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Openness, economic uncertainty, government responses, and international financial market performance during the coronavirus pandemic

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ABSTRACT

This study explores the impact of COVID-19 on financial markets controlled by macroeconomic and administrative factors. As natural experimentation, we employ panel data analysis to test 50 stock market indices from January 01 to August 20, 2020. The findings suggest daily growth of COVID-19 confirmed cases have considerable adverse effects on stock returns and positive impacts on investment risks across markets. The government prompt interventions offset adverse impacts of the pandemic. Market reactions to the outbreak and authority responses information are more momentous in more developed economies due to their better information efficiency. The country-specific features of globalisation, uncertainty, healthcare system readiness, and economic development levels appear to have substantial impacts on equity market reactions. Financial markets in countries with higher levels of globalisation, economic policy and financial uncertainty experience more chaos during the pandemic. While those hostile effects are less significant in countries with robust healthcare systems.

1. Introduction

The financial markets promptly react to major events in terms of financial market dynamics. The prior finance literature has acknowledged the equity market’s responses to several occurrences, especially the health catastrophe. Various studies determine the spillover effects of the contagious diseases such as the 2002–2004 Acute Respiratory Syndrome (SARS) contagion (Chen et al., 2009), 2009 influenza-A (H1N1) (Peckham, 2013), and the 2013–2016 Ebola Virus Disease (Ichev and Marinč, 2018). Since 2020, the deadly coronavirus disease 2019 (COVID-19) pandemic has caused the worse tremor across the global economy since the 2007–2008 Global Financial Crisis. According to the World Health Organisation (WHO), this deadly disease has speedily spread out globally to 216 nations since the first confirmed cases in Wuhan, China, in December 2019 (Gormsen and Kojien, 2020; Zhang et al., 2020). There have been over 156 million confirmed cases, including over 3.2 million deaths globally until May 2021. 1

Although the inclusive economic crashes are not momentous, financial markets have already reacted to this outbreak by the end of February 2020 regarding considerable slumps and high volatilities. This pandemic has worsened the levels of uncertainty, investor confidence, and risk aversion. During the first wave of the outbreak from February to April 2020, the stock indices in the U.S, U.K, and Australian markets suffered from the most rapid fall (more than 20%) with tremendous volatilities. Many global organisations and national governments have been trying to adopt optimal measures to contain the current harsh situation and warping fear initiated by the pandemic (Elgin et al., 2020; Nicola et al., 2020). The economic effects of the COVID-19 catastrophe will possibly surpass those of the 2007–2008 Global Financial Crisis as its movements are unpredictable and intricate (Reinhart, 2020).

1 The data was retrieved in 9th May 2021 from the World Health Organisation (WHO): https://covid19.who.int/.
Some recent empirical studies document the relationship between COVID-19 data and the global equity markets. Most of these papers focus on specific countries or group of countries, such as the U.S stock market (Ramelli and Wagner, 2020; Schoenfeld, 2020) Chinese market (Al-Awadhi et al., 2020), Australian market (Huynh et al., 2021), emerging markets (Topcu and Gulal, 2020), or developed markets (Cepoi, 2020). Considering the freedom factor, Erdem (2020) posits that the negative consequences of the COVID-19 crisis on the stock markets are less in liberated nations. Despite the blooming literature on the impacts of COVID-19 on the financial markets, several important macroeconomic factors such as economic openness, economic and financial uncertainty, or national health spending are still not considered. Thus, the purpose of this paper is to examine the impacts of COVID-19 on stock markets base on national, regional, healthcare expenditure, globalisation level, and economic development level classifications.

We employ data from 50 stock market indices during the most recent COVID-19 stage: 01 January to 20 August 2020.\(^2\) Consistent with Al-Awadhi et al. (2020), our analysis shows that international stock markets negatively reacted to the increase of COVID-19 cases in terms of return and volatility. The active responses of government can reduce the adverse impacts of COVID-19 on the overall financial market. In addition, the efficacies of these interventions are more pronounced in more developed economies. The national-specific characteristics, such as globalisation level, uncertainty, healthcare system readiness, and economic development level, appear to have significant influences on stock market responses. We posit that financial markets in countries with higher economic policy and financial uncertainty experience more chaos during the pandemic. Investors were significantly more sensitive to COVID-19 information in mostly wealthy countries as a result of their advances in information technology and communications.

Our paper makes several contributions to the literature. First, we add to a blooming body of literature investigating the financial inferences of national interventions in response to the COVID-19. Previous studies mainly focus on the effects of COVID-19 on the overall financial market in terms of returns (Al-Awadhi et al., 2020; Zhang et al., 2020); U.S market volatilities (Albulescu, 2021); the role of government interventions (Ashraf, 2020a; Huynh et al., 2021). Unlike the former literature, our paper is more prevailing as it examines how government response to COVID-19 impacts could influence financial market returns as well as volatilities with international evidence. Further, research shows that the higher uncertainty levels, the more adverse responses of financial market during the pandemic. Our study also extends the current finance literature by considering cross-country impacts of COVID-19 regarding both economic policy and financial market uncertainties by using World Uncertainty Index (WUI). This inclusive index is associated with economic policy uncertainty (EPU), stock market volatilities, risks of lower GDP growth. Thus, it is better in explaining the international financial market returns and volatilities than the Economic Policy Uncertainty Index (EPU) that employed by various prior studies (e.g., Albulescu, 2021; Chiaia and Zhong, 2020; Ma et al., 2020; Sharif et al., 2020).

Second, our study contributes to the extant literature by assessing the connections between globalisation levels, healthcare system capacity and equity market during the pandemic. A growing body of literature has shown that national equity market development is driven by the level of trade openness or globalisation (e.g., Do and Levcenko, 2007; Rajan and Zingales, 2003), which particularly relates to the spread of contagious diseases (Price and Adu, 2021). Erdem (2020) considers the relationship between financial market movements and freedom level\(^3\) during the COVID-19 pandemic, which only indicates the national condition of political rights and civil liberties. However, prior studies have not focused on the financial market reactions during the pandemic in the angle of globalisation, which measures the national level of openness or engagement in the global trading system. Also, an effective and robust healthcare system should enhance investors’ assurance and confidence (Baker et al., 2019). It is reasonable to expect that a better healthcare system would improve the national resilient level and possibly diminish the pandemic’s unfavourable effects on the financial market (Capelle-Blancard et al., 2021). The COVID-19 period provides a setting to extend current understanding of the consequences of healthcare system readiness and globalisation on cross-country financial market movements, which is highlighted in this study.

Finally, instead of examining national data as recent papers have done, we provide comparisons on market returns and volatilities across geographical regions and economic development levels in reference to authority involvements during the COVID-19 crisis. Using the economic development as the benchmark for financial market development level, this study addresses a potential concern that economic development can significantly impact financial market performance during the pandemic. The economic development classifications incorporate with information efficiency, which can promptly reflect the financial market by rapid investors' reactions. The remainder of the paper proceeds as follows. Section 2 describes the data, basic statistics, as well as methodology. The main findings of the empirical analysis are presented in Section 3. Finally, Section 4 presents concluding remarks.

2. Data and methodology

To explore the effect of the COVID-19 outbreak on stock market returns, we employ daily international indices of 50 stock markets (See Appendix A.1). The data include 42 specific countries, five regions (Asia Pacific, Europe, North America, Latin America, and, Arabian and Africa), and three groups classified by levels of economic development (developed, emerging, and frontier economies).\(^4\) We also obtain the associated COVID-19 data (total number of confirmed cases per million). By using the per million data, this study can prevent a potential bias regarding more populous nations. Additionally, we use the daily COVID-19 Government Response Index to measure the effect of governmental interventions on the stock market performance. The sample period spans from January 2020 to 20 August 2020. We also collect the 2019 macroeconomic data and the World Uncertainty Index to portray the levels of openness, national healthcare spending, as well as economic policy uncertainty. Using the World Uncertainty Index (WUI) in preference to the Economic Policy Uncertainty Index (EPU), we can inclusively capture the impacts of economic policy and financial market uncertainty on the financial market’s performance. The regional

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\(^2\) This study only considers the first wave of the pandemic since it affected most countries across the world as it would generate the most robust data.

\(^3\) The Freedom score from Freedom House Data is analysed and composed of numerical ratings for the national electoral process, political pluralism and participation, the functioning of the government, freedom of expression and belief, associational and organisational rights, the rule of law, and personal autonomy and individual rights.

\(^4\) The classifications are based on the 2020 Global Market Accessibility Review of Morgan Stanley Capital International. They specify detailed assessments of market accessibility for each stock market based on five criteria of market accessibility (Openness to foreign ownership, Ease of capital flows, Efficiency of the operational framework, Availability of Investment Instruments, Stability of the institutional framework).
Table 1

| Variable                                | Description                                                                 | Source                                      |
|------------------------------------------|-----------------------------------------------------------------------------|---------------------------------------------|
| **Stock market index return (RET)**     | The daily returns stock market indices are computed as: \( RET_{i,t} = \frac{Index_{value_{t,i}}}{Index_{value_{t-1,i}}} \) where \( Index_{value_{t,i}} \) is the stock market index in day \( t \) for country or region \( i \). | Morgan Stanley Capital International (MSCI) database |
| **Stock market index Volatility (VOL)**  | The daily returns stock market indices are computed as:                      | The volatilities are computed based on daily returns of stock market indices. |
|                                          | - Three-day moving volatility (VOL3) \( VOL_{3,i,t} = \sqrt{\frac{\sum (RET_{i,t} - VOL_{2,i,t})^2}{3}} \) |                                             |
|                                          | - Five-day moving volatility (VOL5) \( VOL_{5,i,t} = \sqrt{\frac{\sum (RET_{i,t} - VOL_{4,i,t})^2}{5}} \) |                                             |
| **Daily Growth rate in COVID-19 Confirmed Cases (CASE)** | The growth rate in coronavirus-related data is calculated in the similar manner to the stock index return. | Our World In Data: [https://ourworldindata.org/coronavirus-data](https://ourworldindata.org/coronavirus-data) |
| **Government Response Index (GRI)**     | Oxford COVID–19 Government Response Tracker (OxCGRT) systematically obtains information from diverse common policy responses that governments have taken to react to the COVID-19 pandemic on 17 key indicators such as lockdown restrictions, school closures, or travel bans (Hale et al., 2020). The higher value, the more references to levels of pandemic reactions in the country. | Blavatnik School of Government database, University of Oxford, UK |
| **Trade Openness Index (OPEN)**         | The ratio of trade-to-GDP is used to measure the level of economic openness or the globalisation of an economy. Disregarding other variables, this ratio tends to be low in large and more populated economies (such as Japan and the United States) and higher in smaller economies. The more open, the more affect COVID-19 to the economies. A dummy variable is created for this variable as \( OPEN_{D,2019} = \begin{cases} 1, & \text{if } OPEN_{D,2019} \geq 0.6 \\ 0, & \text{other wise} \end{cases} \) | World Development Indicators - World Bank |
| **Health Care Expenditure (HCE)**       | Health Care expenditure ratio to GDP is used to measure the central government spending for both public and private healthcare. The higher values indicate the more sustainable health care system of the country. A dummy variable is created for this variable as \( HCED_{D,2019} = \begin{cases} 1, & \text{if } HCED_{D,2019} \geq 9.0\% \\ 0, & \text{other wise} \end{cases} \) | World Development Indicators - World Bank |
| **World Uncertainty Index (WUI)**       | This index is used to track uncertainty across the globe by text mining the Economist Intelligence Unit’s country reports, which is associated with economic policy uncertainty and stock market volatility. The higher value, the more uncertainty level of the country. The index for this study is computed by taking the average of WUI in Q1 and Q2 2020. A dummy variable is created for this variable as \( WUID_{D,2020} = \begin{cases} 1, & \text{if } WUI_{D,2020} \geq 3.0 \\ 0, & \text{other wise} \end{cases} \) | World Uncertainty Index Database: [https://worlduncertaintyindex.com/](https://worlduncertaintyindex.com/) |

This table reports a detailed data description and its sources. In this study, all parameters for the dummy variables are the international medians computed from the given database.

and groups of economic development data are computed by taking the average of all nations included in each group, specified in Morgan Stanley Capital International fact sheets (See Appendix A.2). The detailed data description and its source are presented in Table 1.

In this study, the panel ordinary least squares regression model is constructed to examine the effect of COVID-19 and the indirect effect of macroeconomic and uncertainty factors on stock market returns. The panel data analysis is employed to acquire the varying time association between dependent and independent variables (Ashraf, 2017). Further, this method can minimise multicollinearity problems, heteroscedasticity, or estimation bias by applying cross-sectional and time-series variation (Wooldridge, 2010). Thereby, the panel regression is demonstrated by the following specification:

\[
Y_{i,t} = \alpha + \alpha_1 CASE_{i,t-1} + \alpha_2 (GRI_{i,t-1} \times CASE_{i,t-1}) + \beta_0 (XD \times CASE_{i,t-1}) + \sum_{t=1}^{T-1} X_{i,t} \varepsilon_{i,t} + \varepsilon_{i,t}
\]

Where, \( Y_{i,t} \) is the independent variable, including the daily stock return \( (RET_{i,t}) \), three and five-day moving volatility \( (VOL_{3,i,t} \) and \( VOL_{5,i,t}) \) in country or region \( i \) at day \( t \). The \( CASE_{i,t-1} \) is the lagged values of the daily growth in total confirmed COVID-19 cases. We also use the lagged interaction terms of daily growth in total confirmed COVID-19 cases with government response index \( (GRI_{i,t-1} \times CASE_{i,t-1}) \) and three dummy variables \( (XD \times CASE_{i,t-1}) \). These interaction terms demonstrate whether the financial market reaction to the growth in confirmed cases depends on levels of globalisation, healthcare spending, economic policy and financial uncertainty, and government reactions. \( X_{i,t} \) are the country/region fixed-effects dummy variables, which can effectively control all factors in the sample period for each country and region. The error term is captured by \( \varepsilon_{i,t} \).

3. **Empirical analysis**

In this section, we present the results of our empirical analysis. Summary statistics pertaining to our examined data are reported in Table 2. Table 3 reports the panel regression results for 42 national and five regional stock markets’ daily index returns. In Model 1, the growth in confirmed cases variable enters negative and enormously significant, indicating that stock markets react negatively
to the growth in COVID-19 confirmed cases. This variable’s outcomes remain comparable when we include other national and regional level control variables in Model 2, 3, and 4. Consistent with the previous findings of Al-Awadhi et al. (2020), Alfaro et al. (2020), Ashraf (2020a,b), and Erdem (2020); our findings show that the growth of COVID-19 confirmed cases have significant adverse effects on stock market returns.

In Model 1, we also study how government interventions for COVID-19 affect stock market returns by using the interaction term of $GRI \times CASE$. This interaction term enters positive and significant. This result demonstrates that the countries or regions with more active government measures during the outbreak can reduce the negative effect of growth in confirmed cases on stock market returns. Our finding is in line with the conclusions reported in the finance literature by (Ashraf, 2020a), claiming that government announcements may set in motion of positive market returns by instilling confidence that measures are being adopted to reduce the infection rate.

Furthermore, we also include three variables of Openness, Healthcare Expenditure, and World Uncertainty Index interact with the growth in COVID-19 confirmed cases in Model 2, 3, and 4, respectively. The results are statistically significant for the national data. The negative and significant coefficient for the interaction term, $OPEN \times CASE$, indicates the magnification of the negative impacts of COVID-19 confirmed cases on the financial market returns. In other words, economies with higher globalisation levels were more harshly affected by the COVID-19 pandemic. The cross-term of $HCE \times CASE$ enters positive and significant, suggesting that the growth of COVID-19 less adversely impacts the equity market returns in nations with higher health expending. The negative and statistically significant interaction term of $WUI \times CASE$ amplifies the negative impacts of confirmed cases on the stock returns. This result endorses that stock markets in economies with higher economic policy and financial uncertainty levels are more severely crashed by the growth COVID-19 confirmed cases. On another point of remark for the results in Panel B of Table 3, the last three dummy variables with daily growth in total confirmed COVID-19 cases lose significance when regressing regional data, which can be explained by aggregation bias (Topcu and Gulal, 2020).

Additionally, we also examine three and five-day moving volatilities 47 stock market indices to capture the investment risk during the crisis. As tabulated in Table 4, the growth coefficients in confirmed cases variable are positive and strongly significant for the national data. However, it loses significance when we regress the regional data, which again can be explained by aggregation bias. The cross-term $GRI \times CASE$ maintains its positive and statistically significant coefficient in 4 models, which indicates the lessening of the positive relationship between stock market volatilities and growth in confirmed cases. The outcomes remain robust when regressing the regional data. This result demonstrates that the countries or regions with more active measures in response to the pandemic can reduce the positive effect of COVID-19 on stock market volatilities.

We also find that an increase in confirmed cases that interacted with Trade Openness and World Uncertainty Index have significant adverse effects on volatilities. In other words, the

### Table 2

#### Summary statistics.

| PANEL A: Summary statistics for 42 countries | Variable | Observations | Mean | Std. Dev. | Maximum | Minimum |
|--------------------------------------------|----------|--------------|------|-----------|---------|---------|
| RET | 5728 | -0.00002 | 0.03 | 0.17 | -0.20 | |
| VOL3 | 5644 | 0.0198 | 0.02 | 0.15 | 0.00 | |
| VOL5 | 5642 | 0.0210 | 0.02 | 0.14 | 0.00 | |
| CASE | 5728 | 0.121 | 0.75 | 42.66 | -0.01 | |
| GRI | 5728 | 60.06 | 21.59 | 96.15 | 0.00 | |
| OPEN | 5728 | 80.52 | 60.24 | 319.10 | 26.40 | |
| HCE | 5728 | 7.49 | 3.17 | 16.96 | 2.30 | |
| WUI | 5728 | 3.10 | 2.42 | 10.07 | 0.00 | |

| PANEL B: Summary statistics for 5 regions | Variable | Observations | Mean | Std. Dev. | Maximum | Minimum |
|--------------------------------------------|----------|--------------|------|-----------|---------|---------|
| RET | 745 | -0.0003 | 0.02 | 0.12 | -0.15 | |
| VOL3 | 735 | 0.0176 | 0.02 | 0.12 | 0.00 | |
| VOL5 | 725 | 0.0188 | 0.02 | 0.11 | 0.00 | |
| CASE | 745 | 0.105 | 0.25 | 4.35 | 0.00 | |
| GRI | 745 | 55.79 | 24.99 | 80.90 | 1.12 | |
| OPEN | 745 | 54.04 | 18.10 | 84.21 | 29.89 | |
| HCE | 745 | 9.09 | 4.06 | 16.55 | 5.05 | |
| WUI | 745 | 3.96 | 1.04 | 5.35 | 2.94 | |

| PANEL C: Summary statistics of economic development levels | Variable | Observations | Mean | Std. Dev. | Maximum | Minimum |
|-----------------------------------------------------------|----------|--------------|------|-----------|---------|---------|
| RET | 474 | -0.0003 | 0.02 | 0.09 | -0.12 | |
| VOL3 | 468 | 0.0128 | 0.01 | 0.07 | 0.00 | |
| VOL5 | 462 | 0.0134 | 0.01 | 0.07 | 0.00 | |
| CASE | 474 | 0.100 | 0.22 | 2.56 | 0.00 | |
| GRI | 474 | 50.97 | 25.22 | 79.62 | 0.36 | |
| OPEN | 474 | 54.46 | 7.66 | 65.33 | 49.07 | |
| HCE | 474 | 7.13 | 3.86 | 12.49 | 3.46 | |
| WUI | 474 | 3.67 | 0.85 | 4.86 | 2.95 | |

This table reports the summary statistics of all variables in this study. Stock market returns (RET) and three and five-day moving volatilities (VOL3 and VOL5) measure the daily change in major stock indices of examined countries, regions, or groups of the country. The growth in confirmed cases (CASE) is measured as the daily growth in COVID-19 confirmed cases. The Government Response index (GRI) indicates the Government interventions during the COVID-19 outbreak, taken from the Blavatnik School of Government database, University of Oxford (Hale et al., 2020). Two macroeconomic variables represent the levels of openness (OPEN) and healthcare expenditure (HCE) obtained from the World Development Indicators of the World Bank. The World Uncertainty Index (WUI) is taken from the WUI Database, indicating the country’s uncertainty level regarding economic policy uncertainty and stock market volatility.
countries or areas with a higher level of globalisation and uncertainty have higher investment risk in stock markets during the outbreak. On the contrary, the interaction term of HCE × CASE enters negative and strongly significant in Model 2, 3, 4 of Panel A, Table 3. This suggests that countries with a more sustainable healthcare system can reduce the positive impacts of COVID-19 on stock market risks. However, we only obtain a similar outcome for the World Uncertainty Index by utilising the regional dataset, possibly explained by the aggregation effect.

The influences of the COVID-19 pandemic diverge across financial markets; therefore, the grouping of nations or regions in a regression might lead to aggregation bias. Thus, we also estimate the impact of COVID-19 by classifying data into five regions in Table 5. The results demonstrate that the most affected financial markets regarding the stock returns are North American markets, followed by Arabian and Africa and Europe. Studying the stock market risk, North American and European markets are still the most exaggerated by the outbreak. Latin American and Asia Pacific stock markets also experience chaos with relatively high volatilities during the outbreak. In contrast, Arabian and African is found to be the least distressed region. As shown in Table 4, the Arabian, African and European governments are the most effective in reducing the adverse impacts of the crisis on the stock markets. On the other hand, the American regions are found to be the least successful in lowering the pandemic’s impacts on financial markets by implementing the policy responses.

Next, we examine how to examine the effect of coronavirus outbreak by categorising data into three economic development levels in Table 6. We find that developed stock markets are affected the most by the COVID-19 outbreak in both stock returns and volatilities, whereas frontier markets are the least affected. Consistent with the results in Table 5, developed continents such as Europe and North America have been worse affected by the crisis. Thus, this reflects a level of information efficiency of these economies, where the outbreak heavily deteriorates investors’ confidence and stock returns. Despite being affected the most by the pandemic, the developed countries are more successful in managing the negative impacts on their financial markets. Especially, these nations, for having vast amount of financial resources, better healthcare systems, and more transparent communication, are more equipped to deal with the fallout of the pandemic. As a result, they are able to offset the catastrophic impact on their financial markets.

4. Conclusion

This paper proposes novel experiential evidence on the relationship between financial market performance and globalisation,
This study employs panel regression models with broad stock market indices of 42 countries, five regions, and three economic development groups.
Our findings first demonstrate that financial markets are deleteriously affected by the pandemic regarding diminished stock returns and augmented investment risk. The swift actions from government in response to the crisis lead to positive effects on stock returns and negative effect on volatilities. Our findings indicate that the pandemic more robustly shattered stock markets from more open economies. On the other hand, economies with a more robust healthcare system can effectively reduce the negative consequences of the outbreak on the financial market. Using an inclusive uncertainty index (WUI); covering the uncertainty of economic policies and financial markets, we posit that the higher level of uncertainty, the worse the impact of COVID-19 on the financial market. Using the economic development level as the benchmark for financial market growth, we find that more advanced economies are promptly and negatively react to pandemics declarations as a result of their advances in information technology and communications. However, nations with higher wealth and prosperity levels are more effective in reducing the negative impacts of COVID-19 on the stock market by swiftly implementing applicable measures.

From the above findings, our paper makes several contributions to the literature and practical policy implications for policymakers and financial market participants across regions and different levels of economic development. Authorities across countries should prioritise investment and regular spending on the healthcare system, which better equips the countries to minimise the impacts of future outbreaks. Besides, the rise of globalisation can also drive the nation to experience severe consequences from the negativity of extreme events, as evidently shown during this global pandemic.

From the starting point of our findings, short-term and long-term resilience should be prearranged to support overall economic recovery. Meanwhile, the risk controlling framework for institutional and individual investors should also be reconsidered to address the upsurge of financial market volatility and systematic risk associated with this ongoing pandemic. The foremost limitation of our study is the limited sample. It is challenging to forecast the final economic outcomes of the ongoing crisis. Future research with the availability of further data is essential for this topic to provide more factual propositions for policymakers as well as investors in their decision-making manner.

CRediT authorship contribution statement

Nhan Huynh: Conceptualization, Methodology, Investigation, Data curation, Software, Formal analysis, Writing – Original Draft, Writing - review & editing, Visualization. Anh Dao: Conceptualization, Investigation, Validation, Writing - original, Writing - review & editing, Visualization. Dat Nguyen: Conceptualization, Methodology, Data curation, Writing - review & editing, Visualization.

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.

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Appendix A. Supplementary data

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