J. Int. Financ. Markets Inst. Money 88 (2023) 101830

Contents lists available at ScienceDirect

Journal of International Financial Markets, Institutions & Money

journal homepage: www.elsevier.com/locate/intfin

Financial earthquakes and aftershocks: From Brexit to Russia-Ukraine conflict and the stability of European banks

Phuong Thi Thu Vu [a,*], Nhan Huynh [b,*], Hoa Phan [c], Hanh Hoang [d,e]

[a] Faculty of Economics and Management, Thuyloi University, Hanoi, Viet Nam
[b] Department of Applied Finance, Macquarie Business School, Macquarie University, Australia
[c] School of Economics, Finance and Marketing, RMIT University, Australia
[d] UWA Business School, The University of Western Australia, Australia
[e] Faculty of Business Administration, Academy of Finance, Hanoi, Viet Nam

ARTICLE INFO

JEL classifications:
G01
G21
G28

Keywords:
Geopolitical risk
Health crisis
Economic policy uncertainty
Bank stability
European banks

ABSTRACT

This study examines the impacts of recent turbulent events (Brexit, COVID-19 pandemic, and the Russia – Ukraine conflict) on the European banks' resilience. Using the quarterly data of 251 commercial banks in 33 European economies from 2014 to 2022, we find that uncertainties significantly reduce bank's overall performance and stability. The comparisons of each event reveal the differential impacts in nature on specific indicators of performance and stability. The additional analyses highlight the roles of bank size, age, holding capital, and business models in attenuating the destabilizing effects of those shocks. The disparity effects are also visible across affiliations to income-generation levels and the European Union. The results are robust across alternative performance proxies and econometric approaches. From the starting point of this study, valuable implications are proposed for stakeholders, regulators, and policymakers in the challenges of unprecedented uncertainties.

1. Introduction

Since the Global Financial Crisis (GFC) in 2007–2008, the stability of the banking industry has attracted much attention in the current finance literature (Elnahass et al., 2021; Sclip et al., 2019; Huynh and Tran, 2021). Tighter capital and liquidity requirements were imposed on banks through the Basel III regulation, which may strengthen the stability and transparency of the global banking system (Benbouzid et al., 2022). However, the banking industry, considered as the financial intermediaries of the economy, is more sensitive to exogenous shocks than other industries (Demir and Danisman, 2021b). The vast majority of previous studies have examined the effects of unanticipated events on the profitability and stability of the banking system, including economic policy risks (e.g., the Brexit event) (Fernández et al., 2020; Nguyen, 2021), geopolitical risks (Brandt and Gao, 2019; Janbaz et al., 2022; Phan et al., 2022) and public health crisis risks (e.g., the COVID-19 outbreak) (Berger and Demirgüç-Kunt, 2021; Demir and Danisman, 2021b; Duan et al., 2021; Elnahass et al., 2021; Li et al., 2021; Polyzos et al., 2021; Tran et al., 2022). Given the extant literature on uncertainties and the financial sector, prior studies focus on uncertainties under the time-cycle scope. With the long-lasting impacts of the COVID-19 pandemic, Brexit, and the ongoing Ukraine-Russia war, a significant absence from the current literature is whether and

* Corresponding authors.
E-mail addresses: phuongvtt@tlu.edu.vn (P.T.T. Vu), david.huynh@mq.edu.au (N. Huynh), thi.kieu.hoa.phan@rmit.edu.au (H. Phan), hoangthihonghanh@hvtc.edu.vn (H. Hoang).

https://doi.org/10.1016/j.intfin.2023.101830

Available online 28 August 2023
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how the compounding risks caused by uncertain shocks may impact the bank's performance and stability. This paper enters this strand of literature by exploring the impacts of three major uncertain events, namely economic policy and political risk (Brexit), geopolitical risk (Russia-Ukraine conflicts), and public health risk (the COVID-19 pandemic) on European banks' performance and stability.

To our best knowledge, this is the first study to combine all three events in a single study on the resilience of the European banking system. The motivations for this study can be clarified by the following reasons. First, the Europe region includes world-leading economies with the European Union (EU) operating as a single market. Hence, this region exhibits an important role in the driving of the global economy. The European economies contribute approximately 21% of the global GDP and represent one of the most important financial centers with the total banking assets of more than EUR 49 trillion in 2019.[1] Second, the European banks have significant differences in their balance sheets than those in the US (Dursun-de Neef and Schandlbauer, 2021). For instance, the value of loan loss reserves from European banks has been smaller than those from the US banks (Schularick et al., 2020). Also, European banks seem to be weaker to recover after the GFC in 2008 than the US banks (Acharya and Steffen, 2020). Further, the signs of recovery of European economies and banking sector are visible after several chaos from GFC and Eurozone sovereign debt crisis (Degl'Innocenti et al., 2017). Given the close economic connections between the UK and EU, the Brexit event in 2016 triggered economic policy uncertainties, negatively affecting the European economies (Tata, 2018; Shahzad et al., 2019). Also, from 2020 to 2021, the European economies were damaged by the coronavirus outbreak (Huynh et al., 2021). The spread of this health crisis may impact the global banking systems and attribute to precautionary reactions such as withdrawing deposits and dropping market funding for financial intermediaries (Sharma et al., 2020). Recently, the world was shaken by the Russian Federation's invasion to Ukraine in February 2022. This conflict causes extreme geopolitical risks to the European countries due to geographical proximity and economic and trade links between the Eurozone with both Russia and Ukraine. Thus, given the extensive impacts of the COVID-19 pandemic, Brexit, and the ongoing Ukraine-Russia war and the unique characteristics of the European banking industry, it is necessary for policymakers and politicians to understand how European banks operate and react to such external extraordinaries to adjust their regulations, which may stay away from similar mistakes (Dursun-de Neef and Schandlbauer, 2021) and avoid the default risks for small banks as First Republic Bank, Signature Bank and Silicon Valley Bank in the US recently. In addition, given that different policies responses relative to different crises (Carletti et al., 2020), the comparisons of each uncertain event may uncover the differential impacts in nature on specific indicators of bank performance and stability, which then support bank managers and policymakers tracking the sources of effects to efficiently allocate funding, improve the bank risk-management and effectively adjust public policies.

Utilizing the data of 251 commercial banks in 33 European economies from 2014 to 2022, this paper enters this strand of literature to explore the impacts of recent crisis events (namely Brexit, the COVID-19 pandemic, and the Russia-Ukraine war) on the European banks' resilience. Our results show that crisis events adversely impact European banks' financial performance in terms of both accounting-based and market-based proxies. With higher insolvency and liquidity risk, we confirm substantially adverse impacts of the uncertain events on the stability of European banks. The comparisons of the impacts of each event also reveal that Brexit only exerts significant collisions on financial performance regarding the accounting-based proxies. The European banking sector's performance and stability solely suffer from the macroeconomic flu symptoms of the COVID-19 disease; and the Russia-Ukraine war also creates further pressure on their financial performance and valuations. However, our results also reveal positive signs of the impact of the Russia-Ukraine war on European banks regarding relatively better credit and liquidity position due to the proactive responses of every single bank, central banks, and public authorities.

To better identify the effects of uncertainties, we rely on cross-sectional comparison by using three bank-specific factors: size, age, and capital adequacy. Our results indicate that smaller and younger banks are severely mashed down by economic and political uncertainties compared to their counterparts. Better capital adequacy also enhances banks' ability to be more resilient to exogenic shocks in general terms of well-capitalized banks. Besides, we find substantial differences between the two bank types - conventional and Islamic, that Islamic banks report a better financial performance and risk profile but with lower stability contrasted to their conventional counterparts. Our additional analyses on country-specific factors show that banks affiliated with high-income economies perform relatively better than middle-income groups, especially during the COVID-19 pandemic and War. Further, banks in the EU members are negatively and severely affected by the leaving of the UK, while they perform better than banks in non-EU economies during the War.

This study contributes to the existing literature in several ways. First, this is the first study to simultaneously examine three major shocks, namely Brexit, the COVID-19 pandemic, and the Russia-Ukraine war, on the banking stability in a single study. Our study also extends the flow of uncertain events surveyed by Degl'Innocenti et al. (2017) and its impacts on the European banking sector from 2007 to 2012.[2] In addition, prior studies focus on the nexus of uncertainty-bank resilience by employing the time-series data of aggregate uncertainty indices (Demir and Danisman, 2021a; Nguyen, 2021), our study profoundly considers the specific and instantaneous impacts of each event. As such, we not only deepen extant literature on bank stability, but also expand the growing research on the real impacts of uncertainties on the overall stability of financial system (Demir and Danisman, 2021a; Janbaz et al., 2022; Nguyen, 2021). Second, this is the first study to explore the impacts of the Russia-Ukraine war on European bank performance and stability. The ongoing Ukraine-Russia war is considered as a unique geopolitical uncertainty in nature which is considerably

[1] According to the data of GDP (PPP), current prices reported by the International Monetary Fund (2023 estimate) and the data published by Statista Research Department in 2019.

[2] Degl'Innocenti et al. (2017) consider the impacts of three main financial crisis events, including the U.S. subprime crisis (2007–2008), the Global Financial Crisis (2009–2010) and the European sovereign debt crisis (2010–2012) on the productivity growth and integration of banks in 28 European countries.

different from the past political uncertainty and conflicts in the European economies (Qureshi et al., 2022; Ahmed et al., 2022). In fact, the European banking sector attributes to remarkably systemic risk to the economy in the European economies. This is because if a large-scale bank or a group of small–scale banks in this continent were bankrupt, it would substantially impact the European and global economies (Black et al., 2016). Therefore, understanding the impacts of three present shocks from Brexit to the ongoing Ukraine-Russia war on European banks could be crucial for bank managers in risk management, which is also noteworthy for regulators in adjusting policies and supervising the banking sector to avoid significant systematic risk for the whole European economy as well as the global banking system.

Further, we are presenting the first study to comparatively evaluate and spot the economic magnitudes of the impacts of different forms of uncertainty. Given the relatively strongest impacts of the COVID-19 on bank stability, this study strengthens empirical results from previous research on the impact of the public health pandemic on bank soundness (Demir and Danisman, 2021b; Duan et al., 2021; Elnahass et al., 2021; Foglia et al., 2022). It is worth stressing that having insights into this dimension is critical to protect the banking system from unanticipated shocks, such as public health risks that could be more harmful than other uncertainties. These insights help bank managers and policymakers trace the sources of effects, then better allocate funding and supportive measures based on the nature of astonishing events. As such, from the starting points of our findings, bank managers and policymakers can benefit from coping with specific uncertainties spawned from unforeseen shocks. Banks could rely on various tools and techniques for risk management, including stress testing, scenario analysis, risk modelling, and risk hedging. Maintaining profitability might require banks to adjust their pricing strategies and reduce costs during uncertain periods. Finally, from the findings on bank-level heterogeneity and national-specific characteristics, we propose practical policy implications for banks, customers, and policymakers. Our results imply that smaller, younger, and less-capitalized banks tend to be more vulnerable to the adverse impacts of crises. Therefore, governments and central banks should introduce such initiatives as market interferences, fiscal stimulus, and bailout packages for a specific group of banks. This study calls for aligned reactions to directly assist the smaller and younger banks, which suffered the most during those unexpected events. Regarding capital adequacy, bank managers can benefit from these findings to identify the factors responsible for sustaining their institution's stability. The outcomes also have implications for bank customers currently confronting financial pressure. Customers can utilize the bank-level heterogeneity to make informed decisions while selecting between various types of banks, including mature banks with good reputations, bigger banks, and well-funded or Islamic banks. The "asymmetric shocks" from uncertainties in the specific European economy can also create a paradigm for explicit assistance from European Central Bank (ECB), national central banks, and public authorities. These results highlight the need for developing appropriate banking regulatory frameworks, reinforcing formal institutions, and fostering financial development in countries that are highly exposed to macroeconomic and financial risks, particularly in times of significant uncertainty.

The remainder of this paper is structured as follows. Section 2 provides an overview of the relevant literature. The next section presents information on data and methodology, and the empirical findings are reported in Section 4. Section 5 provides the results from additional analyses and robustness checks, and Section 6 concludes the study.

2. Literature Review

Uncertainties are found to substantially debilitate the overall economy and, more particularly, the stability of financial markets and institutions. Over the past decade, academic scholars have been progressively interested in exploring the potential impacts of different types of uncertainty, such as economic policy uncertainty, health crises or pandemics, and geopolitical uncertainty. With the concentration on European economies and their banking sector of this study, we comprehensively review the impacts of major uncertainties and risks that exert adverse impacts on the stability of financial markets and institutions.

The current literature has confirmed the potential effects of *Geopolitical Risk* on the banking system, which captures the uncertainty arising from the possibility of terrorist acts, wars, and international disputes (Caldara and Iacoviello, 2022). In fact, geopolitical risk has an adverse relationship with investor sentiments (Phan et al., 2022). Investors' fear of losing money causes the rearrangement of their portfolios by shifting their investments from riskier to safer assets, thus reducing liquidity among banks. Shleifer and Vishny (2010) find that the banks' stability is significantly driven by investor sentiment fluctuations. Therefore, geopolitical risk is anticipated to make banks more unstable or fragile because it is linked to investor sentiment fluctuations, lower credit growth, profit variability, and a higher probability of default (Brandt and Gao, 2019). The Russian-Ukraine war is considered as an example of geopolitical threats that undermines financial institutions and markets (Caldara and Iacoviello, 2022; Phan et al., 2022), which may therefore harm the stability of the banking system particularly in the European continent.

In the literature on well-documented strains of uncertainty, prior works also prove that Economic Policy Uncertainty (EPU) weakens future economic stability (Fernández-Villaverde et al., 2015; Baker et al., 2016). At the corporate level, EPU causes firms to postpone their investment decisions (Francis et al., 2014; Gulen and Ion, 2016; Boumparis et al., 2017; Tiwari et al., 2020). As a result of these effects, the aggregate demand for loans and bank interest rates tends to be lower in the period of increased policy uncertainty, which eventually erodes bank profitability (Bordo et al., 2016; Chi and Li, 2017). In addition, EPU increases the information asymmetry between banks and their clients (Francis et al., 2014; Ng et al., 2020). As a result, banks tend to tighten their bank credit activities (Barraza and Civelli, 2020) and borrowing standards (Bordo et al., 2016), which then reduce the acceptance probability of new credit applications (Alessandri and Bottero, 2017). Therefore, the high economic policy uncertainty may deteriorate bank profits due to losing income from credit activities.

Among the impacts of geopolitical risk and economic policy uncertainty, the global economy, including the banking system, has also experienced several chaos generated by public health crises or pandemics. Although health crises may cause global impacts, they are different from other crises because they do not come from conflicts of interests regarding economic or political aspects. Therefore,

existing literature provides mixed findings on the impacts of the health crisis on the global banking system. Gong et al. (2021) document that the public health crisis (H1N1 disease) over 2009–2010 attributes to an increase in the costs of borrowing and reduces the volume of bank lending. An et al. (2022) confirm that companies and households in areas damaged by the epidemic disease (e.g., TseTse fly) have lower ability to access external financing (including bank loans). This disease may also minimize citizens' tendency to adopt financial technology, which may adversely influence the development of modern financial systems. Given the recent pandemic of COVID-19, on the one hand, prior research documents a negative impact of the outbreak on banks' financial performance and stability globally (Elnahass et al., 2021; Duan et al., 2021; Tran et al., 2022). The probability of a rise in non-performing loans and the potential withdrawal of deposits from companies and households during the pandemic could seriously impact banks' performance (Goodell, 2020). Elnahass et al. (2021) highlight that the COVID-19 outbreak significantly harms bank profitability, increases costs, and negatively impacts the market value of listed banks. It also damages the banking system's stability because of causing asset risk, default risk, and liquidity risk. The findings from Duan et al. (2021) indicate that the banking industry's systematic risk has increased across countries during COVID-19. Trinh et al. (2022) document that bank tail risks, including systematic and idiosyncratic risks, rise during this public health crisis, suggesting a greater likelihood of potentially significant losses of the market value of the global banking sector.

On the other hand, other studies show that the COVID-19 pandemic shock may have no or little impact on the banking system. Given the Basel III capital requirements and the improvement of bank liquidity after the GFC in 2008, the banking system may be better for dealing with the severe impacts of the COVID-19 contagion (Carletti et al., 2020). Bitar and Tarazi (2022) further support that many regulations responding to the banking system's potential vulnerability, such as the moderation of rules regarding non-performing loans and capital buffers, have been implemented to reduce the adverse effects of the COVID-19 pandemic on the financial systems. Elnahass et al. (2021) argue that in the period of the crisis, banks are more likely to tighten their credit activities and restrictively follow governing requirements to increase their liquidity positions and safeguard their sound capital. Beck and Keil (2022) further explain that banks in some nations refused many loan applications and minimized overdraft credits of borrowers. As a result, banks could avoid non-performance loans during the turmoil. In addition, the magnitude of COVID-19 pandemic impact on the banking system is contingent on bank-specific factors, government response policies, and the informal actions of each financial institution (e.g., depending on their culture and credibility). For instance, Danisman et al. (2021) find that the banking system with a higher presence of Islamic banks is more resilient. Elnahass et al. (2021) support that Islamic banks had a higher risk profile but achieved a higher profitability position and lower operational risk during the COVID-19 turmoil than the others. Also, Demir and Danisman (2021b) suggest that banks with larger capitalization and deposits, greater diversification, lower levels of non-performing loans, and larger size tend to be more resilient under the impact of the COVID-19 pandemic. Likewise, banks with higher levels of financial stability, such as superior profits and greater market values, are better-equipped to handle the COVID-19 shock (Trinh et al., 2022).

Given the sequential event timeline, European economies and financial systems have experienced several shocks during the last ten years. On 23 June 2016, a Brexit referendum in the UK was decided by voters to support the nation in definitively leaving the European Union. The uncertain outcome of the Brexit referendum has created both economic policy uncertainty (Baker et al., 2016; Hill et al., 2019; Nguyen, 2021; Kostakis et al., 2023) and geopolitical risk (Smales, 2017) for European economies. However, to date there has been no study to examine how European banks operated after the UK left, given the close economic connections between the UK, EU and non-EU members. Meanwhile, the tremendous uncertainty following Brexit related to the EU evolving institutional and supervisory arrangements, which will be drafted without the UK involvement, whereby the European Supervisory Agencies may have a larger role (Moloney, 2018). It can anticipate that the financial industry will collaborate intensively across member states after this uncertainty. Therefore, to date, the impact of Brexit on the European bank's stability has remained a significant question which should be addressed. During the period of 2020–2021, the COVID-19 crisis also stunned the profitability and risk-taking behavior of European banks (Elnahass et al., 2021; Dursun-de Neef and Schandlbauer, 2021). However, the current literature has investigated the consequences of public health crises (mostly focusing on the COVID-19 pandemic) on the banking system based on international evidence and provided mixed evidence. The signs of recovery for the financial sectors were relatively visible at the end of 2021 before the Russia-Ukraine conflict in 2022. As stated by Liadze et al. (2023), given trade connections and geographical proximity, Europe is the region affected most with a more than 1% reduction compared to the forecasted GDP in 2022. However, there is no study to comprehensively examine the stability of European banks during the continuous shocks from Brexit to Russia-Ukraine conflict. Overall, the current finance literature leaves a gap for this study to compare the magnitude impact of each event to reveal the differential impacts in nature on specific indicators of performance and stability of European banks.

3. Data and Method

The primary data source for this study is obtained from the Bankscope database compiled by Bureau van Dijk, including accounting, financial, and market data for all European banks. We exclude banks with any data missing during our examined periods.[3] Our final sample comprises 251 commercial banks from 33 European countries. The data spans from the first quarter (Q1) of 2014 to the fourth quarter (Q4) of 2022.[4] Appendix A shows the final sample distributions by region and country for the whole sample period. Country-

[3] To be included, all banks need to have at least data available during the first two quarter of 2022 as we focus on the impacts of Ukraine – Russia conflict in 2022.

[4] Our data begins in Q1 2014 to exclude the potential impacts of the European sovereign debt crisis during the early 2010 until the end of 2013, which is consistent with prior studies on this event (See, Ehrmann and Fratzscher, 2017; Allegret et al., 2017).

Table 1
Variable definitions and data sources.

Dependent Variables			Source
Accounting-based Performance			
Return on Assets	ROA	The ratio of total net income to total assets	Bankscope
Return on Equity	ROE	The ratio of total net income to total equity	Bankscope
Cost to Income	CTI	The ratio of total cost to income which suggests lower bank cost efficiency (Abdelsalam et al., 2021)	Bankscope
Market-based Performance			
Tobin's Q	TBQ	The natural logarithm of Tobin Q (TBQ) is calculated by the sum of total debt and market value of equity, divided by the book value of total assets. Higher value of TBQ implies higher forward-looking market valuation.	Authors' calculation
Market to Book ratio	MTB	The market value of equity scaled by book value of equity. Higher value of MV/BV implies higher current market valuation.	Bankscope
Market Value	MV	Market value of equity in the natural logarithm form. Higher value of LogMV implies higher current market valuation.	Bankscope
Risk proxies			
Insolvency Risk	ZSCORE	Overall bank risk (z-score of insolvency risk). We compute z-score as the total capital asset ratio ($CAR = \frac{\text{Equity capital}}{\text{Total bank assets}}$) plus Return on Assets (ROA) and the 4-year standard deviation of ROA from year t-3 to year t. The ratio is computed as $Z-score = \frac{(CAR + ROA)}{\sigma(ROA)}$ The greater log value of Z-score implies lower default risk. (Houston et al., 2010; Mohsni and Otchere, 2018; and Dias, 2021)	Authors' calculation
Credit Risk	NPL	The ratio of non-performing loans to total loans. The higher value NPL ratio implies higher credit risk of the banks.	Bankscope
Liquidity Risk	LIQ	The ratio of liquidity assets scaled by bank's deposits and short-term funding. The higher value of LA/DSF implies lower liquidity risk of the banks.	Bankscope
Independent Variables			
Event dummies			
Brexit dummy	Brexit	Denotes value of one if the observed period is within 2016, and zero otherwise.	Authors' calculation
COVID-19 dummy	COVID	Denotes value of one if the observed period is during Q1 2020 to Q4 2021, and zero otherwise.	Authors' calculation
Ukraine-Russia conflict dummy	WAR	Denotes value of one if the observed period is during Q1 2022 to Q4 2022, and zero otherwise.	Authors' calculation
Control variable			
Bank-control variables			
Islamic bank dummy	ISLAMIC	Denotes value of one if the observed bank is classified as Islamic banks, and zero otherwise.	Authors' calculation
Capital ratio	CAPITAL	Tier 1 capital/risk-weighted assets. According to the Basel II accord, the minimum percentage required is 4%	Bankscope
Loan ratio	LOAN	The ratio of total loan to total assets of the bank	Bankscope
Bank Size	SIZE	Natural logarithm of bank total assets	Bankscope
Bank Age	AGE	Bank age in the natural logarithm form of 1 plus the number of years of operation	Bankscope
Bank Leverage	LEV	The ratio of total debt scaled by total assets	Bankscope
Audited by Big 4	AUDIT	Denotes value of one if the observed bank is audited by a Big4 company, and zero otherwise.	Bankscope
Cash holding	CASH	The ratio of total Cash hold by banks scaled by total assets	Bankscope
Macroeconomic variables			
GDP per capita	GDP	Gross domestic products per capita, in the natural logarithm form. The GDP growth rate in % to capture the effect of the business cycle on local banks' performance.	WDI and OECD database
Inflation	INF	The consumer price index variable in percentage % to capture an asymmetric influence on deposit and lending rates, which are related to local banks' performance.	WDI and OECD database
Institutional quality	INS	The average value of six key country-governance measures consisting of corruption, government effectiveness, political stability, and regulatory quality, the rule of law, and voice and accountability.	WDI

level variables are retrieved from the World Development Indicators (WDI) of the World Bank, OECD and national authorities' databases to control for the impacts of these factors on domestic banks' performance. We winsorize all bank-level variables at the interval of 1% to offset the influences of extreme outliers. All variables employed in this study are reported in Table 1. The generic specification for our panel data regression models is specified as follows:

$$Y_{i,j,t} = \alpha + \beta_i EventDummies_t + \sum \delta_i Bankcontrol_{i,j,t-1} + \sum \theta_i Countrycontrol_{i,j,t} + u_{i,j,t} \quad (1)$$

Table 2
Descriptive statistics.

Variable	N	Mean	S.D	Min	Max	*Non-crisis*	*Crisis*
Accounting-based Performance							
ROA	7,530	0.88	3.45	−5.28	9.93	*1.35*	*0.49*
ROE	7,530	3.74	15.60	−5.95	8.38	*5.77*	*2.11*
CTI	7,530	57.94	49.82	−8.97	105.84	*55.29*	*67.00*
Market-based Performance							
TBQ	7,530	−0.60	−0.25	0.00	−2.72	*−0.57*	*−0.93*
MTB	7,530	0.32	0.73	0.06	5.53	*0.63*	*0.28*
MV	7,530	11.55	2.28	3.55	12.44	*13.33*	*7.92*
Risk proxies							
ZSCORE	7,530	0.95	0.71	−0.64	2.02	*1.47*	*0.18*
NPL	7,530	5.56	15.28	0.00	20.44	*9.42*	*10.25*
LIQ	7,530	36.19	58.18	4.25	85.38	*32.40*	*38.23*
Independent Variables							
Event Dummies							
BREXIT	7,530	0.13	0.24	0.00	1.00	–	–
COVID	7,530	0.27	0.42	0.00	1.00	–	–
WAR	7,530	0.07	0.25	0.00	1.00	–	–
Control variable							
Bank-control variables							
ISLAMIC	7,530	0.05	0.23	0.00	1.00	–	–
CAPTIAL	7,530	12.81	23.34	0.00	56.12	*11.47*	*13.53*
LOAN	7,530	47.98	27.29	0.00	99.80	*52.27*	*43.45*
SIZE	7,530	5.05	2.75	2.59	9.47	*7.80*	*4.33*
AGE	7,530	2.41	0.43	0.69	2.83	–	–
LEV	7,530	0.26	0.19	0.01	0.98	*0.18*	*0.48*
AUDIT	7,530	0.54	0.50	0.00	1.00	–	–
CASH	7,530	0.10	0.12	0.00	0.34	*0.10*	*0.11*
Macroeconomic variables							
GPD	7,530	11.21	1.63	9.03	15.98	–	–
INF	7,530	2.30	4.25	−2.10	48.70	–	–
INS	7,530	0.81	0.81	−2.02	2.37	–	–

This table reports the summary statistics of all variables in this study. The last two columns report the results of Crisis and Non-crisis periods, which is classified based on three examined events. The descriptions and data sources of all variables are reported in Table 1.

$Y_{i,j,t}$ represents nine different proxies of accounting-based and market-based performance, and the risks of bank i of country j in quarter t. In this model, the dependent variables are captured by banks' market-based performance: Bank Revenue (TR), Tobin Q (TBQ), and Market value (MV). The accounting-based performance proxies include return on assets (ROA), return on equity (ROE) and cost to income ratio (CTI). We also include three indicators proxied for the bank risks, which indicate the overall stability of the banking sector, including: default risk computed by the natural logarithm of Z-Score (ZSCORE), credit risk proxied by the non-performing loan to total loan (NPL), and the liquidity risk proxied by the deposits and short-term funding (LIQ). $EventDummies_t$ indicate the dummy variables for three examined events, which take the value of 1 if the observations fall within three periods of Brexit (Q1 to Q4 2016),[5] COVID-19 pandemic (Q1 2020 to Q4 2021),[6] and Russia-Ukraine war (Q1 2022 to Q4 2022).

Further, we include a comprehensive set of bank-specific ($Bankcontrol_{i,j,t-1}$) and country-specific control variables ($Countrycontrol_{i,j,t}$) in our model, which can potentially affect performance and stability of the banks. Those control variables are

[5] In this study, we examine the initial shocks of referendum in 2016 of UK to leave the European Union - Brexit on European banks rather than the long process of Brexit, which includes several stages and events (Shahzad et al., 2019).

[6] The COVID periods ended in Q4 2021 due to the following reasons: (1) The visible signs of economic recovery at the end of 2021 of World and European economies due to rapid responses of the government with a set of fiscal, monetary, and financial policies to alleviate the economic impacts of the crisis (World Bank, 2022). Inclusively, our studied period can cover the majority of data periods employed in prior banking studies; (2) Several countries ended or significantly relaxed their COVID restrictions at the beginning of 2022 with the average vaccination rate in Europe reached 65% according to the data of Our World in Data (See: https://www.nytimes.com/2022/02/03/world/europe/sweden-announces-end-covid-restrictions.html); (3) In this study, we separate the COVID crisis and Russian – Ukraine conflict (begin in Q1 2022) as its significant different nature of risks, which is discussed in Section 2.

Table 3
Baseline results: Impacts of Brexit, COVID, and war on European banks' performance.

Main variables	Panel A: Accounting-based proxies			Panel B: Market-based proxies			Panel C: Risk proxies		
	ROA	ROE	CTI	TBQ	MTB	MV	ZSCORE	NPL	LIQ
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Crisis Dummies	−1.761***	−2.952***	0.136***	−0.310***	−0.232***	−0.533***	−0.122**	−0.363***	−0.159**
	(0.001)	(0.000)	(0.008)	(0.004)	(0.008)	(0.001)	(0.011)	(0.002)	(0.010)
Controls variables									
ISLAMIC	−0.036***	−0.021	−0.166**	−0.051*	0.116	0.001	−0.026**	−0.009	0.091*
	(0.011)	(0.013)	(0.076)	(0.093)	(0.257)	(0.067)	(0.011)	(0.013)	(0.026)
CAPITAL	0.076*	0.127**	0.266***	0.435***	0.067	0.084*	0.052*	0.189**	0.185**
	(0.027)	(0.015)	(0.011)	(0.006)	(0.151)	(0.019)	(0.028)	(0.005)	(0.007)
LOAN	0.024	0.191**	0.209**	0.008	0.012	−0.118**	−0.014	0.118*	−0.044
	(0.070)	(0.018)	(0.014)	(0.524)	(0.423)	(0.415)	(0.104)	(0.043)	(0.215)
SIZE	−0.165**	0.245***	0.265***	0.253**	0.024	1.294***	0.005	−2.154***	−0.302
	(0.023)	(0.009)	(0.006)	(0.032)	(0.070)	(0.000)	(0.766)	(0.000)	(0.554)
AGE	0.042	0.055	2.823***	0.016	−0.075*	0.067	−0.093	0.027	−1.153**
	(0.059)	(0.045)	(0.002)	(0.057)	(0.041)	(0.151)	(0.063)	(0.074)	(0.002)
LEV	0.352***	0.375***	0.129*	0.842***	0.010	0.443***	−0.253**	−0.132	0.009
	(0.008)	(0.008)	(0.071)	(0.003)	(0.025)	(0.017)	(0.011)	(0.198)	(0.012)
AUDIT	0.352***	0.375***	0.073*	0.009	0.211***	0.125*	−0.084**	0.251***	0.029**
	(0.008)	(0.008)	(0.018)	(0.131)	(0.011)	(0.037)	(0.031)	(0.097)	(0.010)
CASH				−0.122***	−0.094*	0.189***			
				(0.011)	(0.052)	(0.008)			
GDP	0.424***	0.432***	0.509***	(0.011)	(0.009)	0.003	−0.024**	0.184**	0.027
	(0.023)	(0.021)	(0.013)	0.010	0.009	(0.017)	(0.009)	(0.009)	(0.045)
INF	−0.228**	−0.129*	−0.002	−0.093	0.027	−0.018	−0.062*	0.025	0.013
	(0.017)	(0.106)	(0.115)	(0.063)	(0.074)	(0.016)	(0.003)	(0.023)	(0.020)
INS	0.272	0.104	0.298*	0.111*	0.034	0.330**	−0.052***	−0.018	−0.093
	(0.282)	(0.307)	(0.102)	(0.039)	(0.041)	(0.102)	(0.015)	(0.016)	(0.063)
Constant	0.804***	0.714**	0.520***	−0.944***	−0.993***	−0.758***	0.629***	0.440***	0.464***
	(0.021)	(0.020)	(0.012)	(0.106)	(0.104)	(0.125)	(0.135)	(0.090)	(0.087)
Country fixed effects	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Time fixed effects	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Bank fixed effects	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Observations	7,530	7,530	7,530	7,530	7,530	7,530	6,853	7,530	7,530
Adj. R-squared	0.461	0.546	0.417	0.165	0.263	0.242	0.429	0.655	0.404

This table reports the impacts of Brexit, COVID, and war on European banks' performance, with a set of bank-specific and country-specific controls. The results for accounting-based, market-based, and risk proxies are reported in Panel A, B, and C, respectively Variable definitions and data sources are described in Table 1. Standard errors are clustered at the bank level and are presented in parentheses under the associated coefficients. *, ** and *** represent 10%, 5% and 1% significance levels, respectively.

selected based on the extant literature on banking sector performance and risk-taking (Wu et al., 2020; Trinh et al., 2020; Elnahass et al., 2021; Elnahass et al., 2021; Gaganis et al., 2020). Finally, we include controls for the bank, country-fixed and time-fixed effects in all baseline and modified models. Besides, to mitigate the heteroscedasticity and serial correlation problems, standard errors are clustered at the bank level in all models. The details of all variables in the regression are reported in Table 1.

4. Results

4.1. Descriptive statistics

Table 2 presents the descriptive statistics of our data sample. The mean values of accounting-based performance, including Return on Assets (*ROA*) and Return on Equity (*ROE*), are 0.88 and 3.74, respectively. Compared between crisis and no-crisis periods, the means for the ratios of ROA and ROE plummet from 1.35% to 0.49% and 5.77% to 2.11%, respectively. The Cost to Income (*CTI*) exhibits a higher value of 67.00 during the crisis periods compared to 55.29 for the non-crisis, indicating a declining trend of cost efficiency. Regarding three proxies of Market-based Performance, we also see the worsening of forward-looking estimation of firm value - Tobin's Q (*TBQ*) from −0.57 to −0.93 during the crisis events. We also obtain a similar trend, that the market valuation of European banks significantly declines for two indicators of Market to Book ratio (*MTB*) and Market Value (*MV*). Our initial statistics reveal that European banks experience significant deterioration in financial performance regarding all accounting-based and market-based performance indicators during three uncertain events. Further, our statistics also exhibit the diminishing capability of the European banking industry to alleviate financial risks and maintain stability during the intensifying of uncertainties. The European banks experience higher Insolvency Risk with a lower mean of *ZSCORE* from 1.47 to 0.18. We also initially document that European banks are threatened with higher credit and liquidity risks as higher means of *NPL* and *LIQ*.

Regarding the bank-specific variables, the banks reveal an apparent decline in the value of total assets (*SIZE*) and loan portfolios

Baseline results: Impacts of each event on European banks' performance.

Panel A: Accounting-based proxies

Main variables	ROA				ROE				CTI			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
BREXIT	−0.139*			−0.143*	−0.281*			−0.118	0.042			0.052
	(0.082)			(0.075)	(0.054)			(0.068)	(0.059)			(0.045)
COVID		−1.274***		−1.392***		−2.041***		−0.844***		0.483*		0.258*
		(0.000)		(0.037)		(0.005)		(0.036)		(0.129)		(0.028)
WAR			−0.394***	−0.355**			−2.178***	−0.443***			0.476*	0.233
			(0.005)	(0.055)			(0.054)	(0.041)			(0.051)	(0.063)
Constant	0.626*	0.838***	0.661**	0.633***	0.123***	−0.195*	0.310***	0.495***	0.296*	0.559**	−0.546***	0.380***
	(0.021)	(0.029)	(0.039)	(0.015)	(0.011)	(0.092)	(0.023)	(0.167)	(0.014)	(0.102)	(0.070)	(0.012)
Controls variables	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Country fixed effects	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Time fixed effects	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Bank fixed effects	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Observations	7,530	7,530	7,530	7,530	7,530	7,530	7,530	7,530	7,530	7,530	7,530	7,530
Adj. R-squared	0.276	0.653	0.423	0.466	0.354	0.838	0.543	0.598	0.426	0.417	0.421	0.500

Panel B: Market-based proxies

Main variables	TBQ				MTB				MV			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
BREXIT	−0.092			−0.029	−0.082			−0.079	−0.153			0.123
	(0.039)			(0.016)	(0.049)			(0.047)	(0.065)			(0.049)
COVID		−0.099		−0.086		−0.121*		−0.109*		−0.376**		−0.112*
		(0.053)		(0.043)		(0.014)		(0.022)		(0.009)		(0.010)
WAR			−0.191*	−0.176**			−0.174**	−0.134**			−0.280**	−0.220**
			(0.059)	(0.007)			(0.008)	(0.009)			(0.012)	(0.004)
Constant	0.446**	0.685***	−0.280**	0.291**	−2.505***	1.927*	−6.538**	−0.179	0.210***	−0.323*	−0.923***	0.016
	(0.104)	(0.065)	(0.055)	(0.014)	(0.001)	(0.333)	(0.409)	(0.291)	(0.001)	(0.008)	(0.003)	(0.007)
Controls variables	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Country fixed effects	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Time fixed effects	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Bank fixed effects	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Observations	7,530	7,530	7,530	7,530	7,530	7,530	7,530	7,530	7,530	7,530	7,530	7,530
Adj. R-squared	0.444	0.394	0.737	0.376	0.570	0.506	0.946	0.483	0.344	0.293	0.362	0.397

Panel C: Risk proxies

Main variables	ZSCORE				NPL				LIQ			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
BREXIT	−0.074			−0.021	−0.031			−0.045	−0.058			−0.014
	(0.203)			(0.056)	(0.224)			(0.138)	(0.162)			(0.677)
COVID		−1.119***		−0.574***		−0.117**		−0.100*		−0.020		−0.046
		(0.061)		(0.021)		(0.216)		(0.081)		(0.173)		(0.223)
WAR			−0.645***	−0.320**			−0.132**	−0.157**			0.031	0.050*
			(0.036)	(0.047)			(0.108)	(0.103)			(0.202)	(0.441)
Constant	0.446	−0.358**	1.144***	−0.241	−2.497***	0.734**	−4.586***	1.141**	−2.022***	−1.072***	0.857***	0.410***
	(0.306)	(0.151)	(0.035)	(0.300)	(0.002)	(0.027)	(0.000)	(0.022)	(0.283)	(0.205)	(0.034)	(0.023)
Controls variables	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Country fixed effects	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Time fixed effects	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Bank fixed effects	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Observations	6,853	6,853	6,853	6,853	7,530	7,530	7,530	7,530	7,530	7,530	7,530	7,530
Adj. R-squared	0.307	0.516	0.629	0.466	0.393	0.195	0.367	0.272	0.536	0.321	0.604	0.393

This table reports the impacts of Brexit, COVID, and war on European banks' performance, with a set of bank-specific and country-specific controls. Variable definitions and data sources are described in Table 1. The results for accounting-based, market-based, and risk proxies are reported in Panel A, B, and C, respectively. Standard errors are clustered at the bank level and are presented in parentheses

(*LOAN*) during the crisis periods. The statistics also indicate that the financial leverage of banks increases during the crises as the LEV ratio increases from 18% to 48%. Moreover, banks also increase their capital ratio (*CAPITAL*) from 11.47 to 13.53 to tackle their financial difficulties during uncertain events. Our sample's average inflation rate (*INF*) is 2.30, and a logarithmic transformation of GDP per capita (*GDP*) is 11.21. The mean value of Institutional quality (*INS*) in our sample is 0.81, fluctuating from −2.02 to 2.37. Overall, the performance and financial stability of the European banking sector emerge to suffer harshly from the adverse shocks from the events of Brexit to COVID-19 and then the Russia-Ukraine conflicts.

4.2. Baseline results

Table 3 presents our baseline results on the impacts of three examined events on the European banks. Using the dummy variables of three crisis events (Crisis Dummies), our estimated coefficients are negative and statistically significant for all indicators of accounting-based performance (ROA, ROE, and CTI), market-based performance (TBQ, MTB, and MV), and bank stability with ZCORE and LIQ. Our findings support the hypothesis that increased risks will reduce bank performance and undermine stability. Regarding the accounting-based performance reported in Panel A, the ROA and ROA coefficients are −1.761 and −2.952, respectively, and significant at the 1% level. In other words, the value of ROA (ROE) will decrease by 1.761% (2.952%) on a quarterly basis when uncertain events (Brexit, COVID, or War) occur. Our findings are consistent with another accounting-based performance of CTI with an estimated coefficient of 0.136 ($p < 0.001$), indicating a worsening trend of cost efficiency.

In Panel B, we also obtain similar results for three proxies of market-based performance. The estimated coefficient for TBQ is −0.310 and statistically significant at the 1% level, indicating that such uncertain events reduce the forward-looking estimation of value is about −0.31% quarterly. We also find comparable results for the two other market-based proxies of MTB and MV. Overall, the baseline results uncover that European banks are subjected to significant corrosion in financial performance and market values during three vague events. Regarding the bank stability reported in Panel C, we also find that uncertain events drive up banks' risk-taking with higher insolvency risk (lower ZSCORE) and liquidity risk (LIQ) by 0.122% and 0.159% quarterly. Surprisingly, our baseline results denote that credit risk (NPL) is lower for our sampled banks during the crisis periods. However, the results lose their significance when we consider the impacts of each event in Table 4, which is clarified in the following parts.

In Table 4, we consider the impacts of each event (Brexit, COVID-19, and War) by utilizing three separate dummy variables. In Panel A, Brexit exerts negative and significant impacts on two banks' financial performance (ROA and ROE), and adverse impacts of COVID-19 and War are visible for all three accounting-based indicators. Economically, the COVID-19 pandemic (War) has resulted in a reduction in banks' profitability and effectiveness by 1.274% (0.394%) for ROA, 2.041% (2.178%) for ROE, and 0.483% (0.476%) for CTI. These results further confirm the adverse impacts of uncertain events on European banks' financial performance and efficiency. In Appendix B, we also consider alternative performance and risk-taking indicators to replace our original dependent variables and the results remain robust. Consistent with prior studies, uncertainties lead to lower demand for capital due to a cautionary response from depositors that results in diminishing non-interest income and overall profitability (Elnahass et al., 2021; Beck and Keil, 2022). Further, with the estimated coefficients, our results indicate that the impacts of the COVID-19 outbreak, and War are relatively more substantial than Brexit, further considered in Section 6. Regarding the results of market-based indicators reported in Panel B, we also find similar patterns on the impacts of the COVID-19 pandemic and War, as evidenced by significantly negative impacts on three market-related value and cost efficiency variables. However, European banks do not experience reductions in market values during Brexit, with insignificant coefficients across all three market-based proxies. In addition, our results confirm that Brexit, on average, does not have a significant impact on European banks' financial stability. This partially contradicts the findings of Fernández et al. (2020) for the British and Ireland banking sectors by considering the impacts of Brexit. One of the reasons behind the less significant impacts of Brexit is the long-term policies of the European Central Bank (EBC), such as the "no empty shell" policy that calls for banks to follow the EU tactical and risk supervision capabilities corresponding to their levels of risk.[7]

Regarding the investigations into financial stability in Panel C, our findings disclose that European banks, on average, confronted a considerable surge in bank default risks, which negatively impacted their financial solidity during uncertainty periods. Specifically, the coefficients of COVID and WAR are significantly and negatively associated with ZSCORE (higher insolvency risk). Since 2020, the global economy has experienced continuous harmful effects of the COVID-19 pandemic, an unpredictable event caused by non-economic factors. To deal with those shocks, governments conducted many restriction policies, which led to a negative economic impact on the whole society, not only households but also firms and financial institutions (Demir and Danisman, 2021b; Duan et al., 2021; Foglia et al., 2022; Shabir et al., 2023). As such, those events erode the bank profitability and reduce the number of bank deposits from households and businesses, which may trigger the tendency of bankruptcy and bank liquidity risk during the COVID-19 pandemic (Duan et al., 2021; Elnahass et al., 2021; Shabir et al., 2023). Our results are also in accordance with Phan et al. (2022) that geopolitical risk reduces the stability of banks. In fact, the Russia-Ukraine crisis in 2022 has a superior influence on the global economy than other geopolitical conflicts (Liadze et al., 2023), which can significantly damage firms' profitability and the global financial systems, including banks (Fang and Shao, 2022). On the other hand, as economically evidenced by the coefficients, the Russia–Ukraine war exhibits more substantial impacts on the stability of European banks, which the direct link of geographical associations can explain.

Interestingly, the European banks experience lower credit risk during the COVID-19 pandemic and WAR (seen Panel C, Table 4), which aligns with Elnahass et al. (2021) and Shabir et al. (2023). The negative impacts of the COVID-19 pandemic and the War on

[7] See https://www.bankingsupervision.europa.eu/press/interviews/date/2023/html/ssm.in230130~cd7de9ce0c.en.html for the information regarding the policies of EBC for the Brexit.

Table 5
Bank-specific factors: Effects of bank' s size.

Panel A: Small banks

Main variables	Accounting-based proxies			Market-based proxies			Risk proxies		
	ROA	ROE	CTI	TBQ	MTB	MV	ZSCORE	NPL	LIQ
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
BREXIT	−0.206*	−0.342**	0.365**	−0.286**	−0.346	−0.381**	−0.256***	0.267	0.158
	(0.071)	(0.000)	(0.034)	(0.001)	(0.027)	(0.004)	(0.003)	(0.787)	(0.408)
COVID	−1.925***	−2.785***	0.992**	−0.287***	−0.864**	−0.663***	−0.987***	0.464*	−0.154
	(0.001)	(0.000)	(0.001)	(0.000)	(0.008)	(0.000)	(0.000)	(0.029)	(0.328)
WAR	−0.899***	−1.366***	0.558**	−0.265***	−0.667***	−0.335*	−0.664**	0.224**	−0.516**
	(0.005)	(0.000)	(0.074)	(0.001)	(0.006)	(0.093)	(0.010)	(0.005)	(0.016)
Controls variables	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Country fixed effects	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Time fixed effects	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Bank fixed effects	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Observations	2,952	2,952	2,952	2,952	2,952	2,952	2,687	2,952	2,952
Adj. R-squared	0.257	0.189	0.530	0.317	0.244	0.599	0.434	0.189	0.636

Panel B: Large banks

Main variables	Accounting-based proxies			Market-based proxies			Risk proxies		
	ROA	ROE	CTI	TBQ	MTB	MV	ZSCORE	NPL	LIQ
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
BREXIT	−0.081	−0.117	0.007	−0.181*	−0.517	0.077	−0.103	−0.006	−0.058
	(0.679)	(0.256)	(0.275)	(0.064)	(0.203)	(0.228)	(0.213)	(0.325)	(0.450)
COVID	−0.246*	−1.626**	0.348*	−0.141*	−0.304**	−0.516**	−0.486**	−0.145	0.098
	(0.056)	(0.011)	(0.099)	(0.079)	(0.009)	(0.010)	(0.009)	(0.191)	(0.669)
WAR	−0.405	−0.517*	−0.039	−0.031	−0.108	−0.149	−0.362*	0.102	−0.216*
	(0.521)	(0.016)	(0.971)	(0.409)	(0.286)	(0.307)	(0.083)	(0.522)	(0.086)
Controls variables	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Country fixed effects	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Time fixed effects	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Bank fixed effects	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Observations	4,578	4,578	4,578	4,578	4,578	4,578	4,166	4,578	4,578
Adj. R-squared	0.321	0.236	0.661	0.467	0.304	0.763	0.487	0.561	0.482
Coefficient differences - $\chi 2$									
BREXIT	2.55*	5.58***	9.17***	2.32*	0.48	9.65***	7.29***	4.29**	1.76
COVID	5.53**	4.92**	7.50***	5.02**	3.28*	1.14	4.49***	5.10**	0.67
WAR	6.44***	6.34***	6.14***	5.85***	7.50***	1.01	1.18	2.75*	2.27*

This table reports the impacts of Brexit, COVID, and war on European banks performance, with a set of bank-specific and country-specific controls by comparing large and small banks. We utilize the mean of size as the cut-off for classifying large and small banks, which is reported in Panel A and B, respectively. Variable definitions and data sources are described in Table 1. We employ a set of proxies, including accounting-based, market-based, and risk proxies. Standard errors are clustered at the bank level and are presented in parentheses under the associated coefficients. The last row reports the χ^2 for the test of equality of the main coefficients across the two sub-samples. *, ** and *** represent 10%, 5% and 1% significance levels, respectively.

Table 6
Bank-specific factors: Effects of bank' s age.

Panel A: Young banks

Main variables	Accounting-based proxies			Market-based proxies			Risk proxies		
	ROA	ROE	CTI	TBQ	MTB	MV	ZSCORE	NPL	LIQ
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
BREXIT	−0.245**	−0.342**	0.408**	−0.299**	−0.457*	−0.396***	−0.294***	0.147	0.210
	(0.033)	(0.002)	(0.004)	(0.001)	(0.027)	(0.011)	(0.003)	(0.337)	(0.478)
COVID	−1.653***	−3.824***	0.691***	−0.319***	−1.037***	−0.497***	−0.826***	0.422**	0.116
	(0.001)	(0.000)	(0.012)	(0.002)	(0.000)	(0.000)	(0.000)	(0.029)	(0.215)
WAR	−0.672***	−0.635**	0.571***	−0.291**	−0.492**	−0.381**	−0.517***	0.191**	−0.368*
	(0.002)	(0.000)	(0.022)	(0.027)	(0.017)	(0.066)	(0.012)	(0.027)	(0.127)
Controls variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,962	3,962	3,962	3,962	3,962	3,962	3,605	3,962	3,962
Adj. R-squared	0.323	0.238	0.666	0.299	0.398	0.307	0.545	0.238	0.418

Panel B: Mature banks

Main variables	Accounting-based proxies			Market-based proxies			Risk proxies		
	ROA	ROE	CTI	TBQ	MTB	MV	ZSCORE	NPL	LIQ
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
BREXIT	−0.093	−0.082	0.116	−0.114	−0.486*	−0.277**	−0.099	0.064	0.133
	(0.436)	(0.482)	(0.174)	(0.389)	(0.185)	(0.068)	(0.274)	(0.193)	(0.681)
COVID	−0.337*	−1.194**	0.402**	−0.281*	−0.294*	−0.322**	−0.298*	0.377*	0.108
	(0.066)	(0.055)	(0.027)	(0.153)	(0.088)	(0.026)	(0.038)	(0.123)	(0.391)
WAR	−0.235*	−0.315	0.126	−0.115	−0.258*	−0.299*	−0.282*	−0.081	−0.203
	(0.113)	(0.338)	(0.753)	(0.572)	(0.106)	(0.087)	(0.143)	(0.594)	(0.417)
Controls variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,568	3,568	3,568	3,568	3,568	3,568	3,248	3,568	3,568
Adj. R-squared	0.403	0.296	0.683	0.440	0.497	0.391	0.631	0.296	0.400
Coefficient differences - $\chi 2$									
BREXIT	3.21**	7.01***	9.43***	2.19*	0.57	4.94***	9.44***	3.45*	0.66
COVID	9.04***	8.49***	7.37***	3.53**	10.28***	1.08	5.82**	0.93	0.25
WAR	6.34***	6.02***	6.51***	4.12**	6.46***	0.42	7.34***	1.19	0.85

This table reports the impacts of Brexit, COVID, and war on European banks' performance, with a set of bank-specific and country-specific controls by comparing young and mature banks. We utilize the mean of age as the cut-off for classifying young and mature banks, which is reported in Panel A and B, respectively. Variable definitions and data sources are described in Table 1. We employ a set of proxies, including accounting-based, market-based, and risk proxies. Standard errors are clustered at the bank level and are presented in parentheses under the associated coefficients. The last row reports the χ^2 for the test of equality of the main coefficients across the two sub-samples. *, ** and *** represent 10%, 5% and 1% significance levels, respectively.

Table 7
Bank-specific factors: Effects of bank' s capital.

Panel A: Low-capitalized banks

Main variables	Accounting-based proxies			Market-based proxies			Risk proxies		
	ROA	ROE	CTI	TBQ	MTB	MV	ZSCORE	NPL	LIQ
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
BREXIT	−0.353**	−0.319**	0.389**	−0.291**	−0.394*	−0.338**	−0.297***	0.375**	0.166
	(0.037)	(0.005)	(0.024)	(0.009)	(0.038)	(0.012)	(0.002)	(0.057)	(0.256)
COVID	−1.267**	−1.435***	0.864**	−0.295***	−0.732**	−0.473**	−0.815***	0.577**	0.074
	(0.026)	(0.002)	(0.024)	(0.010)	(0.048)	(0.000)	(0.033)	(0.009)	(0.196)
WAR	−0.714***	−1.317***	0.499**	−0.286***	−0.593***	−0.246*	−0.793***	0.263**	−0.286*
	(0.011)	(0.001)	(0.088)	(0.007)	(0.012)	(0.116)	(0.003)	(0.026)	(0.216)
Controls variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,356	2,356	2,356	2,356	2,356	2,356	2,155	2,356	2,356
Adj. R-squared	0.202	0.676	0.350	0.187	0.501	0.161	0.319	0.738	0.228

Panel B: High-capitalized banks

Main variables	Accounting-based proxies			Market-based proxies			Risk proxies		
	ROA	ROE	CTI	TBQ	MTB	MV	ZSCORE	NPL	LIQ
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
BREXIT	−0.104	−0.129	0.113	−0.166*	−0.317*	−0.286*	−0.097	−0.077	0.122
	(0.496)	(0.157)	(0.155)	(0.154)	(0.083)	(0.088)	(0.492)	(0.753)	(0.643)
COVID	−0.367*	−1.026**	0.288*	−0.102	−0.295**	−0.411**	−0.438**	0.164	0.086
	(0.109)	(0.036)	(0.116)	(0.285)	(0.055)	(0.032)	(0.005)	(0.624)	(0.582)
WAR	−0.286	−0.499*	0.139	−0.112	−0.308*	−0.219*	−0.274	−0.092	−0.129
	(0.584)	(0.123)	(0.297)	(0.386)	(0.232)	(0.167)	(0.363)	(0.547)	(0.476)
Controls variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5,174	5,174	5,174	5,174	5,174	5,174	4,698	5,174	5,174
Adj. R-squared	0.252	0.625	0.359	0.275	0.625	0.205	0.372	0.342	0.216
Coefficient differences - $\chi 2$									
BREXIT	5.79***	6.65***	3.52*	2.74*	5.72***	1.57	9.28***	8.42***	0.14
COVID	6.26***	2.54*	6.28***	4.44**	6.80***	0.34	5.72***	6.48***	0.05
WAR	4.39**	4.72***	5.54***	3.20*	2.47*	0.13	7.22***	5.89***	1.36

This table reports the impacts of Brexit, COVID, and war on European banks performance, with a set of bank-specific and country-specific controls by comparing banks' total capital. We utilize the mean of total capital as the cut-off for classifying low- and high-capitalized banks, which is reported in Panel A and B, respectively. Variable definitions and data sources are described in Table 1. We employ a set of proxies, including accounting-based, market-based, and risk proxies. Standard errors are clustered at the bank level and are presented in parentheses under the associated coefficients. The last row reports the χ^2 for the test of equality of the main coefficients across the two sub-samples. *, ** and *** represent 10%, 5% and 1% significance levels, respectively.

Table 8
Cross-country analyses: Comparisons between high-income and middle income- economies.

Panel A: High-income economies

Main variables	Accounting-based proxies			Market-based proxies			Risk proxies		
	ROA	ROE	CTI	TBQ	MTB	MV	ZSCORE	NPL	LIQ
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
BREXIT	−0.149**	−0.113*	−0.024	−0.031	−0.074	−0.016	−0.083	−0.027	0.076
	(0.010)	(0.016)	(0.242)	(0.044)	(0.203)	(0.068)	(0.132)	(0.057)	(0.200)
COVID	−0.631***	−1.240***	0.159	−0.103	−0.371*	−0.141	−0.440***	−0.182	−0.201
	(0.023)	(0.009)	(0.125)	(0.144)	(0.102)	(0.300)	(0.121)	(0.049)	(0.092)
WAR	−0.491***	−0.251**	0.104	−0.303**	−0.231*	−0.117	−0.132**	−0.145	−0.157
	(0.021)	(0.097)	(0.041)	(0.014)	(0.130)	(0.116)	(0.108)	(0.138)	(0.103)
Controls variables	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Country fixed effects	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Time fixed effects	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Bank fixed effects	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Observations	5,932	5,932	5,932	5,932	5,932	5,932	5,399	5,932	5,932
Adj. R-squared	0.291	0.382	0.275	0.295	0.490	0.315	0.383	0.382	0.374

Panel B: Middle-income economies

Main variables	Accounting-based proxies			Market-based proxies			Risk proxies		
	ROA	ROE	CTI	TBQ	MTB	MV	ZSCORE	NPL	LIQ
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
BREXIT	−0.104	−0.438*	0.110	−0.116	−0.163	−0.052	−0.247	0.006	−0.116
	(0.041)	(0.061)	(0.197)	(0.208)	(0.152)	(0.248)	(0.423)	(0.187)	(0.208)
COVID	−0.820***	−1.540***	1.398**	−0.238**	−0.410**	−0.235**	−0.816***	0.267*	−0.299*
	(0.005)	(0.089)	(0.001)	(0.048)	(0.042)	(0.030)	(0.028)	(0.029)	(0.063)
WAR	−0.711***	−1.062**	1.023**	−0.359**	−0.432**	−0.323**	−0.127**	0.036	−0.417*
	(0.005)	(0.094)	(0.064)	(0.015)	(0.066)	(0.493)	(0.020)	(0.855)	(0.089)
Controls variables	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Country fixed effects	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Time fixed effects	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Bank fixed effects	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Observations	1,598	1,598	1,598	1,598	1,598	1,598	1,145	1,598	1,598
Adj. R-squared	0.363	0.477	0.343	0.435	0.611	0.402	0.487	0.561	0.482
Coefficient differences - $\chi 2$									
BREXIT	1.60	6.51***	3.57**	1.15	1.01	0.75	1.05	0.36	1.86
COVID	3.39*	10.74***	4.90**	9.98***	8.72***	4.98**	8.07***	3.34*	0.68
WAR	4.29**	12.51***	6.20***	0.26	4.05**	6.30***	1.33	1.55	5.20**

This table reports the impacts of Brexit, COVID, and war on European banks' performance comparing banks affiliated to high-income and middle-income countries. Variable definitions and data sources are described in Table 1. The results for high-income and middle-income countries are reported in Panel A and B, respectively. The last rows of each panel report the $\chi 2$ and p-values for the tests of equality of coefficients across the two subsamples. Standard errors are clustered at the bank level and are presented in parentheses under the associated coefficients. *, ** and *** represent 10%, 5% and 1% significance levels, respectively.

banks' credit risk can be vindicated by the circumstances of banks' rigorous credit policies by following restrictive regulatory obligations on maintaining sound capital requirements. During uncertain events, banks are more likely to tighten their credit activities and restrictively follow governing requirements to increase their liquidity positions and safeguard their sound capital. Beck and Keil (2022) and Li and Strahan (2021) state that banks in some nations refused many loan applications and minimized the limits of overdraft credits of borrowers. As a result, banks could avoid non-performance loans during the turmoil. Further, government interventions regarding stimulus packages and bailouts during the COVID-19 pandemic and Russia-Ukraine crisis also help banks to preserve higher asset quality, as such lower credit risk. In particular, Europe banks' firmed credit and liquidity positions can be rationalized by the roles of ECB for banks affiliated with the EU during those events. In addition, several refinancing schemes have been implemented by EBC, such as Targeted Longer-Term Refinancing Operations and Pandemic Emergency Longer-Term Refinancing Operations, which significantly support European banks (ECB, 2020). Borri and Di Giorgio (2022) highlight that under the impacts of the COVID-19 pandemic, sovereign default risks of every single European bank seriously damaged systematic risks. Nevertheless, the Pandemic Emergency Purchasing Programme, which the ECB announced, contributed to restoring the stability of the European banking system.

4.3. The roles of bank-characteristics: scale, age, and capital adequacy

We first divide our sample according to their size based on the median of total assets. Then, we repeat our estimations and report the results in Table 5. Overall, we obtain the significantly negative coefficient of all performance indicators across three events for smaller banks in Panel A, indicating solid impacts of uncertainty on smaller banks. In Panel B, the coefficients of the COVID-19

pandemic are significantly and negatively associated with all six accounting-based and market-based performance measures for both groups. In the last three rows, the coefficients differences imply that the impacts of uncertainties on financial performance and valuation are contingent on banks' scale with more significant impacts on smaller banks. With respect to the bank risk indicators, small banks seem to be more vulnerable to insolvency risk than large banks, in line with the negative coefficients of ZSCORE for small banks across three events. Further, the positive and significant coefficients of NPL in Panel A indicate the weaker capability of tackling credit (higher non-performance loan) of smaller banks compared to large banks. The liquidity risk (LIQ) results imply that irrespective of bank size, the bank's liquidity has been considerably diminished during examined events. Overall, smaller banks, in comparison with large banks, exhibit weaker capacity in managing their profitability and financial stability. This result is in line with the findings of Bordo et al. (2016); Tran et al. (2019); Berger et al. (2016) and Elnahass et al. (2021) that bank size possibly impacts the relationship between uncertainties and bank activities.

We further extend our analyses by considering the roles of bank age in modifying the impacts of three investigated events. We utilize the mean of age as the cut-off point for classifying young and mature banks. In Panel A of Table 6, the unfavorable events exert immensely adverse effects on younger banks' accounting-based and market-based performance. Similar to the results in Table 5, young banks, which usually have smaller sizes than mature banks, reveal poor profitability positions during the Brexit, War, and COVID-19 periods. Regarding the risk proxies, we find a significant difference between the two groups with regard to lower ZSCORE and higher NPL for young banks. This indicates the poorer capability of tackling credit and insolvency risks of immature banks during the crises. Overall, our results confirm that older banks are better at managing risks by maintaining their asset quality with effective credit procedures and loan default supervision. In other words, mature banks with better reputations and competitiveness are less susceptible to adverse shocks (Dell'Ariccia, 2001; Wu et al., 2020; Elnahass et al., 2021).

Additionally, we also consider the role of capital adequacy in modifying the impacts of uncertainties on banks' activities. Using the mean of total capital ratio, we cluster the sample into low-capitalized banks (Panel A) and high-capitalized banks (Panel B) in Table 7. Our results disclose considerably harmful impacts of three events on the performance and risk-taking of both groups of banks. Given the coefficient differences (χ^2), we find significant discrepancies between the two groups for all indicators (except for MV and LIQ). In general, low-capitalized banks have inferior performance and higher risks (default risks and credit risks) than well-capitalized banks. It also suggests that banks with larger capital are more resilient to exogenic shocks or severe macroeconomic turmoil in general terms, which is consistent with prior findings of Dias (2021); Elnahass et al. (2021); Flannery and Giacomini (2015) and Valencia (2016).

5. Robustness Checks and Additional Analyses

In this section, we provide several additional tests regarding the cross-section differences between country-specific factors and robustness tests for the baseline results.

5.1. Cross-country analyses: Income classifications and European Union members

Table 8 indicates additional results from the impacts of Brexit, COVID-19 pandemic, and War on European banks' performance across different classifications of economies. Following the criteria of the World Bank,[8] we classify banks located in high-income and middle-income economies by using the gross national income (GNI) per capita and reported in Panel A and B, respectively. Regarding the negative impacts of Brexit, the differences between the two groups are only significant for accounting-based proxies (ROA and CTI), while other indicators are relatively undisturbed. The COVID-19 crisis significantly and negatively influences all performance indicators, indicating that the two sets of economies are ruthlessly and negatively affected by this event. The overall findings are in line with the predictions and main findings, suggesting substantial adverse impacts of the outbreak on bank performance, regardless of the income level of countries. However, when we consider the coefficient differences (χ^2), the middle-income countries are more vulnerable than high-income countries according to the extent of the impacts of COVID-19 pandemic on bank performance. Regarding the impacts of war, all indicators (except for NPL) of banks headquartered in medium-income countries have been significantly and negatively influenced by the war between Ukraine and Russia. Based on the coefficient differences, the impacts of WAR on three groups of proxies are more visible for middle-income economies.[9] Overall, the results are in line with our main findings that banks in middle-income economies are better at maintaining their financial performance during Brexit but perform poorer than banks from high-income economies, given the impacts of the COVID-19 pandemic and War.

To provide more robust evidence on the cross-country heterogeneity, we continue to examine the impacts of those events by splitting the sample into the EU and Non-EU members.[10] We re-estimate the baseline models and report the results in Table 9. With respect to the impact of Brexit on the EU banks, Brexit negatively affects all indicators for accounting-based proxies, market-based proxies, and risk proxies, while there is no significant variance noted for non-EU banks. Thus, the impacts of Brexit on all proxies are strongly visible for the EU countries. The results are consistent with initial expectations, as Brexit only happened in the EU

[8] See:https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups.

[9] In unreported results, we also consider the cross-sectional differences by using the geographical classifications. We look at three broadly defined regions in Europe according to the classifications of The World Factbook: Northern countries, Central, Western and Western European countries, and Southern and South-eastern European countries as in Appendix A. The results further indicate that geographical factors also define the impacts of Brexit and Russia-Ukraine war.

[10] See: https://european-union.europa.eu/principles-countries-history/country-profiles_en for the detail of EU members.

Table 9
Cross-country analyses: Comparisons between EU and Non-EU-economies.

Panel A: EU members' banks

Main variables	Accounting-based proxies			Market-based proxies			Risk proxies		
	ROA	ROE	CTI	TBQ	MTB	MV	ZSCORE	NPL	LIQ
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
BREXIT	−0.266*	−0.301**	0.456***	−0.440***	−0.201**	−0.252**	−0.258***	0.246***	−0.186*
	(0.014)	(0.011)	(0.014)	(0.005)	(0.019)	(0.015)	(0.012)	(0.008)	(0.023)
COVID	−0.446***	−0.578***	0.111*	−0.787**	−1.119***	−0.171*	−0.319***	0.258***	−0.118
	(0.109)	(0.100)	(0.105)	(0.308)	(0.061)	(0.102)	(0.004)	(0.006)	(0.013)
WAR	−0.179*	−0.265**	0.095	−0.021	−0.120	−0.387**	−0.317***	0.183*	0.016
	(0.041)	(0.025)	(0.056)	(0.056)	(0.477)	(0.063)	(0.017)	(0.032)	(0.062)
Controls variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5,248	5,248	5,248	5,248	5,248	5,248	4,776	5,248	5,248
Adj. R-squared	0.830	0.444	0.394	0.448	0.256	0.148	0.505	0.273	0.227

Panel B: Non-EU members' banks

Main variables	Accounting-based proxies			Market-based proxies			Risk proxies		
	ROA	ROE	CTI	TBQ	MTB	MV	ZSCORE	NPL	LIQ
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
BREXIT	−0.016	−0.146	0.011	−0.021	−0.082	−0.174*	−0.079	−0.151	−0.046
	(0.062)	(0.112)	(0.032)	(0.056)	(0.077)	(0.121)	(0.047)	(0.055)	(0.058)
COVID	−0.787**	−1.119***	0.523***	−0.464***	−0.821***	−0.093	−0.360***	0.197**	−0.207*
	(0.308)	(0.061)	(0.008)	(0.004)	(0.004)	(0.019)	(0.039)	(0.049)	(0.021)
WAR	−0.436***	−0.752**	0.545***	−0.291***	−0.293***	−0.574**	−0.291***	0.043	−0.145
	(0.006)	(0.044)	(0.034)	(0.015)	(0.026)	(0.021)	(0.023)	(0.078)	(0.064)
Controls variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,282	2,282	2,282	2,282	2,282	2,282	1,636	2,282	2,282
Adj. R-squared	0.477	0.255	0.226	0.526	0.301	0.258	0.392	0.219	0.150
Coefficient differences - $\chi 2$									
BREXIT	4.75**	8.59***	6.71***	7.87***	5.91**	4.03**	5.87**	6.50***	5.33**
COVID	0.78	2.72*	1.24	1.70	1.87	0.74	0.13	0.86	1.22
WAR	0.64	1.72	1.47	5.48**	3.46*	5.34**	0.02	1.12	1.13

This table reports the impacts of Brexit, COVID, and war on European banks' performance comparing banks affiliated to European Union (EU) and non-EU members. Variable definitions and data sources are described in Table 1. The results for high-income and middle-income countries are reported in Panel A and B, respectively. The last rows of each panel report the $\chi 2$ and p-values for the tests of equality of coefficients across the two sub-samples. Standard errors are clustered at the bank level and are presented in parentheses under the associated coefficients. *, ** and *** represent 10%, 5% and 1% significance levels, respectively.

Table 10
Bank-specific factors: Comparisons between conventional and Islamic banks.

Main variables	Accounting-based proxies			Market-based proxies			Risk proxies		
	ROA	ROE	CTI	TBQ	MTB	MV	ZSCORE	NPL	LIQ
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
BREXIT×D_Islamic	0.149*	−0.113	−0.024	−0.034	−0.313	0.228	−0.264**	−0.006	0.275
	(0.022)	(0.086)	(0.242)	(0.062)	(0.112)	(0.032)	(0.082)	(0.007)	(0.221)
COVID×D_Islamic	0.331***	0.240***	0.159	−0.137	−0.684	−0.087	−0.674***	−0.454**	−0.143*
	(0.023)	(0.009)	(0.125)	(0.186)	(0.362)	(0.274)	(0.001)	(0.009)	(0.042)
WAR×D_Islamic	0.391**	0.251	0.104	−0.171	−0.297	0.341	−0.298**	−0.177*	−0.357**
	(0.021)	(0.197)	(0.041)	(0.154)	(0.109)	(0.176)	(0.018)	(0.068)	(0.003)
Controls variables	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Country fixed effects	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Time fixed effects	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Bank fixed effects	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Observations	7,530	7,530	7,530	7,530	7,530	7,530	6,853	7,530	7,530
Adj. R-squared	0.392	0.514	0.370	0.265	0.341	0.283	0.538	0.537	0.479

This table reports the impacts of Brexit, COVID, and war on European banks performance, with a set of bank-specific and country-specific controls by comparing conventional and Islamic banks. We utilize the interaction terms between event dummies and dummies of Islamic banks. Variable definitions and data sources are described in Table 1. We employ a set of proxies, including accounting-based, market-based, and risk proxies. Standard errors are clustered at the bank level and are presented in parentheses under the associated coefficients. *, ** and *** represent 10%, 5% and 1% significance levels, respectively.

Table 11
Robustness check: Two-step system GMM with IVs.

Main variables	Accounting-based proxies			Market-based proxies			Risk proxies		
	ROA	ROE	CTI	TBQ	MTB	MV	ZSCORE	NPL	LIQ
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
BREXIT	−0.178*	−0.124	0.086	−0.101	−0.096	−0.178	−0.027	0.025	−0.051
	(0.094)	(0.217)	(0.373)	(0.089)	(0.278)	(0.262)	(0.542)	(0.457)	(0.436)
COVID	−1.035***	−0.893***	0.212*	−0.148*	−0.132*	−0.247**	−0.431***	0.177*	−0.121
	(0.006)	(0.012)	(0.048)	(0.040)	(0.077)	(0.002)	(0.032)	(0.189)	(0.129)
WAR	−0.415**	−0.348***	0.198*	−0.175*	−0.179**	−0.271**	−0.297**	0.053	−0.093*
	(0.018)	(0.005)	(0.065)	(0.037)	(0.042)	(0.056)	(0.046)	(0.236)	(0.319)
Instrumental Variables	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Controls variables	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Country fixed effects	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Time fixed effects	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Bank fixed effects	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Observations	7,156	7,156	7,156	7,156	7,156	7,156	6,355	7,156	7,156
Adj. R-squared	0.251	0.489	0.434	0.232	0.621	0.200	0.395	0.534	0.283

This table reports the two-step system GMM regression results for the impacts of Brexit, COVID, and war on European banks performance, with a set of bank-specific and country-specific controls by comparing banks' total capital. We utilize the one-lagged values of all potential endogenous variables as their Instrument Variables. Variable definitions and data sources are described in Table 1. We employ a set of proxies, including accounting-based, market-based, and risk proxies. Standard errors are clustered at the bank level and are presented in parentheses under the associated coefficients. *, ** and *** represent 10%, 5% and 1% significance levels, respectively.

economies. In addition, the impacts of the COVID-19 pandemic on three groups of proxies are significant across sub-samples, regardless of the EU or Non-EU countries. The results of Table 10 reflect that banks across Europe have encountered substantial problems, such as low financial performance (i.e., consistently poor profitability and low stock market valuations), high insolvency risk, and credit risk caused by the outbreak of the COVID-19 disease. The impacts of WAR on market-based proxies are more visible for the non-EU countries compared to the EU countries, while other proxies (accounting-based and risk proxies) are the same. We observe significant negative associations between WAR and TBQ, MTB, and MV in the non-EU banks, while War has a significantly negative impact on MV only in the EU banks. Overall, banks in the EU economies were strongly mashed down during Brexit but performed relatively better than banks from the non-EU economies during the War, which may be a result of the supported policies from the ECB.

5.2. Bank business models: Conventional and Islamic banks

Prior literature confirms that uncertainties impact conventional and Islamic banks differently due to different business models and corporate governance (Baldwin et al., 2019; Beck et al., 2013; Abdelsalam et al., 2022). As such, we take an additional move to investigate the effect of the bank types and report the results in Table 10. Due to the small number of Islamic banks in our sample (See Appendix A.1), we do not use the subsample analyses in this section. Instead, we utilize the interaction terms between crisis events and Islamic banks to examine the heterogeneous impacts of bank business models. The interaction terms are positive and statistically

Table 12
Robustness check: 2SLS with IV.

Main variables	Accounting-based proxies			Market-based proxies			Risk proxies		
	ROA	ROE	CTI	TBQ	MTB	MV	ZSCORE	NPL	LIQ
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
BREXIT	−0.136	−0.155	0.108	−0.127	−0.120	−0.223*	−0.034	0.036	−0.098
	(0.142)	(0.205)	(0.124)	(0.089)	(0.368)	(0.062)	(0.402)	(0.387)	(0.126)
COVID	−1.184****	−1.043***	0.286**	−0.155**	−0.166*	−0.310***	−0.399***	−0.281**	−0.095
	(0.003)	(0.002)	(0.084)	(0.072)	(0.088)	(0.004)	(0.012)	(0.019)	(0.377)
WAR	−0.533***	−0.947***	0.237**	−0.135*	−0.293**	−0.299**	−0.301**	−0.088	−0.052
	(0.018)	(0.006)	(0.048)	(0.175)	(0.036)	(0.086)	(0.028)	(0.214)	(0.549)
Instrumental Variable	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Tests of endogeneity									
Durbin statistic	8.15	3.89	5.64	4.84	6.17	8.40	4.59	7.44	9.27
Wu–Hausman statistic	9.24	5.97	6.39	5.48	8.25	9.52	5.20	6.79	12.37
First stage F-test (p-value)	0.000***	0.000***	0.002***	0.038**	0.016***	0.043**	0.016**	0.007***	0.013**
Over-identification test (p-value)	0.443	0.364	0.285	0.251	0.296	0.845	0.642	0.366	0.846
Observations	7,084	7,084	7,084	7,084	7,084	7,084	6,112	7,084	7,084
Adj. R-squared	0.461	0.266	0.520	0.246	0.301	0.212	0.420	0.357	0.660

This table reports the 2SLS regression results for the impacts of Brexit, COVID, and war on European banks performance, with a set of bank-specific and country-specific controls by comparing banks' total capital. We utilize the governance quality as an IV, which is proxied by the average of six institutional indicators obtained from WDI. Variable definitions and data sources are described in Table 1. We employ a set of proxies, including accounting-based, market-based, and risk proxies. Standard errors are clustered at the bank level and are presented in parentheses under the associated coefficients. *, ** and *** represent 10%, 5% and 1% significance levels, respectively.

Table A1
Final sample distributions based on bank types, income, and EU-nation classifications.

Country	Number of Banks			Income classifications		EU classifications		Region
	Commercial bank	**Islamic bank**	**Total**	**High-income**	**Middle-income**	**EU**	**Non-EU**	
Albania	5	0	5		x		x	Southeast
Austria	1	0	1	x		x		Central
Belarus	7	0	7		x		x	East
Bosnia & Herzegovina	1	0	1		x		x	Southeast
Bulgaria	6	0	6		x	x		Southeast
Croatia	4	0	4	x		x		Southeast
Cyprus	1	0	1	x		x		Southeast
Czech Republic	8	0	8	x		x		Central
Denmark	16	2	18	x		x		North
Estonia	7	0	7	x		x		North
Finland	5	0	5	x		x		North
France	2	0	2	x		x		West
Germany	4	0	4	x		x		West
Greece	5	0	5	x		x		Southeast
Hungary	2	0	2	x		x		Central
Iceland	3	0	3	x			x	North
Ireland	1	0	1	x		x		West
Italy	15	2	17	x		x		South
Lithuania	3	0	3	x		x		North
Netherlands	1	0	1	x		x		West
Norway	15	0	15	x			x	North
Poland	8	0	8	x		x		Central
Portugal	11	0	11	x		x		South
Romania	3	0	3	x		x		Southeast
Serbia	11	1	12		x		x	Southeast
Slovakia	2	0	2	x		x		Central
Slovenia	1	0	1	x		x		Southeast
Spain	32	1	33	x		x		South
Sweden	12	0	12	x		x		North
Switzerland	5	0	5	x			x	Central
Turkey	21	3	24		x		x	Southeast
Ukraine	2	0	2		x		x	East
United Kingdom	19	3	22	x			x	West
Total	**239**	**12**	**251**	**26**	**7**	**23**	**10**	

Table B1
Alternative dependent variables.

Alternative Variables			**Source**
Cost to Income	A_CTI	The operating cost as a share of total operating revenue.	Bankscope
Net Interest Income	NIM	The ratio of net interest income to total interest-earning assets	Bankscope
Return on Average Assets	ROAA	Net income scaled by average total assets	Bankscope
Return on Average Equity	ROAE	Net income scaled by average total equity	Bankscope
Operational Risk	SDROA	Standard deviation of ROA. The greater value of SDROA suggests greater operational risk.	Bankscope
Asset Risk	ARISK	ROA scaled by the SDROA. The greater value of ROA/SDROA suggests lower asset risk.	Bankscope

significant for ROA and ROE, especially during the COVID-19 period. However, we find significant results for only some market-based indicators. Regarding the risk indicators, we also find that Islamic banks have reported considerably higher insolvency risk across three events, with higher credit and liquidity risk during the COVID-19 outbreak and War periods. Overall, our results indicate adverse effects of uncertainties on banks' profitability position (risk), but those impacts are less (more) considerable for Islamic banks than for conventional banks. The better performance, along with the higher risks, for Islamic banks can be explained by the characteristics of their business model, which features unique governance mechanisms (double governance), profit–loss sharing, and forbids speculative investment interests (Beck et al., 2013; Abdelsalam et al., 2022; Abdelsalam et al., 2021).

5.3. Two-step System Generalized Method of Moments (GMM) approach

Given the impacts of Brexit, COVID-19 pandemic, and War on the EU banks, our results may suffer from potential endogeneity

Table B2
Regression results: Alternative dependent variables.

Main variables	A-CTI				NIM			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
BREXIT	−0.102*			−0.114*	−0.179**			−0.109*
	(0.133)			(0.098)	(0.073)			(0.122)
COVID		−0.645***		−0.681***		−1.669***		−1.023***
		(0.036)		(0.054)		(0.004)		(0.005)
WAR			−0.318**	−0.255***			−1.019***	00.601***
			(0.008)	(0.025)			(0.005)	(0.027)
Controls variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7,530	7,530	7,530	7,530	7,530	7,530	7,530	7,530
Adj. R-squared	0.470	0.445	0.454	0.369	0.603	0.571	0.583	0.473

Main variables	ROAE				ROAA			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
BREXIT	−0.392**			−0.216*	−0.046			−0.048
	(0.037)			(0.088)	(0.044)			(0.045)
COVID		−2.178***		−2.041***		−0.326***		−0.358***
		(0.007)		(0.005)		(0.057)		(0.028)
WAR			−0.926***	−0.876***			−0.144**	−0.154*
			(0.034)	(0.027)			(0.035)	(0.033)
Controls variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7,530	7,530	7,530	7,530	7,530	7,530	7,530	7,530
Adj. R-squared	0.437	0.485	0.442	0.406	0.560	0.622	0.567	0.521

Main variables	SDROA				ARISK			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
BREXIT	−0.017			−0.057	−0.264*			−0.121
	(0.042)			(0.212)	(0.065)			(0.149)
COVID		−0.186		−0.146		−1.026***		−1.020***
		(0.157)		(0.106)		(0.005)		(0.007)
WAR			−0.056	−0.058			−0.426***	−0.560***
			(0.103)	(0.151)			(0.045)	(0.028)
Controls variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7,530	7,530	7,530	7,530	7,530	7,530	7,530	7,530
Adj. R-squared	0.457	0.420	0.596	0.372	0.587	0.641	0.765	0.478

problems. As such, we employ the two-step system Generalized Method of Moments (GMM) estimations (Arellano and Bover, 1995; Blundell and Bond, 1998; Tran et al., 2022) for the robustness check to further confirm our findings.[11] The GMM method can reduce those problems by capturing the disregarded effects via the alteration of the variables into the first difference. As such, the heterogeneity and omitted variable bias in our models can be reduced. Further, following the study of Elnahass et al. (2021), we also add the one-lagged values of all potential endogenous variables ($Y_{i,j,t-1}$) as their Instrument Variables (IVs).[12] Hence, our models can consider all bank-specific variables as endogenous and country-specific factors as precisely exogenous. We modify Equation (1) as follows:

$$Y_{i,j,t} = \alpha + \beta_i EventDummies_t + \gamma Y_{i,j,t-1} + \sum \delta_i Bankcontrol_{i,j,t-1} + \sum \theta_i Countrycontrol_{i,j,t} + u_{i,j,t} \quad (2)$$

Table 11 reports results from the GMM estimations. Overall, our key findings remain robust when we consider the potential issues of simultaneousness, unobserved heterogeneity, and dynamic endogeneity.

[11] In unreported results, we also re-estimate the baseline regression by using four alternative econometric approaches. Those approaches include Random sampling bootstrap method; Least Squares Dummy Variable Corrected (LSDVC) estimation (Kiviet, 1995); Prais-Winsten estimation; and the Driscoll-Kraay estimation. Overall, our results remain qualitative unchanged. The results are available on request.

[12] The endogeneity problems are implausible in our transformed models as one-lagged values of all endogenous variables in prior periods do not have significant impacts on the bank performance and risk-taking in subsequent quarters.

5.4. Instrumental Variable Analysis - Two-stage Least Squares estimator

In this last robustness test, we implement the instrumental variable approach to control for potential endogeneity issues in our regression models. As stated by Barth et al. (2003) and La Porta et al. (2013), the instrumental variables are chosen based on the current literature in law and finance. Dias (2021) uses governance quality as an IV, proxied by the average of six institutional indicators obtained from WDI (See Table 1). A country's institutional and governance quality contributes to the enforcement of better interventions and macroprudential policies during periods of economic and political uncertainties. However, those factors are not likely to impact banks' overall performance or risk-taking (Ashraf, 2017; Dias, 2021) other than through its impacts on national policies during unfavorable events. As such, we utilize the average governance index of each country in the sample as an IV and dummy coded as 1 if they are higher than the median of the sample and 0 otherwise. We report the results from the IV analyses in Table 12. The main coefficients are negative and significant, consistent with the previous results, especially for the COVID-19 pandemic and War period. Overall, the results from 2SLS indicate qualitatively similar results to previous models after treating potential endogeneity concerns.

6. Conclusion

This paper investigates the impacts of three major uncertain events, including economic policy risks (Brexit), geopolitical risks (Ukraine-Russia war), and unprecedented health crisis risks (the COVID-19 pandemic), on European banks' performance and stability. Using the comprehensive dataset of 251 commercial banks from 33 European countries, our results confirm that uncertain events exert significantly adverse impacts on banks' financial performance regarding the accounting-based and market valuation indicators. The bank risks also prominently surge during crisis periods, which can be ascribed to the worsening economic conditions and financial uncertainties. In addition, the impacts of each crisis are also separately considered. Our results indicate that Brexit, on average, does not have significant impacts on European banks' financial stability. Also, the adverse effects of COVID-19 and the War on market-related value and cost efficiency are more significant than those during Brexit. Given the direct link of geographical associations, the Russia–Ukraine war also substantially impacts European banks' stability.

To provide more comprehensive results, we further explore the role of bank-level heterogeneity and country-level factors. Considering the bank sizes (large vs. small) and ages (young vs. mature), we find that smaller and younger banks face significant challenges from the economic and political uncertainties. Further, banks with better capital adequacy also exhibit a better capacity to maintain financial performance and stability during stressful periods. We also observed differential effects of uncertainties on the solidity of Islamic banks versus conventional banks. By employing country-specific factors (countries' income groupings and European members' affiliations, we find that banks' performance and stability during the uncertainty periods are significantly associated with the geographical connections as well as interventions of the authorities. Our results are robust to alternative measures and hold across different model specifications.

Our findings provide valuable practical and policy implications during periods of high uncertainty. Measures in managing risks and maintaining profitability are of the essence for banks to mitigate adverse influences of uncertainties on bank performance and stability during crises. More specially, policymakers should implement stricter regulations on activity restrictions to discourage banks from engaging in risky behavior during times of heightened ambiguity. Furthermore, governments and central banks should introduce such initiatives, especially targeting small, younger, and less-capitalized banks, as they tend to be more vulnerable during stressful times. Bank customers also benefit by considering different bank categories (larger, mature, well-funded, and Islamic banks) as deposit options. Given our findings and contributions, several limitations still open doors for potential research areas. As the primary emphasis of this study is on bank financial performance and stability, lending strategies and market structures should be explored in further studies. Future research could also extend our study by considering the signals of recovery and the effectiveness of executed policy measures in the long run.

7. Data availability statement

The data that support the findings of this study are available from the Bankscope database compiled by Bureau van Dijk. Restrictions apply to the availability of these data, which were used under license for this study.

CRediT authorship contribution statement

Phuong Thi Thu Vu: Conceptualization, Investigation, Formal analysis, Validation, Writing – original draft, Writing – review & editing, Funding acquisition. **Nhan Huynh:** Conceptualization, Methodology, Data curation, Software, Investigation, Validation, Formal analysis, Writing – original draft, Writing – review & editing, Project administration. **Hoa Phan:** Conceptualization, Investigation, Validation, Formal analysis, Writing – original draft, Writing – review & editing. **Hanh Hoang:** Conceptualization, Writing – original draft, Writing – review & editing, Funding acquisition.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The authors do not have permission to share data.

Acknowledgements

The authors are indebted Toan Huynh (Queen Mary University of London), Quan Nguyen (University of Sussex), Lee Eun Kyung (Chongqing University), Stephen White (University of Pretoria) and Quang Thien Tran (Van Lang University) for their thoughtful comments and suggestions. Phuong Thi Thu Vu acknowledges the financial supports from Thuyloi University – Vietnam.

Appendix A. Final sample distributions

See Table A1.

Appendix B. Robustness checks: Alternative performance and risk proxies

See Tables B1 and B2.

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