



Does the Russia-Ukraine war lead to currency asymmetries? A US dollar tale

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ABSTRACT

We examine the impact of the Russia-Ukraine war on the value of global currencies against the US dollar (USD) using event study methodology and market model estimates. We show that the Russia-Ukraine conflict had a negative impact on the value of the global currencies; however, a region-by-region analysis shows that while European currencies (particularly the Russian rouble, Czech koruna, and Polish zloty) depreciated against the USD, Pacific currencies appreciated significantly, and the currencies of the Middle East and Africa (ME&A) are insignificant. We also show that due to the financial and economic sanctions imposed on Russia, as well as Poland and the Czech Republic's proximity to the war zone, their currencies have weakened significantly against the USD. Furthermore, the Russian Central Bank's announcement to peg the rouble with gold, has had a significant positive impact on the pan-American, European (particularly the Russian rouble and the Polish zloty), and ME&A currencies. The analysis reveals a group of currencies that are unaffected by exogenous shocks. Incorporating these stable currencies into a portfolio would reduce the risk of volatile currencies. Future research can help gain additional insights by combining them with other major currencies such as the Chinese yuan, Japanese yen, British pound, and euro.

1. Introduction

1.1. Background

Following the disintegration of Soviet Russia in 1991, a major conflict erupted between Russia and Ukraine in 2014 with Russia's annexation of Crimea. Before February 2014, the Russian rouble was significantly stronger (1 USD = 30 roubles) than in February 2022 (1 USD = 75–80 roubles). Diplomatic relations between the two countries have been strained for the past eight years, but the early-2020 war between the Donetsk and Luhansk regions, backed by Russia, resulted in several sanctions against Russia. Ukraine's desire to join the North Atlantic Treaty Organization (NATO) exacerbated this conflict. Since globalization, there has been a history of war. However, the Russia-Ukraine war of 2022 is considered to have led to the biggest refugee crisis since World War II¹. New barriers to global trade in the form of Western sanctions and the Russian responses are expected to significantly impact international trade. Other

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¹ <https://www.theguardian.com/world/2022/mar/08/tuesday-briefing-refugee-crisis>.

consequences of the war include disturbance in the supply of gas and energy. Concurrently, the supply of major commodities is also affected. While the future of bilateral and multilateral trade is expected to shift drastically, some currencies are expected to stand stronger against the US dollar (USD). While researchers are concerned about the economic consequences of this war, including those on financial markets, we look into the initial effects on global currencies.

Over the last two years, a large body of research has examined COVID-19's short- and long-term impacts from various perspectives². While some significant studies provide for the contagion and spillover effects of the pandemic on stock markets and various asset classes (Akhtaruzzaman, Boubaker, & Sensoy, 2021; Banerjee, 2021; Cicchiello, Cotugno, Monferrà, & Perdicchi, 2022; Corbet, Larkin, & Lucey, 2020, 2021; Dell'Atti, di Tommaso, & Pacelli, 2022; Huynh, Nasir, & Nguyen, 2020; Li, Zhou, Chen, & Liu, 2021; Shah & Dar, 2022; Zorgati & Garfatta, 2021), there is little evidence of impacts on start-ups, energy markets, and network shifts due to pandemic-led lockdown measures (Goodell & Huynh, 2020; Hoang, Nguyen, & Nguyen, 2022; Huynh, Foglia, Nasir, & Angelini, 2021, 2022; Liu, Huynh, & Dai, 2021; Philippas, Dragomirescu-Gaina, Goutte, & Nguyen, 2021; Xi, Zeng, Lu, & Huynh, 2022; Xie, Wang, & Huynh, 2022). Some studies have also demonstrated the adverse effects of the pandemic across various sectors (Batten, Choudhury, Kinateder, & Wagner, 2022; Goodell, 2020; Pandey & Kumar, 2022a; Salisu, Vo, & Lucey, 2021). Even positively impacting corporate actions failed to hold fear sentiments triggered by the pandemic (Hoang et al., 2022). Researchers worldwide have investigated different investment avenues to safeguard losses from equity markets (Akhtaruzzaman, Boubaker, Lucey, & Sensoy, 2021; Arfaoui, Chkili, & ben Rejeb, 2022; Banerjee & Pradhan, 2021; Conlon & McGee, 2020; Esparcia, Jareño, & Umar, 2022; Ji, Zhang, & Zhao, 2020; Kinateder, Campbell, & Choudhury, 2021; Umar & Gubareva, 2020), but no one wondered whether economies worldwide would face the economic hazards of a human-borne disaster. Here, we are more concerned about contributing to the wartime literature. The wartime literature is gradually expanding. Among the early studies on the Russia-Ukraine war, Boubaker, Goodell, Pandey, and Kumari (2022) and Boungou and Yatié (2022) provide evidence of the heterogeneous effects of the war event on global stock markets. Evidence of some country-specific variables that strongly drive these impacts was presented by Boubaker et al. (2022). Abbassi, Kumari, and Pandey (2022) and Pandey and Kumar (2022b) provide similar firm-level evidence on the G7 stock markets and the global tourism sector, respectively. Umar, Bossman, Choi, and Teplova (2022) provide evidence of increased geopolitical risk due to the Russia-Ukraine war. Umar, Polat, Choi, and Teplova (2022) examined the impacts of the Russia-Ukraine war on financial market connectedness and found that European equities and Russian bonds are net shock transmitters. Dating back to the literature on war and conflicts, we find only a few studies that have discussed the adverse impacts of war and conflicts on trade (Carmignani & Kler, 2018; Hudson & Urquhart, 2015, 2022; Ruiz Estrada, Park, Tahir, & Khan, 2020; Schneider & Troeger, 2006). There is a need to extend the existing COVID-19 literature to connect with the Russia-Ukraine war. With a few studies examining the impacts of the Russia-Ukraine war on the stock market indices, we set out to examine the strength of the global currencies against the USD and vice-versa. Given the few event studies that have examined informational efficiency in exchange rates (Dewenter, Higgins, & Simin, 2005; Hayward, 2018), to the best of our knowledge, this is the first study to examine the strength of the USD against global currencies during the Russia-Ukraine war, using the event study methodology with market model estimates. Another motivation for this study is the economic dependence on currencies. For instance, international trade is affected by exchange rates based on different theories. One such theory, the flow-oriented approach, suggests that weaker exchange rates signal cheaper exports, thus enhancing the competitiveness of export-oriented firms (Bahmani-Oskooee & Saha, 2016). Nusair and Olson (2022) supported the flow-oriented approach in the short run. Moreover, Lyócsa and Plíhal (2022) show how volatile exchange rates (especially the Russian rouble) resulted from the war. However, we believe that the shock generated by war will gradually shift to other currencies.

The findings indicate that the Russia-Ukraine war adversely affected global currencies. However, a regional analysis shows that while European currencies (particularly the Russian rouble, Czech koruna, and Polish zloty currencies) depreciated against the USD, Pacific currencies appreciated significantly. We also show that due to the financial and economic sanctions imposed on Russia, as well as Poland and the Czech Republic's proximity to the war zone, their currencies have weakened significantly against the USD. Furthermore, the Russian Central Bank's announcement has had a significant positive impact on pan-American, European (particularly the Russian rouble and Polish zloty), and ME&A currencies. These findings have significant implications for investors, portfolio managers, and researchers.

1.2. Motivation for event selection and hypotheses

Since the introduction of the efficient market hypothesis (Fama, Fisher, Jensen, & Roll, 1969), the use of event studies has increased significantly (Bekiros, Boubaker, Nguyen, & Uddin, 2017; Boubaker, Farag, & Nguyen, 2015; Hayward, 2018). The most integral part of an event study is selecting the event of interest (Armitage, 1995; Mackinlay, 1997; Park, 2004). In this section, we discuss selected events and their relevance.

War and conflict are never good for international trade, especially between the parties to war and conflicts (Fernandez, 2007; Schultz, 2015). While economies worldwide were fighting the COVID-19 outbreak, several political and border conflicts emerged: Indo-China border skirmishes, the capture of Kabul by the Taliban, Kyrgyzstan-Tajikistan clashes, and the Israel-Palestine crisis, to name a few. Although not all conflicts impact the global economic system, the one between Russia and Ukraine is significantly important for a few reasons. First, there is a global dependence on Russian-Ukrainian commodities. Second, most Western nations have introduced financial and economic sanctions. Third, this war has led to the biggest refugee crisis since World War II. Due to financial

² Some early studies on the covid-19 pandemic provide insights on the effects on developed, emerging and global stock markets (Al-Awadhi, Alsafi, Al-Awadhi, & Alhammedi, 2020; Ashraf, 2020; Baker et al., 2020; Goodell, 2020; Pandey & Kumari, 2021).

sanctions, currencies are more vulnerable to the event.

Further, economic sanctions to ostracize Russia impose new barriers to global transportation, and trade is expected to impact market linkages, thus making currencies more volatile (Boubaker et al., 2022). Furthermore, while fiat currencies are net receivers of shocks during crises (Umar, Jareño, & González, 2021), demand and supply shocks to oil prices also lead to fluctuations in foreign exchange rates (Aziz, Umar, Gubareva, Sokolova, & Vo, 2022). Hence, we anticipate that the event will lead to asymmetries in currency values in terms of the USD. In fact, we examine the strength of the USD abreast. Our first event of interest (e1) is the Russia-Ukraine war, and the event day is February 24, 2022. The null hypotheses for this event are *H1* and *H2*.

H1. Abnormal change in currency values around the Russia-Ukraine war is zero.

H2. Cumulative abnormal change in currency values around the Russia-Ukraine war is zero.

While the Russian banks were disconnected from the Society for Worldwide Interbank Financial Telecommunications (SWIFT), the assets of the Russian Central Bank were frozen, foreign exchange reserves could not be used, and a series of economic sanctions were imposed on Russia, and therefore, the rouble was expected to suffer even more. However, from a low of 0.0072 USD in March 2022, the Russian currency is now around 0.015 USD. However, it has still not reached the value before the 2014 invasion of Ukraine. After the end of the Bretton Woods system in 1971, this was the first time a world currency had been pegged to gold³. Hence, we anticipate this major event will lead to asymmetries across currency values. The second event of interest (e2) is the announcement by the Russian Central Bank to peg 5000 roubles to 1 g of gold, and the event day is March 25, 2022. The null hypotheses for this event are *H3* and *H4*.

H3. Abnormal change in currency values around the Russian Central Bank announcement is zero.

H4. Cumulative abnormal change in currency values around the Russian Central Bank announcement is zero.

The remainder of the paper is organized as follows. Section 2 describes the data and methods. Section 3 presents the summary statistics and discusses the findings of the event study analysis. Section 4 provides implications and future research agendas while concluding the paper.

2. Data and methods

2.1. Data

The sample currencies are restricted to members of the International Monetary Fund (IMF), whose currencies are used to fund financial transactions⁴. However, our final sample included only 32 currencies⁵. To capture regional asymmetries, we divided the sample into six parts: pan-America, Europe, Europe (ex-Russia), Asia, Middle East and Africa (ME&A), and the Pacific. Daily exchange rates from the IMF website⁶. We converted these exchange rates in USD per currency, that is, 1 INR = 0.013 USD, where an increase in the exchange rate indicates depreciation of the USD.

2.2. Empirical approach

2.2.1. Estimation and event window

We use a 145-day estimation window $[-148, -4]$ to estimate the normal changes that would have occurred had the events not occurred. While we studied the impact of Russia's invasion of Ukraine and the Russian Central Bank's announcement, there could have been several other events that may affect the results of this study. Hence, we mitigate the possible confounding effects by using an 11-day $[-3, +7]$ shorter event window (Abbassi et al., 2022; McWilliams & Siegel, 1997; Sorescu, Warren, & Ertekin, 2017).

2.2.2. Calculating the abnormal changes

Employing Brown and Warner's (1985) event study method to observe abnormal changes in exchange rates, we calculate the abnormal changes (AC) and cumulative abnormal changes (CAC).

$$AC_{ct} = C_{it} - (\hat{\alpha} + \hat{\beta} \cdot C_{USDt}) \quad (1)$$

where AC_{ct} is the abnormal change in currency c on day t , C_{ct} is the actual logarithmic change for currency c on day t , $\hat{\alpha}$ and $\hat{\beta}$ are the

³ <https://theconversation.com/why-russia-has-put-the-rouble-on-a-gold-standard-but-its-unlikely-to-last-180632>.

⁴ We aim to examine the impacts of the two events on the currencies worldwide, especially their strength against the USD. For this, we need the exchange rates provided by the central banks issuing these currencies. We use the currencies of the member nations of the International Monetary Fund (IMF), whose currencies are used in the Fund financial transactions. The IMF explicitly mentions that these currencies are included because the respective central banks provide the daily exchange rates. The currency of a country where the exchange rate determination is not possible due to the unavailability of the spot price of USD is excluded. Further, the impact on the currencies indicates how the trade activity (particularly international trade), tourism, and geopolitical risk of these nations are expected to be impacted by the war.

⁵ We exclude the Omani riyal, Qatari riyal, Saudi Arabian riyal, and UAE dirham because they have a fixed exchange rate against USD. Further, we also eliminate Kuwaiti dinar due to static data. The list of sample currencies is available in Table 1.

⁶ https://www.imf.org/external/np/fin/data/param_rms_mth.aspx.

intercept and slope coefficients of the OLS regression model, respectively, and C_{dt} is the rate of change in the value of USD⁷ on day t .

$$CAC_{c, p-q} = \sum_{t=p}^q AC_{ct} \quad (2)$$

where $CAC_{c, p-q}$ is the cumulative abnormal change for each currency c in the event window $(p-q)$.

Further, the abnormal changes (Equation (1)) are aggregated across sample currencies to calculate the average abnormal changes generalized to global currencies.

$$AAC_{global} = \frac{1}{N} \sum_{c=1}^N AC_{ct} \quad (3)$$

where AAC_{global} is the average abnormal change in currency value generalized for the global sample on day t ; N is the number of currencies in the global sample, and AC_{ct} is as per Equation (1).

The cumulative average abnormal changes (CAAC) are the cumulative daily AAC calculated to examine the average effect of the event on the sample currencies.

2.2.3. Testing significance of the abnormal changes

We test the statistical significance of the abnormal changes using Equations (4) and (5).

$$AAC_t = \frac{AAC_{global}}{AgSD} \quad (4)$$

$$CAAC_t = \frac{CAAC_{global}}{AgSD(N_{t+1})} \quad (5)$$

where, AAC_t is the average abnormal changes in the currency value on day t ; $CAAC_t$ is the cumulative average abnormal changes in the currency value on day t ; $AgSD = \sqrt{\frac{\sum_{c=1}^N eSD_{c,e}^2}{N^2}}$ where, $eSD_{c,e}$ is the estimation period standard deviation of the abnormal changes in the value of currency 'c'; and, N_{t+1} is the absolute value of the event day plus one.

3. Findings and discussion

This section is divided into several parts. First, we present the summary statistics of the sample currencies; second, we discuss the event study results for the global sample during e1 and e2; third, we discuss the asymmetries across regions; and finally, we analyze country-wise changes in currency value.

3.1. Descriptive statistics

Table 2 presents summary statistics of the cumulative abnormal changes in currency value for the sample currencies during the pre- and post-event windows for both events. It is evident from the mean, standard deviation, minimum, and maximum values that e1 has a greater effect on global currencies than e2. The kurtosis and skewness indicate that the cumulative abnormal changes in currency value are not normally distributed. However, the non-normality of the data does not affect the results of the event study analysis with market model estimates (Brown & Warner, 1985; Dyckman, Philbrick, & Stephan, 1984).

3.2. Impact on global currencies

Table 3 presents the results of the significance tests of the average and cumulative average abnormal changes in currency value during e1 and e2. It is evident that the changes are significantly negative on the event day, with significantly positive changes on $t+1$, $t+3$, and $t+6$. Concomitantly, the abnormal changes in currency value are significantly negative on $t+2$, $t+4$, $t+5$, and $t+7$, indicating a negative impact on the sample currencies. The cumulative abnormal changes are significantly negative from the event day to $t+7$. The negative impact on the sample currencies indicates that the USD became stronger due to the Russia-Ukraine war.

Contrary to the findings in e1, the currencies responded positively to e2. The abnormal changes in the currency value are significantly positive from $t-2$ to $t+3$, except $t+2$, and significantly negative on $t+5$. The cumulative abnormal changes in currency value are significantly positive from $t-2$ to $t+7$, indicating that the sample currencies appreciated during the event window. The appreciation in the value of the sample currencies indicates that the USD depreciated after the announcement made by the Russian Central Bank to peg the rouble to gold. The significant positive abnormal changes before the event may be attributed to the Russian

⁷ We use the daily SDRs per USD as the benchmark.

Table 1
List of sample currencies.

Country	Currency
China	Chinese yuan
European Union	Euro
Japan	Japanese yen
United Kingdom	British Pound
Algeria	Algerian dinar
Australia	Australian dollar
Botswana	Botswana pula
Brazil	Brazilian real
Brunei	Brunei dollar
Canada	Canadian dollar
Chile	Chilean peso
Czech Republic	Czech koruna
Denmark	Danish krone
India	Indian rupee
Israel	Israeli New Shekel
South Korea	Korean won
Malaysia	Malaysian ringgit
Mauritius	Mauritian rupee
Mexico	Mexican peso
New Zealand	New Zealand dollar
Norway	Norwegian krone
Peru	Peruvian sol
Philippines	Philippine peso
Poland	Polish zloty
Russia	Russian ruble
Singapore	Singapore dollar
South Africa	South African rand
Sweden	Swedish krona
Switzerland	Swiss franc
Thailand	Thai baht
Trinidad	Trinidadian dollar
Uruguay	Uruguayan peso

Notes: We use the daily SDRs per US dollar as the benchmark.
The sample period for most of the currencies end on March 7, 2022 for event 1, and on April 5, 2022 for event 2.

Table 2
Summary statistics.

Cumulative abnormal change in currency value during event 1					
	[-3,-1]	[0,0]	[+1,+3]	[+1,+5]	[+1,+7]
Mean	0.046928	-0.5275	-0.14165	-0.75206	-0.8318
Median	0.038917	-0.00081	-0.00876	0.043614	0.104798
Standard Deviation	1.464068	1.510571	1.306815	4.569994	5.408686
Kurtosis	16.90926	11.00605	8.062339	26.23456	21.43639
Skewness	-3.3036	-2.84656	-2.17118	-4.92361	-4.28503
Range	9.738937	8.347374	7.581388	27.17402	32.83933
Minimum	-6.87388	-7.07778	-5.41891	-24.6975	-27.9025
Maximum	2.865061	1.269589	2.162475	2.476545	4.936798
Sum	1.501689	-16.88	-4.53285	-24.0658	-26.6177
Count	32	32	32	32	32
Cumulative abnormal change in currency value during event 2					
	[-3,-1]	[0,0]	[+1,+3]	[+1,+5]	[+1,+7]
Mean	0.795018	0.27094	0.654119	0.548537	0.75985
Median	0.618863	0.107003	0.089489	0.262977	0.276118
Standard Deviation	1.920266	0.549936	2.362566	2.899101	3.049673
Kurtosis	16.28866	3.256654	23.73698	18.52875	20.15892
Skewness	3.500485	1.592186	4.615288	3.338928	3.60283
Range	11.68302	2.561193	13.72037	20.70295	21.9366
Minimum	-1.84469	-0.51911	-0.96144	-6.26582	-6.26926
Maximum	9.838326	2.042087	12.75893	14.43713	15.66734
Sum	25.44058	8.67008	20.93181	17.55319	24.3152
Count	32	32	32	32	32

Note: This table reports the descriptive statistics of the cumulative abnormal changes in currency value across the sample currencies.

Table 3

Results of the event study analysis.

Event 1 (February 24, 2022)					Event 2 (March 25, 2022)				
Days	AAC	t-value	CAAC	t-value	Days	AAC	t-value	CAAC	t-value
t-3	0.055	0.625	0.055	0.313	t-3	0.156	1.461	0.156	0.731
t-2	-0.041	-0.474	0.013	0.087	t-2	0.304	2.841***	0.460	2.484**
t-1	0.034	0.387	0.047	0.380	t-1	0.335	3.140***	0.795	5.263***
t	-0.528	-6.047***	-0.481	-5.509***	t	0.271	2.537**	1.066	9.979***
t+1	0.160	1.830*	-0.321	-2.601***	t+1	0.231	2.163**	1.297	8.586***
t+2	-0.522	-5.979***	-0.842	-5.575***	t+2	0.173	1.616	1.470	7.944***
t+3	0.220	2.525**	-0.622	-3.566***	t+3	0.250	2.344**	1.720	8.052***
t+4	-0.409	-4.692***	-1.032	-5.288***	t+4	0.077	0.724	1.797	7.526***
t+5	-0.201	-2.305**	-1.233	-5.768***	t+5	-0.183	-1.713*	1.614	6.171***
t+6	0.187	2.147**	-1.045	-4.529***	t+6	0.121	1.133	1.736	6.141***
t+7	-0.267	-3.061***	-1.312	-5.319***	t+7	0.090	0.845	1.826	6.043***

Note: Significance level is shown as *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

President's announcement, a couple of days before e2, that he would supply gas to the enemy countries only in exchange for roubles⁸. Fig. 1 shows a graphical presentation of abnormal changes in the event window.

The adverse effects of the war on the sample currencies are attributable to several reasons. While the demand for currency depends on international trade, tourism, speculation, and geopolitical risk factors, the policies adopted to tackle exogenous shocks also impact currency value. To mitigate shock-driven risks, investors attempt to rebalance their portfolios by leaving markets with weaker USD exchange rates (Boubaker et al., 2022). Further, weaker economies are expected to be the most adversely affected by exogenous shocks (Armstrong & Read, 2020; Rodrik, 1999). The more adverse the impacts, the more vulnerable the currency is to shocks. Moreover, financial systems are now globalized, and shocks are transmitted from one region to another (Boubaker, Jouini, & Lahiani, 2016; Luo, Liu, & Wang, 2021). These findings are also attributable to stock market responses to war events. The appreciation in USD is in line with the insignificant impact on the Dow Jones industrial average reported by Boubaker et al. (2022). The asymmetries in the currencies are also attributable to Russia's call to settle the dues of enemy nations in roubles⁹. The IMF has already approved the euro, British pound (GBP), Japanese yen, and Chinese yuan as reserve currencies in the past, and the USD does not possess a monopoly. Any potential harm to the USD value would lead to appreciation in these currencies. The Russian Central Bank's announcement was perceived as positive news for other currencies, as well as the rouble. It is perceived that the gold-backed rouble is stronger than before.

3.3. Regional asymmetries

As discussed, currency values do not depend on a single viable reason; while some currencies may appreciate that some currencies may depreciate in response to certain events. To capture these asymmetries across regions, we examined the impact of both events on region-wise samples. In this part of the analysis, a negative (positive) impact on the currency indicates a stronger (weaker) USD.

Table 4 presents the region-wise results generated by event analysis for e1. The pan-American currencies exhibit a significant positive change on t-1 and a significant negative change on the event day, with a significant positive cumulative change on t-1, indicating that the pan-American currencies responded negatively to the announcement but immediately recovered. Asian currencies exhibit significant negative changes on t+1, t+2, and t+6, with a significant positive cumulative change in currency value on the event day, indicating that the event slightly impacts Asian currencies. A more substantial negative impact is observed in the European currencies. The abnormal changes are significantly negative on t-1 to t+2, t+4, t+5, and t+7. A significant positive abnormal change in European currencies is observed on t+1 and t+6. However, the cumulative abnormal changes are significantly negative from t-1 to t+7, indicating that the USD has been substantially stronger than European currencies. We know that the impact on the Russian rouble could influence the results of the European currencies; hence, we include a separate sample of European currencies, excluding Russia. The impact on Europe (ex-Russia) was comparatively lower than that on Europe, indicating that the Russian currency was the most adversely impacted currency during the event window. However, adverse impacts on other European currencies cannot be denied. European (ex-Russia) currencies experience a significant negative change in currency value on the event day and t+4, a significant positive change on t+1, and significantly negative abnormal changes on the event day and from t+2 to t+7. The ME&A currencies are insignificant for war events. The attributable reason is that they are mostly oil-exporting countries, farthest from the war region, and less dependent on Russia-Ukraine. Exceptionally, Pacific currencies outperform the other currencies. We find significant positive abnormal changes in currency values in the Pacific region on t-1, event day, t+3, t+4, t+6, and t+7. The abnormal change is significant and negative only on t+1. Pacific currencies experience a cumulative abnormal change in their values from t-1 to t+7, indicating that the USD has become weaker against Pacific currencies. A graphical presentation of the effects of the Russia-Ukraine war is shown in Fig. 2.

⁸ <https://economictimes.indiatimes.com/news/international/world-news/russia-will-only-accept-rubles-for-gas-deliveries-to-europe-putin/articleshow/90400383.cms?from=mdr>.

⁹ <https://www.oe24.at/welt/ukraine-krieg/russland-setzt-oesterreich-auf-liste-der-unfreundlichen-staaten/512910266>.

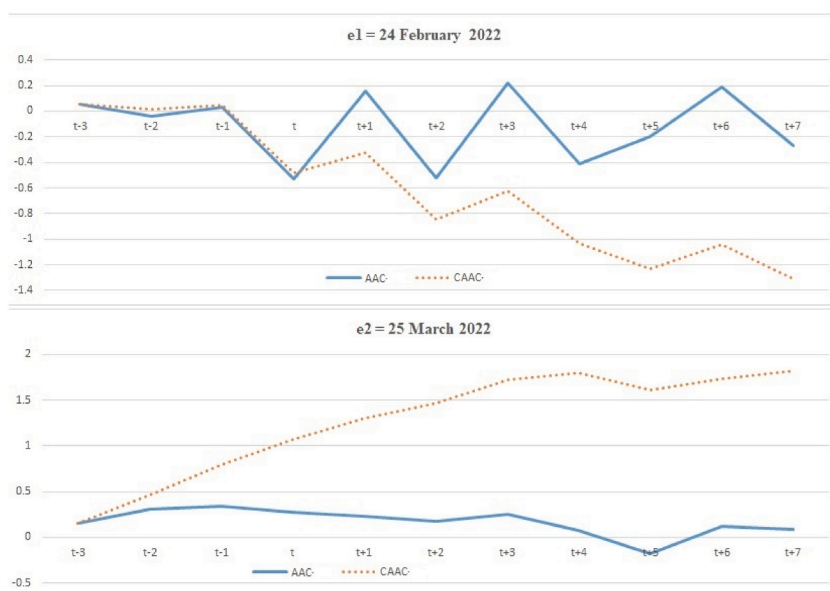


Fig. 1. AAC and CAAC-line for both events during the event window.

The e2 occurs when e1 is present. However, the e1 event window is already closed. The e2 event day is on t+21 of e1. Table 5 presents the region-wise results of the event study analysis for e2. The pan-American currencies exhibit significant positive abnormal changes in currency value from t-3 to the event day, and t+3, with a significant negative abnormal change on t+6.

Further, the cumulative abnormal changes are significantly positive from t-2 to t+7, indicating that in anticipation of depreciating the USD, the pan-American currencies responded positively to the Russian Central Bank's announcement. The impact on Asian currencies is slightly positive, with significant positive results on t+3 and t+4 and a significant negative cumulative abnormal change only on the event day. Asian currencies have a minor impact on both events. The abnormal changes in currency value for European currencies are significantly positive on t-1, t+1, and t+2, and significantly negative on t+5, with significant positive cumulative abnormal changes from t-1 to t+7. As in e1, we run the analysis on European currencies, excluding Russia. We find that European currencies (ex-Russia) experience a significant negative abnormal change on t+5, with significant positive cumulative abnormal changes from the event day to t+4. The results indicate that the Russian currency outperforms during e2, and the impact is reflected in European currencies. Conclusively, European currencies do not react significantly to e2, although the cumulative abnormal changes are significantly positive. The ME&A currencies reflect a significant positive abnormal change in value at t-2, with significant positive cumulative changes in currency value from t-1 to t+4, t+6, and t+7. Unlike e1, the Pacific currencies are less affected during e2. The abnormal changes in currency value are significantly negative (positive) on t-3 and t+2 (t-2, t+3, and t+7), with a significant negative change in currency value on t+2, indicating that the e2 effects on Pacific currencies are less than the e1 effects. A significant value for cumulative abnormal changes reflects the average effect of the event on the sample currencies (McWilliams & Siegel, 1997). In conclusion, the average impact of the rouble pegged to gold on pan-America, Europe, Europe (ex-Russia), and ME&A was positive, indicating a feeble USD during the e2 event window. Fig. 3 is a graphical presentation of the region-wise effects of the Russian Central Bank's announcement to peg the Russian currency to gold.

3.4. Country-wise cumulative abnormal changes in exchange rates

In the previous section, we discussed that when divided regionally, global currencies exhibit heterogeneous effects of both events. Now, we are concerned with analyzing individual currencies during both events. For this purpose, we use the cumulative abnormal change in currency values, as in Equation (2), for the sample currencies during five shorter event windows: [-3,-1] the pre-event window, [0,0] the event window, and [+1,+3], [+1,+5], and [+1,+7] the post-event windows.

Table 6 presents the cumulative abnormal change in currency value during the e1 event windows and their respective significance values. The pre-event cumulative abnormal change is significantly positive only for the Uruguayan peso, a pan-American country, and insignificant for the other currencies. The event-day cumulative impact is significantly positive (negative) for only three (ten) currencies. Approximately 59 percent of the global sample currencies are insignificant in the Russia-Ukraine war event. The positively impacted currencies include the Chinese yuan (0.31%), Swiss francs (0.81%), and New Zealand dollars (0.87%). The negatively impacted currencies include the Brazilian dollar (-1.60%), Czech koruna (-2.77%), Danish krone (-0.44%), euro (-0.38%), Israeli new shekel (-0.93%), Mexican dollar (-1.32%), Peruvian sol (-2.29%), Polish zloty (-1.73%), Russian rouble (-7.08%), and Uruguayan peso (-1.64%). Among the negatively impacted currencies, one belonged to ME&A, four belonged to pan-America, and five belonged to Europe (including Russia), providing supporting evidence for the findings of the region-wise analysis. We find

Table 4

Region-wise results of the event study analysis for event 1.

pan-America					Asia				
Days	AAC	t-value	CAAC	t-value	Days	AAC	t-value	CAAC	t-value
t-3	0.20	0.88	0.20	0.44	t-3	0.08	0.87	0.08	0.43
t-2	0.21	0.90	0.41	1.03	t-2	-0.03	-0.27	0.06	0.34
t-1	0.47	2.09**	0.88	2.73***	t-1	-0.01	-0.13	0.05	0.33
t	-0.87	-3.82***	0.01	0.05	t	0.16	1.63	0.21	2.10**
t+1	0.16	0.71	0.17	0.53	t+1	-0.19	-1.91*	0.02	0.14
t+2	-0.01	-0.04	0.16	0.42	t+2	-0.16	-1.68*	-0.15	-0.86
t+3	0.37	1.61	0.53	1.17	t+3	0.13	1.33	-0.02	-0.08
t+4	0.07	0.33	0.61	1.19	t+4	-0.05	-0.49	-0.06	-0.29
t+5	-0.22	-0.98	0.38	0.69	t+5	-0.14	-1.41	-0.20	-0.84
t+6	0.22	0.95	0.60	1.00	t+6	-0.18	-1.83*	-0.38	-1.47
t+7	-0.33	-1.43	0.27	0.43	t+7	0.00	-0.02	-0.38	-1.38
Europe					Europe-ex-Russia				
Days	AAC	t-value	CAAC	t-value	Days	AAC	t-value	CAAC	t-value
t-3	-0.21	-1.58	-0.21	-0.79	t-3	-0.11	-0.53	-0.11	-0.27
t-2	-0.14	-1.06	-0.35	-1.52	t-2	-0.15	-0.76	-0.26	-0.75
t-1	-0.45	-3.39***	-0.79	-4.26***	t-1	0.23	1.14	-0.03	-0.11
t	-1.47	-11.20***	-2.26	-17.22***	t	-0.77	-3.81***	-0.80	-3.96***
t+1	0.78	5.90***	-1.49	-8.00***	t+1	0.38	1.86*	-0.43	-1.49
t+2	-1.55	-11.77***	-3.04	-13.33***	t+2	-0.32	-1.58	-0.75	-2.13**
t+3	0.05	0.35	-2.99	-11.37***	t+3	-0.20	-0.96	-0.94	-2.32**
t+4	-1.74	-13.23***	-4.73	-16.09***	t+4	-0.53	-2.60***	-1.47	-3.24***
t+5	-0.72	-5.50***	-5.45	-16.93***	t+5	0.17	0.83	-1.30	-2.62***
t+6	0.40	3.02***	-5.05	-14.53***	t+6	-0.29	-1.43	-1.59	-2.97***
t+7	-1.20	-9.16***	-6.26	-16.83***	t+7	-0.22	-1.08	-1.81	-3.16***
Middle East & Africa					Pacific				
Days	AAC	t-value	CAAC	t-value	Days	AAC	t-value	CAAC	t-value
t-3	0.19	0.48	0.19	0.24	t-3	0.19	0.94	0.19	0.47
t-2	-0.50	-1.25	-0.31	-0.44	t-2	0.18	0.87	0.37	1.04
t-1	0.08	0.21	-0.22	-0.39	t-1	0.38	1.89*	0.75	2.62***
t	-0.17	-0.43	-0.40	-0.99	t	0.46	2.29**	1.21	5.99***
t+1	0.12	0.31	-0.27	-0.48	t+1	-0.50	-2.47**	0.71	2.49**
t+2	-0.30	-0.74	-0.57	-0.82	t+2	-0.05	-0.25	0.66	1.89*
t+3	0.10	0.24	-0.47	-0.59	t+3	0.66	3.26***	1.32	3.27***
t+4	0.13	0.33	-0.34	-0.38	t+4	0.47	2.33**	1.80	3.97***
t+5	0.57	1.41	0.22	0.23	t+5	0.12	0.57	1.91	3.85***
t+6	-0.01	-0.02	0.22	0.20	t+6	0.59	2.93***	2.50	4.67***
t+7	0.00	0.01	0.22	0.19	t+7	1.14	5.64***	3.65	6.37***

Note: Significance level is shown as *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.**Fig. 2.** Region-wise AAC and CAAC-line during event 1.

significant positive abnormal changes in currency value during post-event windows for the Australian dollar (2.06% and 4.94% in 5-day and 7-day windows, respectively), New Zealand dollar (3.58% in a 7-day window), Norwegian krone (2.16%, 2.48%, and 2.75% in 3-day, 5-day, and 7-day windows, respectively), and Uruguayan peso (1.09% in a 3-day window). The cumulative abnormal change in currency values during the post-event windows is significantly negative for the Algerian dinar (-0.49% and -0.94% in the 5-day and 7-day windows, respectively), Czech koruna (-1.79%, -2.52%, -2.49% in the 3-day, 5-day, and 7-day windows, respectively), Indian

Table 5

Region-wise results of the event study analysis for event 2.

pan-America					Asia				
Days	AAC	t-value	CAAC	t-value	Days	AAC	t-value	CAAC	t-value
t-3	0.45	1.99**	0.45	1.00	t-3	-0.15	-1.51	-0.15	-0.75
t-2	0.45	1.99**	0.90	2.30**	t-2	-0.01	-0.13	-0.16	-0.95
t-1	0.38	1.70*	1.29	4.01***	t-1	-0.03	-0.28	-0.19	-1.35
t	0.55	2.41**	1.83	8.08***	t	0.02	0.16	-0.17	-1.76*
t+1	0.10	0.46	1.94	6.04***	t+1	0.04	0.39	-0.14	-0.97
t+2	0.34	1.52	2.28	5.81***	t+2	-0.12	-1.17	-0.25	-1.47
t+3	0.50	2.22**	2.79	6.14***	t+3	0.16	1.65*	-0.09	-0.44
t+4	-0.13	-0.57	2.66	5.24***	t+4	0.24	2.41**	0.15	0.68
t+5	0.06	0.25	2.71	4.88***	t+5	-0.03	-0.26	0.13	0.52
t+6	-0.39	-1.73*	2.32	3.87***	t+6	0.15	1.50	0.27	1.05
t+7	0.01	0.04	2.33	3.63***	t+7	0.04	0.45	0.32	1.14
Europe					Europe-ex-Russia				
Days	AAC	t-value	CAAC	t-value	Days	AAC	t-value	CAAC	t-value
t-3	0.40	1.49	0.40	0.74	t-3	0.31	1.37	0.31	0.69
t-2	0.27	1.00	0.67	1.44	t-2	0.14	0.65	0.45	1.17
t-1	0.83	3.08***	1.50	3.94***	t-1	0.01	0.04	0.46	1.46
t	0.31	1.14	1.81	6.70***	t	0.30	1.35	0.76	3.41***
t+1	0.61	2.28**	2.42	6.35***	t+1	0.33	1.48	1.09	3.46***
t+2	0.95	3.52***	3.37	7.22***	t+2	0.06	0.28	1.15	2.98***
t+3	0.12	0.46	3.49	6.48***	t+3	-0.09	-0.39	1.06	2.39***
t+4	0.13	0.49	3.63	6.02***	t+4	0.01	0.02	1.07	2.14**
t+5	-0.50	-1.84*	3.13	4.74***	t+5	-0.62	-2.81***	0.44	0.81
t+6	0.35	1.29	3.48	4.88***	t+6	0.32	1.42	0.76	1.29
t+7	-0.04	-0.16	3.44	4.51***	t+7	-0.13	-0.56	0.63	1.00
Middle East & Africa					Pacific				
Days	AAC	t-value	CAAC	t-value	Days	AAC	t-value	CAAC	t-value
t-3	0.22	0.66	0.22	0.33	t-3	-0.37	-1.66*	-0.37	-0.83
t-2	0.66	1.95*	0.89	1.50	t-2	0.40	1.79*	0.03	0.07
t-1	0.13	0.39	1.02	2.11**	t-1	0.07	0.29	0.09	0.30
t	0.53	1.56	1.55	4.55***	t	-0.04	-0.20	0.05	0.22
t+1	0.15	0.44	1.70	3.53***	t+1	0.06	0.25	0.11	0.34
t+2	-0.20	-0.58	1.51	2.55**	t+2	-0.93	-4.17***	-0.82	-2.13**
t+3	0.11	0.31	1.61	2.36**	t+3	0.41	1.84*	-0.41	-0.93
t+4	0.02	0.05	1.63	2.14**	t+4	0.05	0.23	-0.36	-0.72
t+5	-0.32	-0.93	1.31	1.57	t+5	-0.08	-0.34	-0.44	-0.80
t+6	0.27	0.79	1.58	1.75*	t+6	0.31	1.39	-0.13	-0.22
t+7	0.25	0.74	1.83	1.90*	t+7	0.46	2.05**	0.33	0.52

Note: Significance level is shown as *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.**Fig. 3.** Region-wise AAC and CAAC-line during event 2.

rupee (−1.45% in the 7-day window), Polish zloty (−2.29%, −3.83%, and −7.46% in the 3-day, 5-day, and 7-day windows, respectively), Russian rouble (−5.42%, −24.70%, and −27.17% in the 3-day, 5-day, and 7-day windows), Korean won (−2.57% and −3.06% in the 5-day and 7-day windows, respectively), and Swedish krona (−2.00% in the 7-day window). In conclusion, the post-event impact is substantially negative (positive) on the Polish zloty, Russian rouble, and Czech koruna (Australian dollar and Norwegian krone). This may be attributable to the fact that while Russia is involved in the war and faces financial and economic sanctions,

Table 6

Cumulative abnormal changes for different event windows for event 1.

Country	−3,−1	0,0	+1,+3	+1,+5	+1,+7	Country	−3,−1	0,0	+1,+3	+1,+5	+1,+7
Algerian dinar	0.028	0.049	−0.251	−0.487	−0.941	Mexican peso	0.304	−1.321	0.539	0.081	−1.452
	0.157	0.473	−1.405	−2.112**	−3.450***		0.280	−2.110**	0.497	0.058	−0.876
Australian dollar	1.016	0.535	0.840	2.055	4.937	New Zealand dollar	1.041	0.866	0.153	0.913	3.581
	1.239	1.131	1.025	1.942*	3.943***		1.146	1.651*	0.169	0.779	2.581***
Botswana pula	0.032	0.111	−0.348	0.640	0.388	Norwegian krone	0.773	−0.628	2.162	2.477	2.753
	0.046	0.271	−0.492	0.699	0.358		0.783	−1.101	2.189**	1.941*	1.824*
Brazilian dollar	2.865	−1.600	1.316	1.298	1.802	Peruvian sol	0.982	−2.288	0.491	0.781	1.092
	1.900	−1.838*	0.873	0.667	0.782		0.949	−3.828***	0.474	0.585	0.691
Brunei dollar	−0.123	0.230	−0.086	0.030	−0.351	Philippine peso	−0.140	0.466	0.221	−0.061	−1.062
	−0.377	1.223	−0.263	0.070	−0.705		−0.248	1.427	0.390	−0.084	−1.228
Canadian dollar	−0.127	−0.494	0.965	1.560	1.189	Polish zloty	−0.489	−1.725	−2.289	−3.830	−7.460
	−0.169	−1.142	1.288	1.613	1.039		−0.618	−3.777***	−2.894***	−3.750***	−6.173***
Chilean peso	0.549	1.270	−1.257	−2.291	−2.075	Russian rouble	−6.874	−7.078	−5.419	−24.697	−27.903
	0.375	1.500	−0.857	−1.210	−0.926		−6.506	−11.603***	−5.129***	−18.107***	−17.289***
Chinese yuan	0.165	0.307	0.010	0.041	0.350	Singapore dollar	−0.020	0.034	−0.292	−0.030	−0.030
	0.740	2.387**	0.045	0.143	1.027		−0.063	0.188	−0.919	−0.073	−0.063
Czech koruna	−0.559	−2.769	−1.788	−2.522	−2.486	South African rand	0.148	0.079	−0.843	1.224	2.561
	−0.945	−8.117***	−3.026***	−3.305***	−2.754***		0.057	0.053	−0.326	0.367	0.648
Danish krone	−0.090	−0.443	−0.027	−0.108	−0.327	Korean won	0.293	0.258	−0.965	−2.567	−3.063
	−0.341	−2.903***	−0.103	−0.316	−0.810		0.492	0.750	−1.620	−3.338***	−3.366***
Euro	−0.104	−0.384	−0.070	−0.101	−0.267	Swedish krona	0.185	−0.601	0.396	−1.035	−2.003
	−0.390	−2.507**	−0.266	−0.296	−0.658		0.264	−1.485	0.565	−1.144	−1.870*
Indian rupee	0.666	−0.454	−0.428	−0.695	−1.451	Swiss franc	0.144	0.806	0.497	0.839	1.761
	1.371	−1.620	−0.881	−1.108	−1.954*		0.301	2.922***	1.041	1.361	2.414
Israeli new shekel	−1.104	−0.928	1.128	1.105	0.457	Thai baht	−0.422	0.361	−0.506	0.046	−0.267
	−1.514	−2.202**	1.546	1.173	0.410		−0.600	0.889	−0.720	0.051	−0.248
Japanese yen	0.962	0.422	−0.263	−0.150	1.247	Trinidadian dollar	−0.237	−0.004	0.492	0.350	0.246
	1.579	1.200	−0.432	−0.191	1.340		−0.574	−0.017	1.195	0.658	0.391
Malaysian ringgit	0.045	0.002	0.015	0.293	0.905	GBP	−0.113	−0.425	0.010	0.298	−0.020
	0.124	0.012	0.042	0.619	1.613		−0.218	−1.414	0.019	0.444	−0.025
Mauritian rupee	−0.118	0.108	−0.030	−0.345	0.230	Uruguayan peso	1.823	−1.642	1.093	0.823	1.040
	−0.309	0.488	−0.078	−0.697	0.392		3.977***	−6.203***	2.384***	1.390	1.485

Note: Figures in parenthesis below cumulative abnormal changes indicate the t-values. Significance level is shown as ***p < 0.01, **p < 0.05, *p < 0.1.

Poland and the Czech Republic are nearest to the Ukraine-Russia war zone. Proximity to the war zone triggers negative impacts (Boubaker et al., 2022; Ichev & Marinč, 2018). In contrast, although Norway shares borders with Russia, its currency appreciates during the war. While the effects on the Algerian dinar and Korean won are moderate, those on the Indian rupee and Swedish krona are minor. These currencies did not react during the event or initial event windows. Accordingly, the significant negative changes in their currency values may be attributable to fear sentiments due to the furtherance of the war.

We present the cumulative abnormal change in currency value during the e2 event windows and their respective significance values in Table 7. The results are quite the opposite to those in e1, but are interesting. We find a significantly positive (negative) cumulative change in the values of the five (two) currencies. A significant positive cumulative abnormal change is noted for the Brazilian real (3.32%), Israeli new shekel (1.48%), Russian rouble (9.84%), GBP (0.93%), and Uruguayan peso (1.79%). The significant negative cumulative change in the pre-event window is experienced by the Japanese yen (−1.85%) and Malaysian ringgit (−0.60%). However, substantial evidence of the immediate announcement effect is present only in the Norwegian krone (2.04%) and Uruguayan peso (0.66%). The cumulative abnormal change in currency value during the post-event windows is present in the Brazilian real (2.70% in a 5-day window), Danish krone (0.53% in a 5-day window), Norwegian krone (−6.27% in 5-day and 7-day windows), Polish zloty (2.41% and 2.82% in 5-day and 7-day windows, respectively), Russian rouble (12.76%, 14.44%, and 15.67% in 3-day, 5-day, and 7-day windows, respectively), Trinidadian dollar (2.30% in a 5-day window), and Uruguayan peso (0.98% in a 3-day window). In conclusion, the second event did not impact most currencies. Unlike the e1 results, the currencies of Poland and Russia have significantly positive impacts. The significant negative impact on the Norwegian krone and significant positive impact on the Brazilian real, Danish krone, Trinidadian dollar, and Uruguayan peso is moderately present. Currency values are dependent on various factors¹⁰, including the level of foreign capital inflow (Griffith-Jones, 2000), tourism receipts (Čavlek & Wanhill, 2015), and level of international trade (Kang & Dagli, 2018; Santana-Gallego & Pérez-Rodríguez, 2019), geopolitical risk (Iyke, Phan, & Narayan, 2022; Kyriazis & Economou, 2021), etc., and it needs to be investigated as to which potential factors led to these asymmetries in the abnormal change in currency values across different countries.

Thirteen (twenty) currencies are insignificant to e1 (e2). The Botswana pula, Brunei dollar, Canadian dollar, Chilean peso, Malaysian ringgit, Philippine peso, Singapore dollar, South African rand, and Thai baht are the most stable currencies, which have been insignificant to both events. The Japanese yen, Mauritian rupee, Trinidadian dollar, and GBP were insignificant to e1. The Algerian dinar, Australian dollar, Chinese yuan, Czech koruna, Euro, Indian rupee, Mexican peso, Peruvian sol, Korean won, Swedish krona, and Swiss franc were insignificant to e2. Approximately 41% and 63% of the sample currencies are insignificant for e1 and e2, respectively. While global currencies are mostly non-reactive to information on the Russia-Ukraine war, Boubaker et al. (2022) and Bounou and Yatié (2022) provide evidence of adverse or positive impacts on most stock markets. This also indicates that currencies are less reactive to exogenous shocks than stock market indices are.

4. Conclusions, implications, and future research agendas

4.1. Conclusions

Using the event study methodology with market model estimates, we examine the impact of the Russia-Ukraine war on the value of global currencies against the USD. We show that the Russia-Ukraine war adversely impacted global currencies; however, the region-wise analysis reveals that while the European currencies (especially the Russian rouble, Czech koruna, and Polish zloty) depreciated against the USD, the Pacific currencies appreciated significantly. Through the country-wise analysis, we further show that owing to the financial and economic sanctions against Russia and the proximity to the war zone for Poland and the Czech Republic; their currencies became significantly weaker against the USD. Furthermore, the announcement of the Russian Central Bank, on average, has had significant positive impacts on pan-Americans, Europeans (especially the Russian rouble and Polish zloty), and ME&A currencies. The findings call for examining previous theories on how tourism receipts, level of foreign capital inflows, international trade balance, and geopolitical risk factors of the sample countries drive the abnormal changes in currency values during crises.

4.2. Implications and future research agendas

The regional analysis reveals that the war's cumulative impact is negative in Europe and Europe (ex-Russia), positive in the Pacific region, and insignificant for others. However, the cumulative impact of the rouble pegged to gold is positive for pan-America, Europe, and Europe (ex-Russia) regions and insignificant for the others, indicating that depreciation in the USD leads to an appreciation in the currencies of these regions. These findings have significant implications for investors, portfolio managers, and researchers. The analysis reveals a set of insignificant currencies to the exogenous shocks. Including these stable currencies in the portfolio mitigates the risk of volatile currencies.

Further, future researchers may find these findings helpful for extending the study to explore safe-haven and hedge currencies using the DCC GARCH and wavelet models (Akhtaruzzaman, Boubaker, & Sensoy, 2021; Kumar & Padakandla, 2022). It is also evident that the network of global currencies may shift because of the contagion effect (BenSaïda, Boubaker, & Nguyen, 2018; Chakrabarti, Jawed, & Sarkhel, 2021; Zhang, Zhuang, Lu, & Wang, 2020). Future researchers can explore this angle using network analysis to provide

¹⁰ This list although not exhaustive calls for future research.

Table 7

Cumulative abnormal changes for different event windows for event 2.

Country	−3,−1	0,0	+1,+3	+1,+5	+1,+7	Country	−3,−1	0,0	+1,+3	+1,+5	+1,+7
Algerian dinar	−0.051 (−0.257)	0.099 0.869	0.086 0.434	−0.025 −0.098	−0.049 −0.164	Mexican peso	1.638 1.501	0.743 1.179	0.093 0.086	0.432 0.306	0.499 0.299
Australian dollar	1.216 (1.308)	0.549 1.024	−0.472 −0.508	−0.904 −0.753	1.298 0.914	New Zealand dollar	0.971 0.977	−0.220 −0.384	−0.528 −0.531	−0.681 −0.531	−0.088 −0.058
Botswana pula	0.9810 (1.384)	0.567 1.387	−0.150 −0.212	−0.411 −0.449	0.040 0.037	Norwegian krone	1.269 1.330	2.042 3.705***	−0.961 −1.007	−6.266 −5.085***	−6.269 −4.300***
Brazilian dollar	3.316 (2.263**)	1.172 1.386	2.699 1.842*	1.120 0.592	−0.056 −0.025	Peruvian sol	0.953 0.949	0.446 0.770	0.704 0.701	2.515 1.940	0.285 0.186
Brunei dollar	0.022 (0.068)	0.010 0.053	−0.171 −0.534	−0.179 −0.434	−0.035 −0.072	Philippine peso	0.025 0.047	0.041 0.133	0.637 1.186	1.016 1.465	1.968 2.399
Canadian dollar	0.542 (0.748)	0.263 0.629	0.009 0.012	−0.198 −0.212	0.492 0.445	Polish zloty	−1.146 −1.072	0.115 0.186	2.417 2.261**	2.408 1.745*	2.816 1.725*
Chilean peso	1.071 (0.720)	0.621 0.722	1.761 1.184	0.433 0.225	1.592 0.700	Russian rouble	9.838 2.705***	0.362 0.172	12.759 3.508***	14.437 3.074***	15.667 2.820***
Chinese yuan	−0.031 (−0.127)	0.032 0.229	−0.051 −0.208	−0.058 −0.185	0.105 0.284	Singapore dollar	0.032 0.101	0.015 0.079	−0.156 −0.487	−0.158 −0.381	0.066 0.135
Czech koruna	0.696 (0.727)	0.280 0.507	1.075 1.122	1.248 1.009	1.365 0.933	South African rand	1.665 0.791	1.662 1.368	−0.366 −0.174	−0.919 −0.338	0.496 0.154
Danish krone	0.067 (0.211)	0.013 0.073	0.533 1.680*	0.331 0.809	0.267 0.552	Korean won	−0.026 −0.038	−0.505 −1.299	0.048 0.072	0.924 1.062	0.492 0.479
Euro	0.048 (0.147)	0.020 0.107	0.505 1.540	0.300 0.708	0.224 0.447	Swedish krona	0.954 1.135	−0.182 −0.374	0.303 0.360	−0.052 −0.048	0.716 0.557
Indian rupee	−0.040 (−0.078)	0.127 0.430	0.275 0.536	0.403 0.610	1.164 1.487	Swiss franc	0.848 1.576	0.309 0.994	−0.523 −0.971	0.030 0.043	−0.048 −0.058
Israeli new shekel	1.483 (1.902*)	−0.199 −0.442	0.669 0.858	0.390 0.387	0.634 0.532	Thai baht	−0.326 −0.456	0.318 0.771	−0.095 −0.133	0.295 0.320	0.344 0.315
Japanese yen	−1.845 (−2.848***)	−0.519 −1.388	−0.690 −1.066	−0.200 −0.239	−0.158 −0.160	Trinidadian dollar	−0.302 −0.751	−0.082 −0.355	0.419 1.042	1.195 2.302**	0.650 1.058
Malaysian ringgit	−0.543 (−1.507)	0.067 0.324	0.246 0.684	0.231 0.496	0.154 0.279	GBP	0.926 1.883*	−0.198 −0.698	−0.919 −1.869*	−0.528 −0.831	−0.082 −0.109
Mauritian rupee	−0.600 (−2.168**)	0.036 0.224	−0.203 −0.735	−0.236 −0.661	−0.246 −0.582	Uruguayan peso	1.788 3.188***	0.663 2.048**	0.978 1.744*	0.660 0.912	0.014 0.016

Note: Figures in parenthesis below cumulative abnormal changes indicate the t-values. Significance level is shown as ***p < 0.01, **p < 0.05, *p < 0.1.

insights into the changing nodes of currency markets pre-and post-events. Furthermore, the results are limited to the IMF list of global currencies and only 32 pairs of currencies. Future research can explore further insights by employing different methods for a set of these currencies paired with other major currencies, such as the Chinese yuan, Japanese yen, GBP, and euro (Anwer, Naeem, Hassan, & Karim, 2022; Huang, Gau, & Wu, 2021).

CRedit authorship contribution statement

Sana Gaied Chortane: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Software, Validation, Writing – original draft, Writing – review & editing. **Dharen Kumar Pandey:** Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Software, Validation, Project administration, Writing - original draft, Writing - review & editing.

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