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ARTICLE

Dynamic connectedness among regional FinTech indices in times of turbulences

Muneer M. Alshater [a], Onur Polat [b,e], Rim El Khoury [c] and Seong-Min Yoon [d]

[a]Faculty of Business, Philadelphia University, Amman, Jordan; [b]Department of Public Finance, Bilecik Seyh Edebali University, Bilecik, Turkey; [c]Department of Accounting and Finance, Notre Dame University, Louaize/ Lebanese American University, Lebanon; [d]Department of Economics, Pusan National University, Busan, Republic of Korea; [e]Department of Applied Statistics and Operations Research, Universitat Politecnica de Valencia, Alcoy, Spain

ABSTRACT

This study examines the connectedness among several regional FinTech indices and analyses the impact of Russia's invasion of Ukraine on the dynamic spillovers. We employ the time-varying parameter vector autoregression and time-frequency connectedness network approach using data spanning from 2 September 2021 until 4 April 2022. We find that the returns and volatility spillovers among FinTech indices burst with the outbreak of the invasion. During this invasion, Asia-Pacific and Japan FinTech appeared to be the largest recipients of the spillovers. In contrast, Europe and North America FinTech appeared to be the largest transmitters of spillovers. The short-term effect among regional FinTech indices is stronger than the long-term relationship.

KEYWORDS

FinTech; Russia's invasion of Ukraine; directional spillover; time and frequency domain; dynamic connectedness network

JEL CLASSIFICATION

C58; F51; G15

I. Introduction

Financial technology (FinTech) demonstrated tremendous development, as companies leverage innovative technologies. While more than half of FinTech investment is in the Americas, the Asia-Pacific region is home to the highest growing FinTech companies and the number of FinTech users.

Fintech stocks are more likely to have greater returns and volatility than non-FinTech stocks, generating various sources of risk. Although FinTech has progressed drastically, existing studies are still at a nascent stage. Within the strand of connectedness, some studies investigate the spillover effects between technology-based stocks, clean energy, and crude oil (Bondia, Ghosh, and Kanjilal 2016; Nasreen et al. 2020; Lesame et al. 2021), FinTech, US dollar, gold, and equities (Bouri et al. 2021, 2022; Le, Yarovaya, and Nasir 2021), FinTech and traditional financial industry (Li et al. 2020), and FinTech and cryptocurrencies (Le, Abakah, and Tiwari 2021). Nonetheless, studies on the fintech connectedness are quite limited, and thus this study aims to contribute to this literature by examining the linkages between technology-based stocks aftermath geopolitical bursts such as the Russia-Ukrainian conflict.

While some studies found that FinTech index experienced the most volatility spillovers during the pandemic (Le, Yarovaya, and Nasir 2021), it is critical to understand the changes in the pattern of information transmission among Fintech indices during another turbulent period, namely the Russian invasion of Ukraine in 2022, which can be found to hugely impact the Fintech world.

We explore the connectedness between FinTech indices and add to the literature along the following dimensions: (a) this study explores the interconnection among four regional FinTech indices: Europe, North America, Asia-Pacific, and Japan to determine which is the main region of transmission; (b) this study investigates a more recent data covering the Russia's invasion of Ukraine (RIU) to see if their connectedness was driven by this crisis; (c) this study uses the time-varying parameter vector autoregression (TVP-VAR) of Antonakakis, Chatziantoniou, and Gabauer (2020) and Ellington and Barunik (2020) for time and frequency domains, respectively.

Using the TVP-VAR connectedness model has three main advantages: (1) there is no loss of observations, (2) it can handle low-frequency data, and (3) it does not depend on an arbitrary selection of the rolling window size. Moreover, the frequency-

CONTACT Seong-Min Yoon smyoon@pusan.ac.kr Department of Economics, Pusan National University, 2, Busandaehak-ro 63beon-gil, Geumjeong-gu, Busan 46241, Republic of Korea

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based TVP-VAR connectedness network approach provides several additional novelties. Therefore, the TVP-VAR connectedness approaches have been extensively employed by recent studies (Bouri et al. 2021, 2022; Lesame et al. 2021).

II. Data and methodology

Data

We employ four FinTech regional indices constructed by Refinitiv: Europe, North America, Asia-Pacific excluding Japan, and Japan. The dataset includes the daily closing prices spanning from 2 September 2021, until 4 April 2022. The daily return series are calculated as the first difference of the logarithmic price, while the realized volatilities are calculated as the annualized standard deviation of log returns of closing prices in a 10-day rolling.[1] We divide this whole sample into two periods: pre-RIU (2 September 2021–23 February 2022) and RIU (24 February 2022–4 April 2022).

The descriptive statistics are summarized in Table A.1 and Figures A.1–A.2 (online Appendix). Figures A.1 and A.2 depict significant spikes around the RIU (24 February 2022), which is more prominent for the volatilities.

Methodology

This study explores the connectedness in the time and frequency domains based on TVP-VAR using the methodology of Antonakakis, Chatziantoniou, and Gabauer (2020) and Ellington and Barunik (2020), respectively. Both methodologies are explained in Table 1 and more details are provided in Appendix A.1 and A.2.

III. Empirical findings

TVP-VAR connectedness results

When comparing the two subsamples (pre-RIU and RIU periods), Table 2 reveals a connectedness clustering among FinTech indices during the war with the total return (volatility) increasing from 30.00% to 38.27% (52.96% to 57.19%). Furthermore, it is interesting to notice that the intensity of transmitting to and receiving from regional FinTech indices increased during the war for all indices, except the transmission of spillovers from Japan to others. Moreover, net return and volatility spillovers display variation, increasing considerably in absolute values between the two sub-periods with a clear dominance for European and to a less extent North American indices during RIU. The receivers of shocks are Japan and Asia Pacific. These findings suggest that European and North American Fintech markets are driving the volatilities in the world's regional FinTech indices. Moreover, the results reveal that the war has significantly altered the interdependence among regional FinTech indices. Of particular interest is that during both periods, North America FinTech indices is playing a lesser role than the European market. Although America is the region with the

Table 1. Summary of methodology.

	Antonakakis, Chatziantoniou, and Gabauer (2020)	Ellington and Barunik (2020)
Total connectedness index (TCI)	$C_t(H) = \frac{\sum_{i,j=1,i\neq j}^{m} \tilde{\Phi}_{ij,t}(H)}{\sum_{i,j=1}^{m} \tilde{\Phi}_{ij,t}(H)} \times 100 = \frac{\sum_{i,j=1,i\neq j}^{m} \tilde{\Phi}_{ij,t}(H)}{m} \times 100$	
Local network connectedness		$C(\mu,d) = 100 \times \sum_{i,j=1 i\neq j}^{N} \left[\tilde{\theta}(\mu,d)\right]_{j,k} / \sum_{i,j=1}^{N} \left[\tilde{\theta}(\mu)\right]_{i,j}$
Total directional connectedness TO others	$C_{i\rightarrow j,t}(H) = \frac{\sum_{j=1,i\neq j}^{n} \tilde{\Phi}_{ji,t}(H)}{\sum_{i=1}^{n} \tilde{\Phi}_{ji,t}(H)} \times 100$	$C_{j\rightarrow\cdot}(\gamma,d) = 100 \times \sum_{\substack{i=1 \\ i\neq j}}^{N} \left[\tilde{\theta}(\gamma,d)\right]_{i,j} / \sum_{i,j=1}^{N} \left[\tilde{\theta}(\gamma)\right]_{i,j}$
total directional connectedness FROM others	$C_{i\leftarrow j,t}(H) = \frac{\sum_{j=1,i\neq j}^{n} \tilde{\Phi}_{ij,t}(H)}{\sum_{i=1}^{n} \tilde{\Phi}_{ij,t}(H)} \times 100$	$C_{j\leftarrow\cdot}(\gamma,d) = 100 \times \sum_{\substack{i=1 \\ i\neq j}}^{N} \left[\tilde{\theta}(\gamma,d)\right]_{j,i} / \sum_{j,i=1}^{N} \left[\tilde{\theta}(\gamma)\right]_{j,i}$
NET total directional connectedness	$C_{i,t}(H) = C_{i\rightarrow j,t}(H) - C_{i\leftarrow j,t}(H)$	

[1]The 10-day rolling historical volatility has been extensively used for two reasons. First, it is a measure of past performance and a statistical measure of the dispersion of returns. Second, it allows for a more long-term interpretation of risk (Umar et al. 2022).

Table 2. Connectedness table.

	Before the RIU					During the RIU				
	Europe	Asia-Pacific	North America	Japan	FROM others	Europe	Asia-Pacific	North America	Japan	FROM others
Returns										
Europe	71.52	10.02	13.23	5.24	28.48	67.72	7.27	22.44	2.57	32.28
Asia-Pacific	11.68	65.48	5.26	17.58	34.52	13.52	54.88	12.99	18.61	45.12
North America	14.53	3.21	79.93	2.34	20.07	25.75	2.83	70.66	0.75	29.34
Japan	10.74	17.28	9.16	62.83	37.17	17.74	20.45	8.16	53.64	46.36
TO others	36.94	30.50	27.64	25.16	120.25	57.01	30.56	43.59	21.93	153.09
NET	8.46	−4.02	7.57	−12.01	**TCI** = 30.00%	24.73	−14.57	14.26	−24.42	**TCI** = 38.27%
Volatilities										
Europe	45.95	13.20	13.29	27.57	54.05	41.49	16.08	17.74	24.69	58.51
Asia-Pacific	18.15	41.93	20.42	19.50	58.07	22.33	40.4	22.05	15.22	59.60
North America	16.36	16.97	58.16	8.51	41.84	20.84	19.71	48.98	10.47	51.02
Japan	28.64	19.66	9.59	42.11	57.89	27.86	17.39	14.38	40.37	59.63
TO others	60.44	44.35	29.79	58.92	193.51	71.03	53.19	54.18	50.37	228.76
NET	9.10	−8.25	1.45	−2.31	**TCI** = 52.96%	12.51	−6.41	3.15	−9.26	**TCI** = 57.19%

Note: RIU denotes the Russia's Invasion of Ukrainian.

most FinTech start-ups globally, their market is not as deep as European market and there is a concern that their development is not at the same pace as the European markets.

To better understand the evolvement of the interdependence between regional indices over time, Figures 1 and 2 focus on the net transmitters and receivers of return and volatility spillovers before and during RIU, respectively. Among all regional FinTech indices, Europe is the net transmitter of returns and volatility shocks, whose role notably amplifies with the RIU. The Asia-Pacific and Japan are mostly net receivers of return and volatility shocks in both episodes. Furthermore,

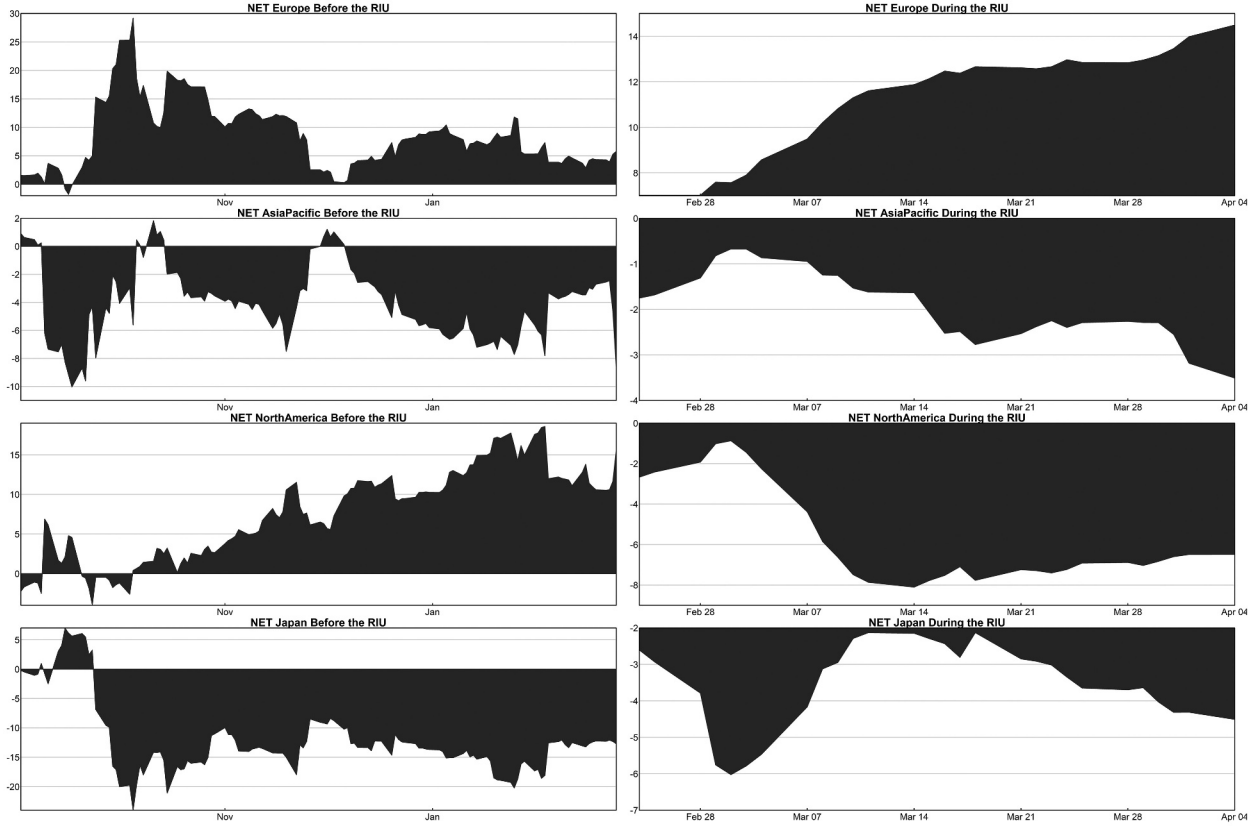

Figure 1. Time-varying net return connectedness before and during the RIU.

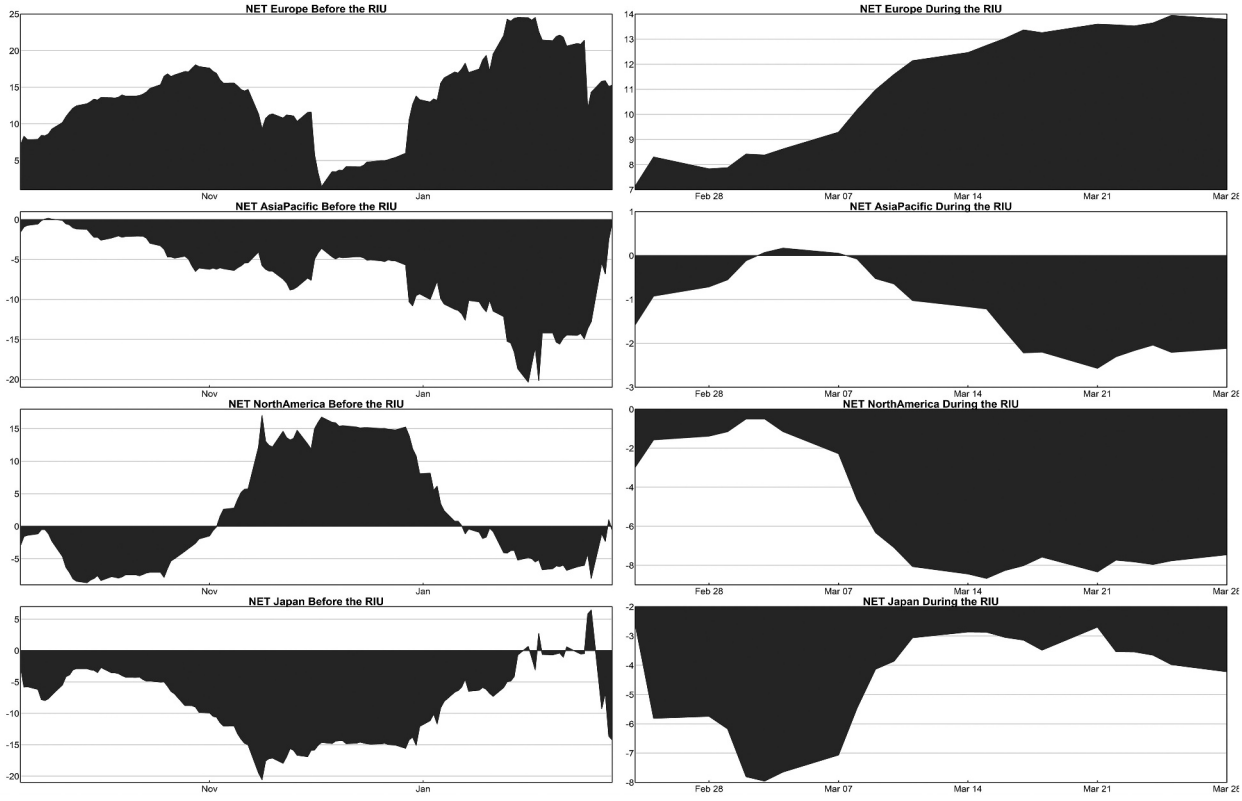

Figure 2. Time-varying net volatility connectedness before and during the RIU.

North America flips its role as a net propagator to a net recipient with the RIU, particularly in the case of returns.

Our results are in line with the findings of that connectedness surges among all markets during a geopolitical turmoil such as the pandemic (Le, Abakah, and Tiwari 2021) and war crises (Umar et al. 2022). In the process of uncertain events, limited diversification opportunities were available within the same sector across different regions, due to a high degree of regional spillovers. Besides our finding of Europe being the largest transmitter of shocks in the pre RIU is consistent with Youssef, Mokni, and Ajmi (2021).

Time-varying connectedness

In the second step, we analyse transitory or short-term (1–5 days) and persistent or long terms (more than 20 days) interdependencies networks for returns and volatility before and during the RIU (Figure 3). Findings indicate that transitory linkages are larger than the persistent ties, indicating that FinTech market absorb information rapidly, demonstrating more short-term connections. This result is consistent with the findings of Umar et al. (2022). Since the transitory linkages are stronger than the permanent ones, we focus, in the final phase of our study, on the transitory connectedness networks on 24 February 2022 to determine the impact of the RIU, as shown in Appendix A.3. In terms of returns, findings show that the Asia-Pacific and Japan pair had the tightest transitory return connectedness, indicating that geographical proximity plays an essential role in short-term return linkages, followed by North America-Europe pair. The rest of the pairs were mildly connected. The results are consistent with the claims made by Han, Kordzakhia, and Trück (2020).

Looking at the short-term volatility interdependencies, Europe and North America have the strongest transitory returns linkage. Most of the nodes are tightly connected, except Asia-Pacific and Japan/Europe nodes indicating the significant impact of RIU on volatility connectedness.

Figure 3. Transitory and persistent connectedness networks before and during the RIU.

IV. Conclusion

This study provides insights into the frequency and time connectedness among several regional FinTech indices and focuses on the impact of Russia's invasion of Ukraine. This period carries lots of uncertainties in the global market. The spillover index increased during the RIU, the strongest transmitters were Europe and North America, and the largest receivers were Asia-Pacific and Japan. FinTech indices seem to be regionally integrated he FinTech index of these regions cannot act as safe-haven assets. Moreover, the short-term effect or transitory linkage among regional FinTech indices is stronger and larger than the long-term or persistent relationship.

These results are useful for investors, portfolio managers, and financial managers. First, in a turbulent economy, FinTech indices have a high likelihood of concurrent losses; thus, investors – including FinTech companies from several regions – should account for this when building a portfolio. Second, Europe and North America are net contributors, indicating their important roles in transmitting shocks. Third, short-lived connectedness displays greater return and volatility spillovers than long-term connectedness, indicating that FinTech market absorbs information rapidly.

Our results that the temporary linkages are more pronounced than the persistent connectedness underpins the importance of short portfolio reallocation and the development of hedging strategies in the wake of such geopolitical uncertainty. Future research can be conducted using long-term datasets post-war, which will be valuable for post-war diversifiers and hedgers post-war.

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Disclosure statement

No potential conflict of interest was reported by the author(s).

ORCID

Muneer M. Alshater http://orcid.org/0000-0001-6876-3301

Onur Polat http://orcid.org/0000-0002-7170-4254
Rim El Khoury http://orcid.org/0000-0003-4359-7591
Seong-Min Yoon http://orcid.org/0000-0003-3011-9486

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