLAMIC FINANCE[1]

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الملخص

تدرس هذه الدراسة بشكل نقدي ديناميكيات سيولة العملات في الاقتصادات المتقدمة خلال الأزمتين الماليتين عامي 2001 و2009 وجائحة كوفيد-19، وتقييم فعالية استجابات السياسات لغرض تخفيف الاضطرابات الاقتصادية. من خلال استخدام اختبار t للتباين غير المتكافئ لويلش (*Welch*)، وسببية غرانجر ذات التأخر المتغير (*VLGC*)، ومنهجية *Variable Lag Transfer Entropy (VLTE)* ، وتحليل تماسك التردد الزمني (*time-frequency coherence analysis*)، نكشف عن تباينات كبيرة في ظروف السيولة، ونكشف أن سيولة العملات خلال أزمة كوفيد-19 تجاوزت سيولة الأزمات المالية السابقة. تشير النتائج أيضًا إلى وجود علاقات سببية غير خطية بين مؤشرات السياسة النقدية وسيولة العملات، حيث تمارس آثار كوفيد-19 قصيرة الأجل تأثيرًا أكثر وضوحًا من الآثار طويلة الأجل. إلى جانب التحليل التشخيصي، تتحدى هذه الدراسة أطر الاستجابة للأزمات التقليدية من خلال تقديم التمويل الإسلامي كبديل سياسي قابل للتطبيق للاقتصادات الناشئة، وخاصة إندونيسيا. نجادل بأن الآليات المالية الإسلامية – المتجذرة في مبادئ تقاسم المخاطر والمدعومة بالأصول – قادرة على تعزيز الطلب الكلي واستقرار أسعار الصرف خلال الصدمات النظامية. وبصفتها أول تحليل مقارن لسلوك سعر الصرف خلال الأزمات الصحية والمالية التي شملت الدولار الأمريكي والجنيه الإسترليني والين الياباني، فإن هذا البحث يسد ثغرة جوهرية في الدراسات السابقة، ويقدم حلولاً عملية لصنع السياسات لاقتصادات رابطة دول جنوب شرق آسيا (آسيان). وتدفع نتائجنا إلى إعادة تقييم نماذج إدارة الأزمات، مؤكدةً على الحاجة إلى استراتيجيات نقدية تكيفية، وعلى الإمكانات غير المستغلة للتمويل الإسلامي في تعزيز المرونة الاقتصادية. ولا تقتصر هذه الدراسة على تطوير الخطاب النظري فحسب، بل تزود صانعي السياسات أيضاً باستراتيجيات مبنية على أسس تجريبية لتحصين الأنظمة المالية ضد الاضطرابات المستقبلية.

Abstract

This study critically examines the dynamics of currency liquidity across developed economies during the 2001 and 2009 financial crises and the COVID-19 pandemic, assessing the efficacy of policy responses in mitigating economic disruptions. By employing Welch's unequal variance *t*-test, Variable Lag Granger Causality (VLGC), Variable Lag Transfer Entropy (VLTE), and time-frequency coherence analysis, we uncover significant disparities in liquidity conditions, revealing that currency liquidity during the COVID-19 crisis surpassed that of prior financial crises. Our findings further expose nonlinear causal relationships between monetary policy indices and currency liquidity, with short-term COVID-19 effects exerting a more pronounced influence than long-term impacts. Beyond diagnostic analysis, this study challenges conventional crisis response frameworks by introducing Islamic finance as a viable policy alternative for emerging economies, particularly Indonesia. We argue that Islamic financial mechanisms—rooted in risk-sharing and asset-backed principles—can enhance aggregate demand and stabilize exchange rates during systemic shocks. As the first comparative analysis of exchange rate behavior across health and financial crises involving the USD, GBP, and JPY, this research fills a critical gap in the literature while offering actionable policy prescriptions for ASEAN economies. Our results compel a reevaluation of crisis management blueprints, emphasizing the need for adaptive monetary strategies and the underutilized potential of Islamic finance in fostering economic resilience. This study not only advances theoretical discourse but also provides policymakers with empirically grounded strategies to fortify financial systems against future disruptions.

الكلمات الدالة: كوفيد-19، الأزمة المالية، الوباء، الدول المتقدمة، سيولة العملة.

Keywords: COVID-19, Financial Crisis, Pandemic, Developed Countries, Currency Liquidity.

1.0 Introduction

Historically, various financial crises have been faced by countries worldwide and investors. Kindleberger (1978) anticipated that the financial crisis occurred due to economic crises which burst from a pro-cyclical change in the supply of credit in the markets. But, in the case of COVID-19, it turned the world upside down and resulted in a health crisis. COVID-19 emerged from Wuhan, China, on 23rd January 2020 and widened to peak cases in the middle east and Italy, and subsequently to the US in the middle of March 2020. It caused the US government to announce a national emergency and follow the crowding hypothesis whereby most countries announced the same outcome to reduce the outbreak of COVID-19. Specifically, China and G7 countries are the most affected, with higher recorded cases. The World Economic Forum (2020) indicated that the market-wide circuit breaker dropped to 7% and was triggered 18 times since March 2020 in the US stock market to reduce the market crash. This alarming market reaction is tremendously sensitive to this pandemic crisis that requires unconditional attention from policymakers, investors, governments, etc. For instance, the DJIA, FTSE100 and Nikkei-225 have experienced a significant drop in the index points, as The Guardian (2020) and Bloomberg (2020) reported.

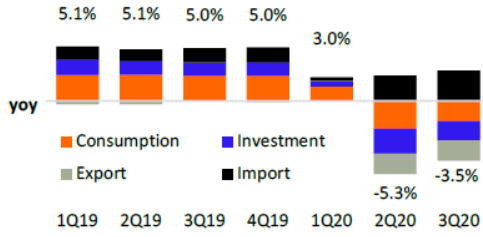
Due to the enormous impact of this health crisis, several kinds of literature concerning COVID-19 are snowballing. Recent studies by Zhang et al. (2020) and Ashraf (2020) confirmed that the impacts of COVID-19 were tremendous on stock market returns, and it varies worldwide. There are shreds of evidence concerning the COVID-19 effects on stock markets in 2020 (Lyócsa and Molnár, 2020; Zhang et al., 2020; Ali et al., 2020; Thaker and Ah Mand, 2021; Mishra et al., 2020). In different dimensions, Conlon and McGee (2020) investigated whether bitcoin can be considered a safe investment during the COVID-19 outbreak. Thaker and Ah Mand (2021) attempted to analyse which time-horizon bitcoin is suitable for investment, given the COVID-19 pandemic. However, this study was focused on Asian countries. Additionally, Yarovaya et al. (2020) show no abnormal herding behaviour in cryptocurrency markets during this health crisis.

Differently, using another perspective, some literature examines how COVID-19 affects the oil and gas industry (Salisu and Adediran., 2020; Devpura and Narayan., 2020; Huang and Zheng, 2020, Liu et al., 2020., Prabheesh et al., 2020). Using Economic Policy Uncertainty (EPU), one study by Sharif et al. (2020) shows that EPU tends to be lower during the COVID-19 pandemic than the geopolitical risks. Evidence on exchange rates is the study by Iyke (2020b), and global trade and insurance is the study by Wang et al. (2020) and C.T. and Prabheesh (2020). Moreover, there are studies on sentimental, emotional and fear (Salisu and Akanni, 2020; Chen et al., 2020) and sectoral economic effects (Xiong et al., 2020; Gu et al., 2020).

On the same note, the COVID-19 impacts on Indonesia's economy were undeniably significant, especially in the financial market, whereby the exchange rate of Indonesian rupiah against the US dollar reached a minimum point since the Asian Financial Crisis. The U.S. Dollar as of March 23 was 16 575 rupiahs despite the Bank Indonesia trying to control local currency movement. Indonesia's stock exchange was also affected by the outbreak, whereby the stock index has fallen around from 6,200 to 4,000 in the final week of March before jumping to 4,500 in April, given the facts of positive sentiments from medical and pharmaceutical industries for the high demand for health products (Hidayat et al., 2020). The first COVID-19 case was recorded in Indonesia in March 2020. Still, the economic growth for the 1st quarter of 2020 reduced from an annual average year-on-year of 5.0% to 3.0%, followed by consecutive contractions of 5.3% in the 2nd quarter of 2020 and 3.5% in the third quarter of 2020, thus the cumulative growth reduced to negative 2.0% (Habir & Wardana., 2020). Reduction in private consumption, investment and export significantly dropped (Figure 1).

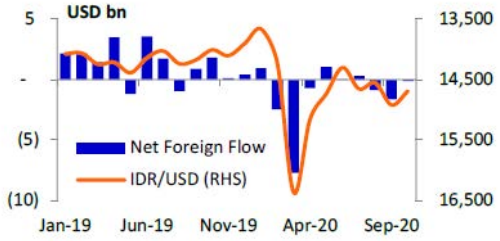
Indonesia's Foreign Direct Investment (FDI) shows worse results; the portfolio investment outflows were recorded at USD 7.7 billion by March 2020. These were the most significant cash outflows since Asian Financial Crisis (Figure 2). However, in May 2020, this value was offset by trade surpluses and USD7.5 billion of external corporate bonds resulting in an improvement in the current account deficit from 2.7 % to 1.2% in 2020. A similar effect on the exchange rate as well. (Habir & Wardana., 2020)

Figure 1: Key Economic Statistics



Source: Central Bureau of Statistics

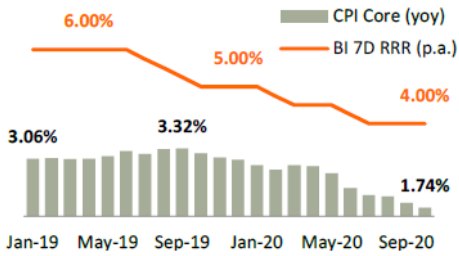
Figure 2: FDI and Foreign Exchange Rate (IDR/USD)



Source: Bank Indonesia, MoF, IDX

Bank Indonesia revised its policy rate by 100bps in four stages of revision (Figure 3). The yield of 10-year government bonds went down from 7.9% in March to 6.8% in July 2020. This further down the bank deposit and lending rates but lowered the demand for bank loans and continued stationary. (Habir & Wardana., 2020)

Figure 3: Policy Rate and Inflation



Source: Bank Indonesia, Central Bureau of Statistics

The impacts of COVID-19 spillover are pretty significant and impact all ASEAN countries, including Indonesia. The expected consequences are deterioration of local domestic consumption, international trade, reduction in tourism activities and health crisis. A simple example is that the tourism industry's impact was recorded between $1.7 billion and $3.4 billion (Abiad et al., 2020). This health crisis is expected to affect the daily livelihood of Indonesians in informal economies as 80% of the employment consists of workers from daily paid and e-hailing industries. Hence, it will bring another crisis, such as severe unemployment and poverty in Indonesia, in which the impacts are vulnerable. As reported by the Ministry of Workforce, Indonesia's unemployment (including formal and informal economies) will increase by 1.2 million, given some industries are practising retrenching policy (Sandi, 2020). Border restrictions will affect their currency flows, weaken their currency value, and impact the domestic economy, particularly MSEs and the overall economy of Indonesia. MSE's contribution to the Indonesian economy or GDP equals 24% in 2018, contributing 99.90% of total business units and 93.87% of employment.

COVID-19 has impacted Indonesia’s financial market and monetary policy subtleties the above. Considering the studies published on the impacts of COVID-19 on Indonesia’s markets, we can focus mainly on the real sector of the economy and fiscal policy aspect. The survey by Susilawati et al. (2020) and Surhayadi et al. (2020), and Hasibuan et al. (2020) focuses on the household sector and fiscal policy responses to COVID-19. The research on what happens to their trading partners and currencies behaviours are limited, and our study comes at the right time to show this research area's significance. More importantly, our research will enhance the current understanding of how currency liquidity crisis could be addressed through the lens of the theory of liquidity preference. During the Covid-19 pandemic, much attention has been paid to how different liquidity preferences will affect market prices and how infectious diseases are managed. These preferences include precautionary savings, cyclical liquidity preference, and rational expectations. Each type of liquidity preference can affect market prices in meaningful ways during the pandemic (Duong et al., 2022). While these types of liquidity preferences can

theoretically affect market conditions in the long-term, it is more important to understand how these preferences could impact local markets and communities during a crisis like the one we are facing now. By understanding how different liquidity preferences can affect the prices of specific assets, we can see how these preferences can influence prices at the local (Indonesian economy in our case) level (Lavoie & Reissl, 2019).

Evidentially, there is clear evidence to indicate that exchange rate behaviour during the COVID-19 crisis is relatively unexplored, especially concerning developed countries. From the above, we can see one study on the exchange rate: Iyke (2020b) did a study to test whether COVID-19 contains any information signalling that can improve the exchange rate return and volatility using selected currencies. Our study received inspiration from their investigation but in a different context. Our analysis uses more comprehensive methodologies such as nonlinear causality (which is fresh evidence in terms of developed countries) as well as the time-frequency domain. Furthermore, our study compares developed country currency's liquidity during two major financial crises and the COVID-19 period. Moreover, we utilize developed countries as the study sample, which is also relevant to the Indonesian market. We chose the three major developed countries for the analysis because of the excellent trading partnership among the three countries with Indonesia. Thus, the three selected currency movements will aggressively influence the Indonesian market (trading flows influenced by inflows and outflows of currencies given the export and import activities). So, it is crucial to know how the counterparty countries' currencies behave during the crises. Thus, the Indonesian policymaker or government can take the necessary actions or policy implementation in future in the case facing equivalent crises. To make our study more comprehensive, we also propose the role of Islamic finance during the crisis-era and the way forward. Therefore, based on the facts mentioned above, our study aims to investigate the impact of COVID-19 on the THREE developed currencies' liquidity. Hence, our study set out the following research questions:

1) How does the currency liquidity of YEN, USA and UK countries behave during the various financial crises?

2) How is the nonlinear causal relationship between currency liquidity with the COVID-19 and monetary policy rate?

3) How is the time-frequency dynamics of currency liquidity for YEN, USA and UK countries during the pandemic time?

3) What are the mitigation plans taken by these developed countries against COVID-19?

4) How Islamic finance can contribute to the further development of the Indonesian market and the way forward.

To the best of our knowledge, the current study is the first study to compare the exchange rate behaviour during the health crisis and other financial crises involving YEN, USA and UK currencies and propose some policy implementation to major Asean countries like Indonesia. This research will enrich the current literature standpoint on this field of research. Additionally, our study will assist governments or policymakers in designing a better blueprint to enhance economic activities and exchange rates in the case of crises management by learning from the past and mitigation plans implemented in developing countries. The role of Islamic finance during the crisis-era would significantly contribute to this paper. The paper is organized as follows: Section 2 discusses the related literature and section 3 describes the methodology. Section 4 illustrates the data sources and description, and section 5 briefly explains empirical results. The last three sections discuss the mitigation plan by developed countries, the role of Islamic finance and the conclusion.

2.0 Literature Review

2.1 Theoretical underpinning

The theory of liquidity preference is an economic theory that attempts to explain why people prefer cash over other forms of investments, such as stocks or bonds (Oreiro et al., 2020). Money provides people with security because it is easy to store and transport and provides investors with an easy way to access their investments if the need arises. Equally, Lavoie and Reissl (2019) debate that individuals would make all of their financial decisions based on current information and their preferences for saving and spending in a perfect world. In reality, this is not the case. Instead, we make decisions based on our current income

or expected future income and growth (Duong et al., 2022). Additionally, we tend to make decisions based on past experience and current market trends rather than information directly relating to the current situation. This tendency to base our decisions on what has worked in the past is known as rational expectations theory. Hommes, Massaro, and Weber (2019) accentuate that rational expectations theory posits that individuals will use past trends and data to make predictions to determine how to invest their money. This type of liquidity preference can be heavily influenced by recent events and news cycles that cause large market swings and investor confidence. As a result, the markets tend to react quickly to changing conditions and overreact in many cases to news that doesn't directly impact the markets in the long run. Furthermore, individuals in a panic generally feel forced to sell their assets and hoard money to protect what they have rather than wait to see how the economy plays out (Chang, McAleer, & Wang, 2020).

When traders and investors behave this way, it causes them to be net sellers in the market and causes asset prices to fall in the short term as investors sell off their assets to lock in profits or preserve their capital (Duong et al., 2022). On the other hand, if people are calm and patient, they tend to hold on to their investments and wait for markets to recover (Oreiro et al., 2020). From this perspective, we can understand why people make some financial decisions during the current market crisis based on emotions rather than logic. With so much uncertainty surrounding the economy's and the markets' future, it is understandable that people may be scared out of investing altogether. As a result, they may choose to keep their money in cash until things calm down a bit. However, suppose this continues for too long. In that case, it will likely lead to increased market instability and a lack of confidence in the economy and the markets, which will negatively impact everyone's investment portfolios (Chang, McAleer, & Wang, 2020).

2.2 Empirical findings

The existing literature on monetary policy and financial markets focuses on the transmission of monetary policy to one single market parameter such as bond yields (Chen et al., 2020), stock market returns (Bayraci et al., 2018., Ferrer et al., 2016), an exchange rate (Bouakez & Normandin, 2010) and CDS spreads (Chung & Chan, 2010; Hull et

al., 2004 and Alexander & Kaeck., 2008). In another dimension of literature, the approach skews toward the event-study process to capture the movement. For instance, Claus et al. (2018) measure the effect of conventional and non-conventional monetary policy shocks on government bonds, corporate bonds, gold index real estate and exchange rates in the US market. The authors found that responses to policy shocks are consistent with one another but are often greater and more substantial during the atypical phase. Although some indicators indicate a higher transmission of shocks, the larger reactions are primarily the result of stronger shocks in the unconventional period. Equally, regarding the global coronavirus outbreak and the probable economic repercussions of interest rates remaining low for longer, Sieroń (2023) evaluates the effectiveness of aggregate demand management and interest rate reductions. The author contends that keeping interest rates excessively low for an extended period of time can compromise their signalling and allocation capabilities and result in serious long-term negative effects, including resource misallocation, excessive risk-taking, economic zombification, and debt build-up

Since this study mainly focuses on COVID-19, in this section, we only look at the recent literature on COVID-19. There are few historical studies in this area as the post-COVID-19 literature, and financial markets show positive and growing trends in academic research. Scholars in finance and economics quickly produce research papers to urge policymakers/governments to look at the impact of this pandemic on financial markets. The study by Yarovaya et al. (2022) concluded that pandemic time benefitted the scholars in carrying out extensive studies regarding the impact of a pandemic on financial markets. The authors further recommend that future studies should investigate the nature of return and volatility transmission relationships, which occur in the geographical sequences of markets trading in the intra-daily time intervals, and the fact that high frequency data (i.e., higher than daily) have not yet been used very extensively in the existing contagion literature, we believe that this current study will bridge the research gap. Goodell (2020) also postulates the same view as Yarovaya et al. (2020), whereby some new area of research has emerged given the impacts of the pandemic. The

dimensions of analysis are diversified in terms of methodology, research objectives etc. The authors contend that most of the prior research was mainly concentrated systematic literature review (SLR) basis which basically failed to provide robust empirical findings and suggested investigating empirically the money market and covid-19 nexus with help of a large data set and advanced statistical approach. Ozili and Arun (2020) argued that during the pandemic time, in the context of the Nigerian market, investors tended to move towards safer investments such as government bonds and unit trust instead of the highly volatile stock market.

Similarly, Corbet et al. (2020) highlighted that gold and cryptocurrency seem to be a flight to the safety zone compared to the equity market, especially during the COVID-19. Besides, Sharif et al. (2020) mentioned that the pandemic seems to have a more substantial implication in terms of geopolitical instability than economic instability. The study looks at the association between the pandemic, oil prices, equity market, geopolitical risk and economic policy uncertainty in the US market. The authors further recommend that future researchers must need to extent this study with a large data set that can incorporate global evidence. Likewise, Ashraf (2020) postulates that COVID-19 negatively responded to stock markets, and this conclusion was made using 64 countries but the author unfortunately overlook the advanced statistical methodology and robustness test. Following that, Izzeldin et al. (2020) studied the impact of COVID-19 on G7 equity markets. They found that almost all business sectors realized adverse losses during the pandemic, especially the US and the UK. The authors suggested to see the real spillover impact of covid-19 that transmit from a developed to a developing country.

What we know about the effect of the policy rate is primarily based on observational studies that investigate how policy rates impact the stock market movement. A recent survey by Ozili and Arun (2020) argues that during the pandemic period between March 23rd and April 23rd, 2020, there was evidence showing that policy rates negatively impacted the stock price movements in North America, Africa, Asia, and Asia Europe. Concerning exchange rate research pre and during the pandemic time, Yilmazkuday (2022) examined the impact of US

monetary policy on exchange rates employing a vector autocorrelation model from 12 developed countries and 11 emerging countries. The findings imply that evidence for the spillover effects of U.S. monetary policy existed for nearly all nations before COVID-19, however, they were only effective for a small number of countries during COVID-19. While Bhar and Malliaris (2020), in their comprehensive approach, found that the unconventional monetary policies implemented by FED after the 2008 financial crisis resulted in reducing the longer-term interest rates and the central bank learned a lesson from this implementation, but unfortunately this study failed to address whether the same policies may apply to this pandemic or not. Additionally, Using the NK-DSGE paradigm, Shah and Garg (2023) investigate the efficiency of fiscal and monetary policy in reducing the effects of COVID-19 in India. The findings suggest that expansionary monetary policy is successful in stimulating economic development from both the demand side and the supply side. On the other hand, expansionary fiscal policy only works from the supply side.

Given all that has been mentioned so far, there remain several aspects of currency behaviour during a crises about which relatively little is known. Overall these studies suggest that some studies touch upon a single country and more than one country; some are based solely on the COVID-19 pandemic, single monetary policy and exchange rate. We believe that looking into developed countries and comparing currency liquidity with other financial crises solely with the exchange rate will enrich the literature on the exchange rate, especially in the context of the Indonesian market. Furthermore, looking at the role of Islamic finance during the crisis period, especially for the Asean zone, is limited in the existing literature. Thus, our study is timely needed research for the policymakers.

3.0 Estimation

3.1 Variable Choice

Our research questions require the operationalization of currency liquidity variables for the analysis. Several techniques have been developed in this regard. However, we adopt the currency-based liquidity specification conceptually supported by finance literature. Hence, we adopt the methodology of Domowitz et al. (2001) to

measure currency liquidity. Therefore, the currency liquidity is calculated as the spread between bid and ask prices in the same trading (Domowitz et al., (2001); Yu Chen and Yin Gau., 2014).

A variety of methods are utilized to assess currency liquidity. Each has its advantages and drawbacks. However, the process we quantify in the current study suggests that the supply and demand of the currency as currency liquidity reflect various market dimensions reflected in the temporary price fluctuations that allow transactions to be made. Thus, the spread between currency bid and ask prices is the most popular liquidity estimator (Yilmaz et al., 2015). In this regard, the lower the spread, the more liquidity is offered. Moreover, our study uses the Oxford COVID-19 index available on the Oxford COVID-19 Government Response[2] and the Federal Reserve rate to proxy for monetary policy in the currency market.

3.2 Methodology

First, we compare the statistical significance of the difference between the mean instrument liquidity for various crises periods using Welch's version of the unequal variance t-test. Second, we employ variable lag Granger causality (VLGC) introduced by Amornbunchornvej C et al. (2020) to capture the nonlinear Granger causality between currency liquidity and the COVID-19 index as well as monetary policy rate. At this stage, we also include the result of variable lag transfer entropy (VLTE) that is considered monitoring the linear causal effect to prove our estimation of nonlinear is superior to the linear approach[3].

Our justification for employing the nonlinear causal effect derives from the fact that fixed time delay does not hold in financial markets (Amornbunchornvej C et al. 2020). The nonlinear causality works by relaxing the assumption of a fixed time lag effect between any time point of the series. Following is the generalized form of nonlinear basis that we use in our estimation;

[2] Available from https://www.bsg.ox.ac.uk/research/research-projects/coronavirus-government-response-tracker#data.

[3] We omit reporting the linear causal effects to avoid clutter. Full results are available from the corresponding author upon reasonable request.

$$r_{YX}^{*}(t) = Y(t) - \sum_{i=1}^{\delta_{max}} \left(a_i Y(t-i) + b_i X(t-i) + c_i X^{*}(t-i)\right) \quad (1)$$

Where r_Y and r_{YX} are the residual terms, a_i and b_i are constant terms used to minimize the residuals of the regression optimally. The constant terms a_i , b_i and c_i optimally minimize the residuals r_Y, r_{YX} and r_{YX}^{*} and the VLGC holds if the variance of r_{YX}^{*} is less than the variances of r_Y and r_{YX}.

The final part of our analysis shed light on the new vision in the time-frequency domain using coherence analysis. Uncovering an important question on the time horizon of currency liquidity, COVID-19 and monetary policy index for developed countries would challenge the general view in the current empirical literature. Thus, research in finance and economics witness the growth of wavelet transformation analysis. However, although several aspects of wavelet methodology suit our study, we do not anticipate counting the advantages of wavelet methodology. But we agree that the implementation of wavelet analysis enables us to fetch high-quality information confined into a signal in various scales.

Using a wavelet transform requires a restricted waveform expressed as Ψ(t)W(t); commonly called a mother wavelet. While the mother wavelet integrates to zero, its harmonizing normalized counterpart ϕ integrates to 1 and is known as a father wavelet. The former is used to interrogate signals in greater detail and, therefore, more relevant for higher frequency testing. As such, we go on to build a wavelet function by forging a series of plans including mother and father wavelets. This is achieved via the mathematical formulation below:

$$\psi_{s,k}(t) = \frac{\psi(\frac{t}{2^s} - k)}{2^{\frac{j}{2}}} \quad (2)$$

$$\phi_{s,k}(t) = \frac{\phi\left(\frac{t}{2^s} - k\right)}{2^{\frac{s}{2}}} \quad (3)$$

In the two equations above, s=1,…, S, S and k are scaling and translation parameters respectively. Also, the wavelet transformation of a signal can be represented as:

$$y(t) = \sum_k \theta_{s,k}\phi_{s,k}(t) + \sum_k d_{s,k}\psi_{s,k}(t) + \sum_k d_{s-1,k}\psi_{s-1,k}(t) + \ldots + \sum_k d_{1,k}\phi_{1,k}(t) \quad (4)$$

The smooth coefficient is $\theta_{s,k} = \int y(t)\phi_{s,k}(t)dt$ and detail coefficient is $d_{s,k} = \int y(t)\psi_{s,k}(t)dt$. Together, $\theta_{s,k}$ and $d_{s,k}$ represent how much a particular wavelet function contributes to the overall signal. Following the methodology of Rua and Nunes (2009) and Kristoufek (2013), we could estimate the wavelet Morlet as follows:

$$\psi_{u,s}(t) = \frac{1}{\sqrt{s}}\psi(\frac{t-u}{s}), \varphi(.)L^2 \subset R \quad (5)$$

At this stage, the cross-wavelet spectrum series are:

$$W^1_{COVID-19,\ Index}(\tau, s) = W_{FED}(\tau, s)W^*_{Index}(\tau, s) \quad (6)$$

$$W^2_{COVID-19,\ Index}(\tau, s) = W_{BAS}(\tau, s)W^*_{Index}(\tau, s) \quad (7)$$

$$W^3_{BAS,\ Index}(\tau, s) = W_{FED}(\tau, s)W^*_{Index}(\tau, s) \quad (8)$$

In accordance, the cross-wavelet spectrum's cross-coherency takes the absolute value of the squares of the smoothed spectrums, as follows:

$$CC^2_{(\tau,s)} = \frac{|S(s^{-1}W_{x,y}(\tau,s)|^2}{S(s^{-1}|W_x(\tau,s)|^2)S(s^{-1}|W_y(\tau,s)|^2)}$$

(9)

Equations 5-7 are useful for capturing the degree to which two time-series co-move across time and frequencies, an improvement over Fourier transforms which deal with frequencies alone. A term $CC^2_{(\tau,s)}$value ranges from 0 to 1, where 0 indicates no co-movement and 1 perfect strong co-movement.

Our method is superior to that of our opponents in a number of ways, including the following: (i) We use conventional economic testing by adopting the Welch (1947) test, which is widely established in both the field of finance and the field of social science. (ii) As was said before, the nonlinear causality method does not adhere to the requirements of the one-lag effect assumption of Granger causality. More broadly speaking, this assumption refers to a fixed lag. Because of this, the method described here is superior to alternative causality assessments (Amornbunchornvej et al. 2020). (iii) In comparison to

other data-driven approaches, the wavelet technique offers a variety of benefits, all of which have contributed to its increased popularity as an estimator among academics in recent years. One of the many benefits is that it is possible to use them for data that is not stationary. In addition to this, wavelet analysis can examine the time and frequency domains, which puts it in a more favourable position compared to other approaches (Thaker and Ah Mand, 2021).

3.3 Sample

The empirical investigation of our research consists of three parts. First, we compare the liquidity of three developed currencies (USA, UK, and Japan) during past crises (2001 and 2009) and the COVID-19 pandemic. This research uses daily data from 1st December 1998-25th December 2020. The rationale behind the selection of these currencies are as follows: USD is a dominant currency in international trade and finance, making it widely used and recognized. Additionally, many countries hold USD as a reserve currency, addition to stability and reliability. Finally, US economy is one of the largest in the world, making the USD a safe heaven currency during times of economic uncertainty (Yilmazkuday, 2020).

GBP on the other hand, considered as a widely accepted currency and traded globally which makes it easily convertible to other currencies. Also, UK has a strong economy and financial system, making it reliable currency with a stable value. From the banking system, London is a major financial center and hub for international trade, further increasing the value and importance of the GBP. Lastly, we select JPY which represents Japan in our study for the following reasons. Japan has a strong economy and financial system and makes it a safe currency during times of global economic uncertainty. Also, Japan is a significant trade partner with many countries, leading to widespread use of the JPY in international trade transactions. Furthermore, low inflation rate and strong government fiscal policy, making the JPY a stable and predictable currency.

The second part of our empirical investigation highlights the nonlinear causal relationship between developed countries' currency liquidity with the COVID-19 index and the monetary policy rate (US Federal Reserve Rate). Finally, we investigate the time domain co-movement between currency liquidity, the COVID-19 index and the

monetary policy rate. For the second and third part of our empirical investigation, the data spans the period from the beginning of the COVID-19 pandemic until 25th December 2020. We adopt the classification of the crises from the chronology of The National Bureau of Economic Research (NBER) to identify the crises period. The final analysis consists of Islamic finance's role in Indonesia's context and the way forward.

4.0 Data Sources and Descriptions

Our study investigates the currency liquidity of three main developed countries, namely: The countries namely are; Japan, the United States and the United Kingdom. As mentioned earlier, the liquidity measure which we use is the spread between currency's bid and ask prices on a transaction day. The daily currency prices were utilized for this purpose. The data for our study was secured from various sources such as Thomson Reuters DataStream and the Oxford COVID-19 Government Response Tracker (OxCGRT). The OxCGRT is generated by the Blavatnik School of Government at the University of Oxford. It tracks and scores the responses of governments to the COVID-19 pandemic in real-time. The OxCGRT uses a standardised framework to track and score the measures taken by governments in areas such as public health, economics, and social policy.

The measures are collected through various sources, including official government statements, news articles, and publicly available data. Once collected, the measures are scored based on their stringency and assigned a numerical value (we employ the difference between the death statistics for each country in our sample). The scores are then aggregated to produce an overall score for each country, representing the stringency of their response to the pandemic. The OxCGRT provides regular updates and allows for comparisons between countries. This information can be useful for researchers, policymakers, and the public in understanding the responses of different governments to the COVID-19 pandemic and how they have impacted their populations[4].

[4] More information of OcCGRT can be found at Blavatnik School of Government at the University of Oxford webpage.

Table 1 Panel A, B and C show the descriptive statistics of the database related to the currency liquidity, the COVID-19 index and the monetary policy rate for the countries mentioned above. At this stage, we divide the study samples into three panels of investigation; Panel A is for the COVID-19 index, Panel B is for currency liquidity, and Panel C is for the federal reserve (monetary policy) rate.

From Panel A, we observe that Japan has the least volatility for the COVID-19 index among other countries, with a standard deviation of 0.06. From panel B, it is observed that British Pound and US Dollar have the highest liquidity and least volatility, with the standard deviation of 0.00 and 0.0013, respectively. From panel C it is also observed that the highest and lowest monetary policy rate for the study period stands at 2.445 and -1.609 respectively.

Additionally, the evidence of non-normality holds for all series and panels under investigations by the Jarque-Bera test and the excess kurtosis (i.e., heavy-tailed). Thus, the assumption of normally distributed are violated for all series of under the investigations.

Table 1: Descriptive Statistics

Panel A- The COVID-19 Index			
	Japan	**UK**	**USA**
Mean	0.03194	0.03837	0.04609
Median	0.01191	0.01049	0.01226
Maximum	0.69315	1.38629	0.91629
Minimum	0.00000	0.00000	0.00000
Std. Dev.	0.06539	0.09748	0.10657
Skewness	5.81755	8.29305	4.02259
Kurtosis	47.94851	104.07500	22.85939
Jarque-Bera	32695.45	159117.50	22.86
Observations	364	364	364
Panel B- Currency Liquidity			
	Japan	**UK**	**USA**
Mean	-0.03847	-0.00019	-0.00025

Median	-0.03000	-0.00018	-0.00021
Maximum	-0.01000	0.00000	0.00014
Minimum	-0.10000	-0.00051	-0.00116
Std. Dev.	0.01359	0.00000	0.00013
Skewness	-2.01588	-0.55908	-1.89292
Kurtosis	8.10507	3.26483	7.33586
Jarque-Bera	10154.00	316.85	7950.35
Observations	5759	5759	5759

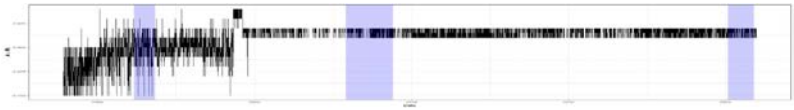
Panel C- Federal Reserve Rate	
Mean	-0.000104
Median	0.00000
Maximum	2.445686
Minimum	-1.609438
Std. Dev.	0.115826
Skewness	2.441505
Kurtosis	92.73849
Jarque-Bera	8171407
Observations	24281

Before we proceed with the findings, Figure 4 displays changes in a bid-ask spread (currency liquidity) for a group of developed country currencies for the study period (shaded areas are NBER recessionary period). From Figure 1, it is noticeable that the spread between the bid and ask price has reduced in other words, the liquidity of currencies had increased for all the three countries. It is an indication that currencies became more liquid throughout the investigation period.[5]

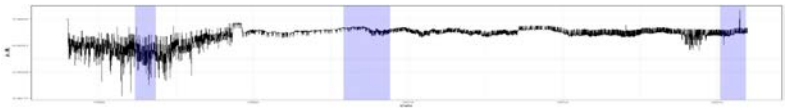
[5] Behavior of Bid-Ask Spread for individual countries are presented in Appendix A.

Figure 4. Shaded area presents crises period- 2001,2009 and the COVID-19 crisis

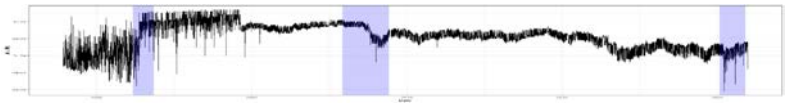
Japan



USA



UK



5.0 Empirical Results

Following the traditional empirical investigation process, we start our empirical investigation with a unit root test to investigate the stationarity of data used in our study. For brevity purpose, we omit discussion on unit root analysis. Nevertheless, our series are stationary at 1% and 5% level and the details are presented in Table 2.

Table 2: Unit Root Test Results Based on Augmented Dickey-Fuller test statistic

	BAS	Prob	COVID-19	Prob	FED	Prob
Japan	-4.8534	0.0000	-5.1297	0.0000	-26.4262	0.0000
UK	-2.8590	0.0504	-3.7418	0.0039	-26.4262	0.0000
USA	-3.7381	0.0036	-3.4148	0.0111	-26.4262	0.0000

* significant at 5% level.

The first set of our findings is related to comparing the currency liquidity during different financial crises times. At this stage, the change in currency liquidity of individual country during three different financial crises of 2001, 2009 and the COVID-19 are investigated. To compare currency liquidities during crises time, Figure 1 and the t-statistic by employing Welch's version of unequal variance shows that currencies' liquidity in three developed countries has experienced a gradual growth from 2001 until 2020 (as we discussed in Figure 4).

Our analysis of currency liquidity during the COVID-19 crisis in comparison to other crises reveals that the pandemic had a significant impact on European currencies. This supports the hypothesis that a country's operating system can impact currency liquidity, as found in Będowska-Sójka (2018). In this regard, the COVID-19 pandemic has not only had a negative impact on the population's health but also affected the economy. Comparing the current and previous crises provides valuable insights into the scale of the COVID-19 pandemic's effect on the economy. The results are consistent with the hypothesis that a country's operating system can influence the liquidity of its currency. This insight is significant as it highlights the importance of a well-functioning financial system in mitigating the impact of such crises.

Overall, our first empirical result sheds light on the relationship between the COVID-19 pandemic and currency liquidity and contributes to our understanding of the economic impact of the pandemic. However, several limitations and areas for improvement should be considered. Firstly, the scope of the study is limited to countries, which may not be representative of the global impact of the pandemic. A more comprehensive study that includes countries from other regions would provide a more robust and comprehensive analysis. Secondly, the study relies on a hypothesis that is based on previous research by Będowska-Sójka (2018). However, this hypothesis should be tested and confirmed through further research, as other factors may contribute to currency liquidity. Additionally, our study does not provide any recommendations for mitigating the pandemic's impact on currency liquidity. This would be a valuable contribution and could provide useful information for policymakers.

Finally, the study only focuses on currency liquidity and does not consider other aspects of the economy that may have been affected by the pandemic, such as employment and consumer spending. A more comprehensive analysis that considers multiple aspects of the economy would provide a more complete picture of the impact of the pandemic. Meanwhile, details of Welch's t-statistic results are presented in Table 3.

Table 3: Welch's t-test for Three Developed Countries

Japan				
Applicable Recessions	**1 tailed (p-value)**	**2 tailed (p-value)**	**3 tailed (p-value)**	**Mean of Spread**
COVID vs 2001	0.000000	2.9595E-247	4.0312E-215	-0.049657143
COVID vs 2009	0.000000	1.1812E-33	1.57644E-49	-0.032615385
COVID				-0.032723404
UK				
Applicable Recessions	**1 tailed (p-value)**	**2 tailed (p-value)**	**3 tailed (p-value)**	**Mean of Spread**
COVID vs 2001	0.000000	1.5184E-138	4.4831E-126	-0.000162686
COVID vs 2009	0.000000	5.9801E-144	1.7776E-178	-0.000153718
COVID				-0.000273447
USA				
Applicable Recessions	**1 tailed (p-value)**	**2 tailed (p-value)**	**3 tailed (p-value)**	**Mean of Spread**
COVID vs 2001	0.000000	2.9232E-236	8.0777E-238	-0.000516743
COVID vs 2009	0.000000	3.4225E-166	1.3915E-190	-0.000161436
COVID				-0.000207106

The second part of our empirical study investigates the nonlinear relationship between the currency liquidity of the three countries with the federal rate policy rate (FED) as a proxy of monetary policy and the COVID-19 index. In this regard, as mentioned earlier, currency liquidity is measured by the difference between currency bid and ask price (BAS) on a trading day. In analysing the

nonlinear causal effects, we considered all alternative causal effects between three variables (BAS, the COVID-19 index and FED) by employing the variable lag causal relationship for each country and sample of all three countries[6].

Table 2 presents the findings of the nonlinear causality for the sample of the individual country. As we expected, the nonlinear relationship from BAS to the COVID-19 for all individual countries were not captured. Furthermore, the nonlinear causality between BAS and FED also does not exist for all countries except the UK. This relationship also holds true for a sample of three countries, and BAS shows that it does not affect FED. Moreover, the nonlinear causal effect of the COVID-19 index on FED shows significant results for all the countries as well as the whole sample data. Furthermore, the COVID-19 shows that the nonlinear effect on BAS holds true for all countries except for the UK and the US[7].

This finding shows the importance of the exogenous crises variable of the COVID-19 on the currency liquidity for the UK and US. This finding is also in line with our earlier result on the lower currency liquidity during the COVID-19 crisis for the three currencies. The results of our second investigation have important implications for stakeholders in the currency market, including policymakers, institutions, and individual participants. The results demonstrate the impact of the COVID-19 pandemic on exchange rates in European countries, reinforcing the idea that a country's operating system can play a role in shaping currency liquidity. This highlights the need for careful consideration of these factors in decision-making processes. The results also underscore the importance of government monetary actions, such as stimulus packages, in mitigating the negative impact of economic crises. The relationship between monetary policy and currency is complex, with the study finding a nonlinear causal relationship. This supports previous research by Yilmazkuday (2020)

[6] For comparison purposes, we tested nonlinear causality by using Variable Lag Entropy Function as well. Our findings confirmed the superiority of nonlinear causality findings as linear causality failed to find causal relationship for almost all the countries and variables.

[7] The nonlinear causal effect from the COVID-19 to BAS holds true when all three countries sampled.

on the negative association between US monetary policy and currency and provides further evidence of the crucial role of monetary policy in shaping currency market outcomes. Additionally, the findings on the negative association between the COVID-19 index and monetary policy in three countries represent a new and valuable contribution to the field. This insight provides a clearer picture of the specific impact of the pandemic on the economy and offers guidance for policymakers on how to respond effectively in times of crisis.

Table 4: Nonlinear Causality Test

	Japan	**UK**	**USA**
BAS vs COVID-19	X	X	X
BAS vs FED	X	√	X
COVID-19 vs FED	√	√	√
COVID-19 vs BAS	√	X	X
FED vs BAS	√	√	X
FED vs COVID-19	X	X	X

Lastly, the causal effect of monetary policy on BAS was not detected for almost all countries except for Japan and the UK[8]. However, the alternative is not captured for all individual countries. The detailed results on the nonlinear causal effect and variable lag entropy results are presented in Table 5

Table 5: Nonlinear Causality and VL Entropy Results

Nonlinear Causality		**X→Y**	**p-value**	**VL Entropy Function**	
				X→Y	**BIC**
Japan	**Y=BAS, X=COVID-19 t-test**	FALSE	F(1)	FALSE	-0.5984683

[8] The nonlinear causal effect from the FED to BAS holds true when all three countries sampled.

	Y=BAS, X=FED t-test	FALSE	F(1)	FALSE	-0.290474
	Y=COVID-19, X=FED t-test	TRUE	T(0)	FALSE	-0.01633292
	Y=COVID-19, X=BAS t-test	TRUE	T(8.359797e-10)	FALSE	-0.01633292
	Y=FED, X=BAS t-test	TRUE	T(1.110223e-16)	FALSE	-0.01633292
	Y=FED, X=COVID-19 t-test	FALSE	F(1)	TRUE	0.649557
Nonlinear Causality		**X→Y**	**p-value**	**VL Entropy Function**	
				X→Y	**BIC**
UK	**Y=BAS, X=COVID-19 t-test**	FALSE	F(1)	FALSE	-0.07770098
	Y=BAS, X=FED t-test	TRUE	T(2.329186e-06)	FALSE	-0.3056794
	Y=COVID-19, X=FED t-test	TRUE	T(0)	FALSE	-0.01633292
	Y=COVID-19, X=BAS t-test	FALSE	F(0.6744166)	FALSE	-0.01633292

	Y=FED, X=BAS t-test	TRUE	T(0.6744166)	FALSE	-0.01633292
	Y=FED, X=COVID-19 t-test	FALSE	F(1)	TRUE	0.6936509
Nonlinear Causality		**X→Y**	**p-value**	**VL Entropy Function**	
				X→Y	**BIC**
USA	**Y=BAS, X=COVID-19 t-test**	FALSE	F(1)	FALSE	-0.01633292
	Y=BAS, X=FED t-test	FALSE	F(1)	FALSE	-1.277684
	Y=COVID-19, X=FED t-test	TRUE	T(0)	FALSE	-0.01633292
	Y=COVID-19, X=BAS t-test	FALSE	F(1)	FALSE	-0.01633292
	Y=FED, X=BAS t-test	FALSE	F(0.8051402)	FALSE	-0.01633292
	Y=FED, X=COVID-19 t-test	FALSE	F(1)	TRUE	0.6236734

Our final objective is to investigate the time-frequency dynamics of three countries' currency liquidity during the pandemic. The results are presented in Figures 5-7. The horizontal line in Figures 5-7 indicates the number of years whereas the vertical line outlines the

frequency component (scale). The yellow indicates higher coherency of the COVID-19 with the selected variables while the blue represents lower co-movement between the two variables. Moreover, the black solid silhouettes resemble that the co-movement is significant at 5%, given a specific time and frequency.

Figure 5: Wavelet Coherence: The COVID-19 Index vs FED

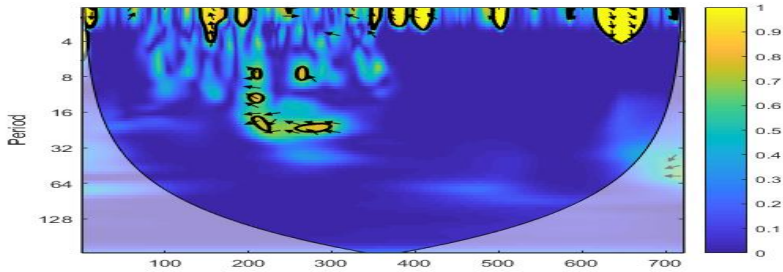


Figure 5 shows the wavelet coherence for the COVID-19 index and FED. The blue colour covers a large proportion of the cone (short until long term). Meaning, the time domain co-movement is commonly weak, one of the reasons is because the COVID-19 was unpredictable in the three countries and the government try to focus mainly on the spread reduction and at the same time maintaining a good standard of living. A small portion of yellow colour can be noticed in the corn in the short term, but it is not that significant. The wavelet phase difference specifies the dynamic relationship of indexes or returns by looking at the lead-lag association between the paired sets (example: A and B). The arrows set out the lead-lag relationship between the series. If the phase arrow points to the right, this signals that the relationship follows a positive co-movement (in phase: A and B). If the arrow points to the left, the relationship is out of phase (negative co-movement: A and B). If the arrow points down, it implies the price or return of A leads to the price or return of B. If the arrow points up, then B leads A. For the case of the COVID-19 and FED, in the medium period, the arrows point to the left indicates the relationship is out of phase between these two variables while in the short period, the arrow point to the down implies that the COVID-19 index leads the FED rate. The long-term did not reveal any relationship.

Figure 6: Wavelet Coherence: The COVID-19 Index vs BAS

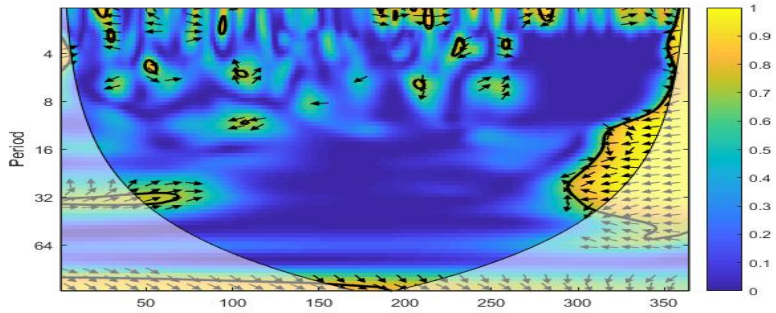
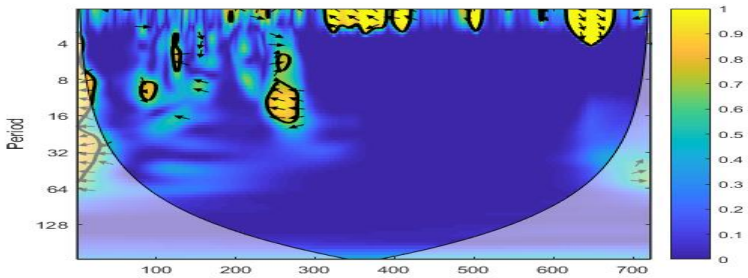


Figure 6 shows the time-frequency domain for the COVID-19 index and BAS. At this point, the blue colour dominates the yellow colour (although some small yellow colon can be noticed in the con). The lead-lag relationship is also showing mixed outcome for the COVID-19 index with BAS. However, in the medium term, the yellow seems to predominately be higher towards the results of depreciation of exchange rate due to less economic activity. Figure 7 presents the Wavelet Coherence of FED and BAS. Like our findings in Figure 3, the blue colour covers a large proportion of the cone (short until long term). Only in the short term can a small part of yellow colour indicate less association between these two variables. Most of the arrows point to the left, meaning it is out of phase relationship, meaning they are on opposite sides. As time progresses, the arrows point to the down implying the BAS movement leads the FED rate.

Figure 7: Wavelet Coherence: FED vs BAS



From these three figures, we can conclude that in the short-term, the COVID-19 index impact on FED and BAS is quite predominant as compared to the long-term. As the COVID-19 pandemic continues to evolve, a number of factors have emerged that have contributed to the positive development of currencies in the three countries under investigation. These factors include the rapid development of vaccines, government policies aimed at boosting economic activity, and increased trade openness. These developments have played a significant role in strengthening the currencies of the three countries and stabilizing their economies.

The time-frequency domain analysis in this study supports our earlier findings on the nonlinear causal relationship between variables. The results suggest that the positive impact of these factors on the economies of the three countries has been consistent over time, leading to a general trend of strengthening currencies and improving economic conditions. This highlights the importance of considering a wide range of factors when analysing currency markets and economic conditions, especially for financial market participants. In particular, it underscores the crucial role of government policies and global trade developments in shaping the health of currencies and economies. These findings are valuable for investors, traders, and other financial market participants, who can use this information to make informed decisions about currency investments and trade activities. Furthermore, the findings of this study can also be used by financial institutions and policymakers to formulate monetary and fiscal policies that are more responsive to changing economic conditions and to better understand the impact of global events and trends on currency markets.

6.0 Mitigation plans by developed countries to achieve V- Shape recovery

6.1 Japan

One of the mitigations plan that Japan has taken to reach the V-Shaped recovery is to push consumption and investment in digitalization and promote remote-based technologies. Japan aggressively focuses on public and private partnerships supporting all economic sectors such as tourism, food and beverages, and entertainment. The Japanese government also supplied incentives to push aggregate demand by

awarding some vouchers and points rewards. Furthermore, revitalization of the regional economy, such as the agricultural economy via inbound tourism and aggressive promotion. In addition, to make the Japanese economy more resilient, the Japanese government tend to make the supply chain more resilient, strong support to the export and domestic production of agriculture, forestry and fishery and public investment.

6.2 United Kingdom (UK)

UK focuses on many aspects when comes achieving V-Shaped recovery. Below are actions plan taken by UK government:

i) Loan Program for Smaller Businesses: Under this programme, companies based in the United Kingdom with an annual turnover of no more than £45 million are eligible to borrow up to £5 million without paying interest for 12 months. This programme is offered by the British Business Bank (BBB), and it is part of a scheme in which the government provides a guarantee to the lender for 80 percent of each loan (subject to a claim limit per lender) and pays the cost of the first 12 months of interest.

ii) COVID-19 Corporate Finance Facility (CCFF) - to provide funding to large businesses through the purchase of short-term corporate debt in the form of commercial paper. CCFF is an acronym for COVID-19 Corporate Finance Facility.

iii) The Coronavirus Fund for Frontline Charities will provide financial assistance to frontline charities all over the United Kingdom, such as hospices and organisations that assist victims of domestic violence.

iv) Small and Medium-Sized Enterprises Concentrated on Research and Development

v) Bounce Back loan scheme for small businesses - a fast-track finance scheme for small businesses that allows firms to apply for Bounce Back loans worth up to 25 percent of turnover, with a maximum payment of £50,000, and access the cash within days. The maximum payment is £50,000.

vi) Pay as you Grow - The Pay as you Grow programme gives companies that have taken out a Bounce Back Loan the option to spread the repayment of that loan out over a period

of up to 10 years, rather than the standard 6 years, which lowers the amount that must be paid each month.

vii) A stimulus for green businesses and environmental projects, also known as the green stimulus.

viii) Improve domestic tourism

6.3 United States (USA)

The U.S government mitigation plans zoom into an investment in public health and time-bound aid to families, communities, and enterprises are the plan's main goals. Indefensible actions A programme from the Small Business Administration provides loans, guarantees, and backstops for small firms that want to keep their employees. The necessary amount of Treasury and agency securities will be purchased. Expanded overnight and long-term repositories are now available. Discount window lending has become more affordable. Reduced the cost of current swap lines with major central banks and extended the maturity of FX operations; expanded U.S. dollar swap lines to more central banks; and established a temporary repo facility for foreign and international monetary authorities. Depository institutions were told to use their capital and liquidity buffers to lend, work constructively with borrowers affected by COVID-19, and indicate that COVID-19 related loan modifications would not be classified as troubled debt restructurings by the Federal Reserve Bank of New York (FRBNY). Achieve an 8 percent reduction in the community bank's leverage. Provide a transition period for the accounting standard known as Current Expected Credit Loss (CECL). Loan modification options and a 12-month moratorium on reporting delinquencies to credit bureaus have been announced by Fannie Mae and Freddie Mac as part of their assistance announcements to homeowners. Other measures include a 60-day moratorium on foreclosure sales and evictions and the suspension of related late fees.

7.0 The role of Islamic Finance to further accelerate the Indonesian economy.

"Islamic finance" is used to describe a method of handling money that adheres to the tenets of Islam, which forbid interest-based transactions while encouraging the sharing of risks, ethical investment, and social responsibility. In this research, we argue that the advent of Islamic

finance could have far-reaching effects on the global financial system, particularly in developing economies like Indonesia's. This is because Islamic banking can serve as a viable alternative to traditional finance, one that has the potential to be more stable and resilient to economic shocks. Furthermore, the notion of Islamic finance is built on risk-sharing, which implies that losses and benefits are shared among parties participating in a financial transaction, and thus, stimulate long-term investment and minimize short-term speculation, leading to greater currency stability. Hence, encourage rational behaviour in investing selections and lessen the risk of a financial crisis spreading (Ahmed., 2009; Diaw., 2015).

Another fascinating aspect of Islamic banking is its reliance on the pledge of physical assets as security for financial deals. That is to say, the financing is backed by real estate rather than speculative financial instruments, which might lessen the market's sensitivity to fluctuations in exchange rates and boost the availability of foreign exchange. Several different types of financial instruments are available in Islamic finance, all of which can be used to increase market liquidity (Kayed & Hassan.,2011; Ouerghi., 2014). Offerings like sukuk (Islamic bonds) give investors a way to have access to capital while staying in line with Islamic law. Large infrastructure projects can be financed using this sukuk, which can benefit the economy as a whole. Islamic banking places a premium on ethical investing and social responsibility, which can boost public trust in the financial sector and strengthen the value of the currency. This is because investors who practice ethical investment and social responsibility are more likely to think about the financial system as a whole and make decisions based on the long-term effects of their investments. For instance, financial stability and lower currency volatility have been linked to the adoption of Islamic financing in countries like Malaysia and Bahrain. Furthermore, sukuk has been demonstrated to allow governments to raise cash in the international capital market in a way that is consistent with Islamic beliefs (Alqahtani & Mayes., 2018; Elsiefy., 2013).

By encouraging ethical investment and social responsibility and providing a variety of financial instruments that can give liquidity to the market, Islamic finance might be useful for policymakers concerned with currency liquidity. It is possible that policymakers can

improve currency stability and liquidity by adopting principles from Islamic finance. The following suggests that Islamic finance can continuously play an important role in accelerating the Indonesian economy, given the crisis hit the market. Furthermore, it can support improving the exchange rate as well. :

i) Islamic banks must also monitor whether a business's income is sufficient to cover its expenses, including loan instalment payments to the bank, following the distribution of financing. In addition, before providing money, Islamic banks must consider the business prospects of their customers and guarantee that potential borrowers can make timely loan repayments. When developing their financing strategies, Islamic banks must also consider the currency rate trend. Typically, the export-import sector or enterprises that utilise imported raw materials are the most susceptible to fluctuations in the currency rate. To avoid the potential for non-performing financing, Islamic banks must be vigilant, deliberate, and assess their funding. Studying trends such as trading partner currencies movements, economic behaviours, and policies would be beneficial for Islamic banking to revise and develop a better plan for managing the businesses.

ii) During times of crisis, the Islamic interbank overnight rate causes volatility in Islamic deposits and financing. Therefore, Islamic deposits and financing are sensitive to the overnight Islamic interbank rate fluctuations. Bank Indonesia could modify and alter this rate to determine the amount of liquidity injected or absorbed by the economy. Islamic bank deposits can contribute to short-term output and growth (Sugandi, 2021). Using Islamic bank deposits, it would be possible to encourage increased or reduced outputs out of concern for economic overheating.

iii) Thirdly, Islamic bank financing has begun to contribute less effectively to economic growth and inflation. The financing channel has developed substantially in recent years. Banks have less dominated financing due to applications that enable innovative device-based mobile funding. The contribution of financial technology businesses to the economy in terms of

output and inflation must be considered by central banks. Additionally, products that utilise profit-sharing agreements should be supported. This will increase the economic contribution of Islamic bank financing. (Faruq., 2021; Wahyudi & Sani., 2014).

iv) Islamic financial institutions need to include Islamic social finance like zakat and waqf in their operations to provide a community-based social security system that will help keep people's jobs, basic needs met, and their ability to buy things. IPB University and IRTI-IsDB did a study that found that Indonesia could get up to 217 trillion rupiahs (about $13.8 billion) from zakat. If this possibility comes true, it could help take care of those in need because of this crisis. Indonesia also has a lot of waqf potential, with assets in the form of land that add up to 510 km2 on their own. If waqf lands were productively used for farming, it could help Indonesia meet basic needs in times of crisis. (Hidayat et al., 2020). Crowdfunding financing is another alternative tool to boost the domestic economy and promote entrepreneurship.

8.0 Conclusion and Policy Implications

The current study identifies the behaviour of currency liquidity of three developed countries during various crises, focusing on the COVID-19 pandemic by utilizing the most commonly used measurement for currency liquidity. We consider the country-level analysis, and group of countries are also viewed as a full sample. We employ a novel nonlinear causality investigation to investigate the nonlinear causal effect of currency liquidity with the COVID-19 index and the monetary policy rate for each country. Moreover, we investigate the frequent dynamics of currency liquidity for three countries during the pandemic.

We summarize the key findings of our paper as follows; overall, the currency liquidity of all three experienced growth for the period of study. However, the currency liquidity during the COVID-19 pandemic shrinks compared to the 2009 financial crisis. We also document a nonlinear relationship between the COVID-19 index and monetary policy rate for the individual country. A nonlinear causal

relationship exists for the developed countries from the COVID-19 index and BAS. Our results on the nonlinear causal relationship have a vital implication and highlight the vulnerability of developed countries to the COVID-19 index.

In addition, based on our time-frequency analysis, the COVID-19 impact on FED and BAS in the short term. Furthermore, the lead-lag relationship between the COVID-19 and FED highlights the importance of the crisis variable in the short run, but the scenario changed in the medium-term and FED. Also, our mixed findings in the wavelet analysis for the COVID-19 index and BAS in the short-run substitute with the COVID-10 lead to the currency liquidity. Finally, monetary policy shows the leading behaviour in the behaviour of currency liquidity for three developed countries. Our time-frequency analysis results confirm our earlier findings on the nonlinear relationship findings. It occurs as monetary policy is a powerful tool for shaping currency liquidity in developed countries, and it can exhibit leading behavior for several reasons. Among them are (i) central banks in developed countries often have a high degree of independence, which allows them to set monetary policy without being influenced by political considerations and this independence enables them to respond quickly and effectively to changes in economic conditions, such as a decrease in currency liquidity, by adjusting the monetary policy rate; (ii) by setting and communicating monetary policy, central banks can influence market expectations about future economic conditions, including the level of currency liquidity and it can have a significant impact on the behaviour of financial markets, as market participants respond to their expectations about future policy decisions; and (iii) monetary policy can directly impact credit markets, by changing the cost and availability of borrowing and lending. This can affect the flow of money in the economy, leading to changes in currency liquidity We also offer some insights into how Islamic finance can play a critical role during the critical time to accelerate economic activities further and improve aggregate demand in the Indonesian market. Future researchers can consider this as a promising area of extension in terms of performance of stock exchange performance during the crisis time.

However, there are some limitations to the current study. This study on currency liquidity during crises from developed countries can be limited by factors such as data availability, generalizability, model limitations, endogeneity, time lag, and the presence of multiple causes. For instance, there may be a time lag between the implementation of monetary policy and its impact on currency liquidity, making it difficult to identify the exact effect of monetary policy on currency liquidity in real-time. Indeed, currency liquidity during crises can be influenced by multiple factors, including monetary policy, fiscal policy, financial market conditions, and macroeconomic indicators. This makes it challenging to isolate the specific impact of monetary policy on currency liquidity and control for other factors that may be affecting the results. These limitations highlight the need for caution in interpreting the results and suggest that additional research is needed to more fully understand the complex relationships between currency liquidity and other economic variables.

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