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Counterfactual analysis among Covid-19: fiscal and monetary policy for green economic recovery

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ABSTRACT

This study examines fiscal-monetary policy links in America across a time period that includes the recent global economic crisis and the COVID-19 emergency. Hypotheses deviate that regulatory administrations are permanent and calculate fiscal policy yearly percentage rate and budgetary regulations which are likely to change between two governments. Additionally, study uses the VAR technique to evaluate the effects of financial initiatives similar to those undertaken in the aftermath of the Covid-19 outbreak. Results discovered that fiscal policy is more successful than monetary policy, and that lavishing on public debt helps increase short-run economic performance. People argue that concerns about a rapid rise in prices as a result of fiscal stimulus are unfounded because the US economy was not close to full employment or full use of funds prior to the global epidemic, and the dissemination processes that could contribute to accelerating rising prices are not always in place. As a result, with the withdrawal of monetary stimulus, the favourable effects on actual GDP and real private expenditure are gone. Long-term mortgage rates have risen, money invested has decreased, and prices have risen, raising concerns about the banking system's inflationary tendency.

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1. Introduction

During the coronavirus outbreak, the financial system is in a full-fledged recession with the administration racking up debt at unprecedented rates and the banking system instituting an unorthodox monetary system in a lower-zero setting. The economic and financial effects of those policy initiatives can indeed be studied in the context of the macroeconomic analysis of traditional processes Rizvi et al. (2020), Mirza et al. (2020a) and Yarovaya et al. (2021). This article examines the relationship

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between taxation and financial regulation in America during a timeframe that encompasses the world financial crisis and aspects of the pandemic situation. Study also alleviates the presumption that the policies are corrected and try to emulate Naqvi et al. (2021), Mirza et al. (2020b) and Ji et al. (2021b) in order to calculate the macroeconomic bank rate regulations and the tax policy guidelines that toggle between the two systems probabilistically. An innovative VAR framework by Umar et al. (2021a) and Umar et al. (2021b) is applied to evaluate the impact of fiscal policy consistent with the different situations of government debt and shortfall tax, comparable to the American (and other governments around the world) policy initiatives on financial regulation conducted during the Covid-19 outbreak Lei et al. (2021), Xiang et al. (2021) and Wu et al. (2022), Tan and Liu (2020) and Sahana et al. (2021). Whereas the vaccination roll-out was originally slow because of the lack of large-scale manufacturing and problems in delivering and giving the injections, it has since recovered rapidly, delivering thousands of shots daily (Tangonyire & Akuriba, 2021). In Hispanic and black populations, substantial racially-based differences in immunisation are also reflected in fewer vaccines than the white majority, which is particularly worrisome considering the greater incidence of illness in African American and Hispanic groups. In addition, some individuals mistrust the health service and are reluctant to get vaccinated even if they are accessible. But at least the United States is in a stronger place now than a year ago because there was minimal awareness of the illness (Tao et al., 2020).

There is a widespread forecast that the international aviation industry will experience strong development worldwide by 2020. In recent days, this has been in the context of a continuous expansion in freight, passenger traffic, and revenues throughout the sector Ozoike-Dennis et al. (2019) and Hilbers et al. (2019). In view of the unexpected and fickle effects of COVID-19 on the world economy, the pandemic's influence on different industries within the economy must thus be constantly monitored and followed to impart wisdom essential for policy and practice Lobato et al. (2021), Ielasi et al. (2018), Karim et al. (2022) and Ferrat et al. (2022). Knowing the evolution of the epidemic is important when companies worldwide are prepared to operate in the epidemic or the 'social trend.' This knowledge enables actions to be adopted to guarantee the organisations' working in different economic sectors Mwanyoka et al. (2019) and Boshoff (2019). The prevailing opinion is that the epidemic has rebooted different world economies, encouraging a new adaptation and mitigation path. Participants think that the new financial outlook has to be sensitive and linked with principles set forth in the sustainable development goal of 2030 and the Sendai Hazard Mitigation Strategy (Nawaz, 2021).

The intensity of catastrophes produced by global warming has suffered defacement of billions of dollars globally (Bourcet & Bovari, 2020) and therefore has impeded some societal GDP recovery. In order to minimise aftermath damages, regimes and corporations have established a variety of pre-disaster preparation and after pandemic recovery and rebuilding assistance strategies (Tu et al., 2021). Furthermore, a comprehensive review of the pace and impact of the aftermath recovery is indeed necessary to evaluate whether such strategies and policies can 'improve the global crisis preventive and abatement capability to attain a green economy'. This is particularly

crucial for the rehabilitation of financial activity, and is one of the main components at stake, and is the aim of the aforementioned programmes and decisions. The development of emergency preparedness theory offers a logical and efficient foundation for a thorough knowledge of the recovery process after a catastrophe and the process of dangerous entities Mohsin et al. (2021a), and Mohsin et al. (2021b). Even though there is no general agreement on the idea of emergency preparedness, its essential nature, i.e., the capability of a way to protect, digest, and retrieve from the detrimental impact of disasters and responsibly enhance its manageability, has indeed been generally understood. The present worldwide upheaval of the financial downturn triggered by the COVID-19 has the potential to make monetary and fiscal policy one of the most serious economic policy instruments available for preventing an economic recession from escalating into a financial meltdown (Shan et al., 2019). Significant cash withdrawals from developing markets and developing countries during times of crisis are a frequent worry, as they may result in liquidity constraints in domestically or internationally traded currencies in the business and financial domains (Sun et al., 2012). This has the potential to generate negative feedback, particularly in situations when exchange rate devaluation is significant and monetary imbalances are frequent Hasnaoui et al. (2021), Mirza et al. (2022) and Yarovaya et al. (2020). If the pandemic issue continues for an extended period of time, the property market is likely to be significantly impacted, which may in turn lead to an aggravation of the crisis in terms of decreasing asset values. Because of these conditions, officials are currently actively debating the implementation of macroeconomic policies or financial market restrictions (Shao et al., 2020).

Several research measures after a pandemic dynamic economic robustness by monitoring the difference in the level of decline in recuperation duration and the level of decline in IELs. Yang et al. (2021), He et al. (2020) and Mohsin et al. (2021) defined economic resilience, distinguished static and dynamic economic resilience, and described their methodologies for quantification measures based on recovery period and direct economic losses assessment, using a computer framework for overall balance. Tiep et al. (2021) also distinguishes various macroeconomic resiliencies and proposes measuring techniques utilising the input/output system based on indirect economic losses analysis findings. In a literature review, calculated that 58 sectors in 44 nations have vibrant economic robustness during 2000 and 2014 to forecast economic growth and recovery on the basis of the IO framework. Also, Ding et al. (2020) assessed the Chongqing province's highly dynamic endurance following the Wenchuan disaster in determining the indirect economic losses dynamic route to transformation.

This research used a state-of-the-art methodology for quantifiable resilience assessment, and one's essential analysis of vulnerability included an analysis of the vibrant worth of this procedure from the moment the catastrophe took place until the conclusion of the aftermath recovery. Furthermore, much of the research has concentrated on the durability of capital investment stocks (the main source of direct economic losses, e.g., transportation, homes) or the affected labour force L. Sun et al. (2020a) *and* Baloch et al. (2020). As being one of the key productive variables, its decrease in supply and recovery will have a major effect on the completeness and

accuracy of the evaluation of economic resilience. The COVID-19 epidemic has resulted in various levels of harm and various improvement routes worldwide (Keen and Apt 2019). The attempt to control the transmission of the illness and minimise its harmful impact on public health and the financial system has had triumphs and failed. Some countries were able to control the disease transmission quickly and effectively, leading to a spectacular recovery, while others have been suffering with increasing cases. To re-establish strong growth, market pressures simply are not enough to address the numerous problems. Authorities have to step up to fill this gap and play an important role in recovery. This study seeks to analyze poverty and reduce inequality in order to revive economic development.

This article provides a review of notable studies, such as Sarkodie and Owusu (2021), Padhan and Prabheesh (2021) and Z. Varnalii et al. (2020) examine the interconnections between fiscal and monetary policy in America. Research is also inspired by the extraordinary large-scale budgetary assistance given by the American regime and the Bank of America's traditional and non-traditional monetary policies. Monetary stimulus, in researchers believe, is more proactive than monetary policy, and that debt-service expenditure promotes short-term demand and production. Therefore, with the termination of the fiscal stimulus, the beneficial impacts on business growth are lost. Long-term interest rates are increasing, investments are falling and prices are rising, generating inflation issues affecting macroeconomic power.

The remaining part of the paper is arranged accordingly. The second section is a review of the literature. Section 3 describes the macro-politics scheme-shifting model, analyses the data, and presents the results. Section 4 depicts Structural VARs, provides the technique for determining sign constraints, analyses data, and conducts a policy analysis for all VARs in terms of impulsive reactions to fiscal policy shocks. The final section outlines the conclusion and policy implications.

2. Literature review

There has lately been a noticeable increase in the amount of research addressing the influence of financial strategy unpredictability on trade flows, and the research on the impacts of trade uncertainty on the commodities markets has been quite well documented for some time. Within the academic realm, the effects of financial macroeconomic uncertainty on financial markets are examined from distinct perspectives (Liu et al., 2021). The first point of view is concerned with the consequences of the actual choices. As a result of increased macroeconomic uncertainty, companies may decide to adopt a 'cautious approach', which allows them to postpone their consumption and investment objectives (Deloitte, 2020). This approach lowers the cost of imported goods (i.e., input products such as building ingredients for manufacturing and consuming activities), which ultimately results in a decrease in the price of commercial input products. Moreover, if the economic plan remains extremely unclear in the long term, asset exporters are more likely to decrease their output, resulting in less deflationary pressure on financial asset prices in the short run. According to this viewpoint, investor sentiment may have a detrimental effect on raw material prices Yu et al. (2022), Ji et al. (2021a), Umar et al. (2021d) and Umar et al. (2021c). The

connection involving COVID-19 and the share market is similar to a link with both wild and domesticated (Dewianawati, 2020). Although stakeholder services are needed to combat COVID-19, the price of an asset has decreased. The primary research topic of a large number of financial studies published in the second quarter of 2020 was thus financial sector responses to the COVID-19 outbreak, particularly public policy measures to limit or eradicate the COVID-19 pandemic. The epidemic concerns Padhan and Prabheesh (2021), Chakraborty and Thomas (2020) and Zaytsev (2020) have generated varied shareholder responses. Bortolini et al. (2013) note that federal policy concern may be regarding government decisions and insecurity about the effect of a government's new policies. These concerns are anticipated to influence the pricing of stocks, since the philosophy and sensationalist behaviour of shareholders in an effort to shift the financial markets will also alter when legislative changes take place.

Numerous studies also show that trade conflicts have a significant negative impact on both American businesses and their key allies, resulting in trade disputes and increasingly complicated features. For example, Khalid et al. (2021), Victor et al. (2021) and Azad et al. (2021) use American corporate and socioeconomic methods to analyse the financial impacts of ambiguity about import tariffs. The findings indicate that the rise in the TPU raises pricing and decreases employment and financial production. This decrease in resources and financial production has been linked by the researchers with growing concern about potential import duties. A note released by National bank, on 10 September 2019 shows that the current downturn including both developed countries and developing countries is due to a variety of reasons, but that it has corresponded with an increase in trade hostilities and international policy insecurity. Their major effects are also shown by the greater magnitude of the secondary huge impact difficulties on the world economy (e.g., the mood of economic players). For instance, if companies are unsure about future trade rules between nations, they will likely cut their operations. Lacalle (2021) claim in this regard that China's membership in the World Trade Organization and commerce with China have decreased America's fear of trade war and led to higher sales. Decreased political instability has additionally led to price declines and rising wages in the US. The writers thus stressed the significance of consensus and the reduction of trade conflicts, which may lead to uncertainty. The effect of trading activities (revenue) regulatory unpredictability on American firms is examined in subsequent research by L. Sun et al. (2020b), H. Sun et al. (2020c) and L. Sun et al. (2020a) and finds that it has adversely impacted the probability of Americans entering an external market and even caused the departure of current markets.

The interconnections between financial regulatory regulation as well as other administration categories, such as financial regulation and investment regulation, have been studied by respected research sectors. For instance, Alemzero et al. (2021), H. Sun et al. (2020c) and Alemzero et al. (2020) indicate that market restrictions and financial regulatory regulation both contribute to economic stability by decreasing net economic growth and also reduce economic liability amounts and risks. The macroeconomic strategy was demonstrated by Agyekum et al. (2021) and Zhang et al. (2021) to be more successful when supplemented by financial regulation. Heyden and Heyden (2021) observed the same impacts on demand growth in fiscal and monetary

policies that include both regulators' complimentary usage in normal times and challenges in times of coincidence between booming economic development and low inflation. Study also examines the connection between fiscal and monetary policy and other authorities, particularly investment restrictions, financial regulation and currency exchange frameworks, as part of this research.

A substantial body of macroeconomic policy research has recently developed predictive concepts to explore how macroeconomic policy rules may decrease the likelihood of a fiscal crisis. Borio (2020) showed that financial regulatory policy lowers the likelihood of disasters and smooth consumption at the cost of economic damage due to somewhat weaker economic growth. Wei and Han (2021) found it optimum to utilise tax debt to enable operators to absorb the structural negative externalities of their choices when an accumulating quantity of interest payments is sufficient in good economic times.

There are also increasing theoretical patterns for the study of the connection between macroprudential policy and other macroeconomic policies. Chien et al. (2021) demonstrated that relying on wind-type monetary policy may backfire and reduce financial stability through multi-balances, which implies the significance of monetary and prudential authorities' capacity to coordinate. Martin and Rice (2018b) utilised a DSGE model and showed that monetary policy may be supplemented by macroprudential policy. Li et al. (2021), Chien et al. (2021) and Iqbal et al. (2021) showed that LTV legislation, followed by banking capital restrictions and monetary policies, is the most effective and the least expensive policy instrument for dealing with household imbalances Iqbal et al. (2021) and Zhang et al. (2021) have shown that taxing credit or capital inflows is the best policy, thus capital restrictions are not warranted as a distinct tool. In contrast, Zhang et al. (2021), Hsu et al. (2021) and Ehsanullah et al. (2021) showed that the optimum policy on macro-prudential capital control should be tightened when the debt-to-output ratio, i.e., an accommodating monetary policy, is high following a decrease in interest rates.

3. Data and methodology

Taghizadeh-Hesary and Yoshino (2019) and Taghizadeh-Hesary and Yoshino (2020) address research discrepancy, which reflects the presumption that policies are immutable and examine the consequences of the changes in the monetary and fiscal policy system. Based on this research and also Yan et al. (2019) we examine regulations on rates of interest for America's monetary policy and fiscal policy regulations that transition across two regimes probabilistically. Let y_t be a data vector q gathered at the moment t. The simplified shape of a reliable $t = 1, \ldots, T, \mathrm{VAR}\, k$, $\mathrm{VAR}(k)$, is provided by,

$$y_t = \sum_{t=1}^{k} B_t y_{t-1} + \varepsilon_t, t = 1, \ldots, T \tag{1}$$

Where $\mathbf{B}_t$ there exist coefficient vectors $(q \times q)$ and lag vectors that determine process model and are a create a higher stochastic operation $\in_t$, that is, separately across time q. The observational matrix $\in_t | \Sigma \sim N_q(0, \Sigma)$ at the moment is linearly dependent

on the prior measurements t, when known k. The slope and external factors k may be introduced to the analysis to change the findings presented here directly; specifics are omitted for brevity. Let the matrix $Z_t = (y'_{t-1}, ..., y'_{t-k})'$ of late data kq be indicated at time t and the matrix $\mathbf{B}' = (\mathbf{B}_1, ..., \mathbf{B}_k)$ generated by gathering the relevant coefficient $(q \times kq)$ indices combined. Eq. (1) may thus be represented $y_t = B'Z_t + \in_t$. The (conditioned) probability $\mathbf{Y}_0 = (\mathbf{Y}'_0, \mathbf{Y}'_{-1}, ..., \mathbf{Y}'_{-k+1})'$ of VAR (k) may be entered in (1) for certain starting values that we expect to be accessible as a whole.

$$\mathrm{f}(\mathrm{y}_1, ..., \ \mathrm{y_t}'|\mathrm{B}, \Sigma) = \prod\nolimits_{\mathrm{t}=1}^{\mathrm{t}} f(\mathrm{y_t}|\mathrm{z_t}, \ \mathrm{B}, \ \Sigma) \tag{2}$$

When the normally distributed probability is each dependent probability $f(\mathbf{y}_t|\mathbf{z}_t, \mathbf{B}, \Sigma)$ in (Eq. (2). Let all observation $\mathbf{z}$ be recorded by the matrix $\mathbf{y}_t|\mathbf{z}_t, \mathbf{B}, \Sigma \sim N_q(\mathbf{B}'\mathbf{z}_t, \Sigma)$ and the matrix $\mathbf{Y} = (\mathbf{y}_1, ..., \mathbf{y}_T)'$, including all delayed factors $(T \times q)$, i.e., Eq. (3) may ultimately $(T \times kq)$ be represented as a matrix $\mathbf{Z} = (\mathbf{z}_1, ..., \mathbf{z}_T)'$.

$$\mathrm{Y} = \mathrm{ZB} + \mathrm{E} \tag{3}$$

So, where's $\mathbf{E} = (\in_1, ..., \in_T)$' the erroneous matrices $(T \times q)$ after a matrix? Ordinary zero-averaged distributions j, the cross-covariance matrices j' among vector columns $\mathbf{Y}$ and vector $\sigma_{jj} I_T$ column similar Σ to and the scalar row covariance matrices equal to that we express $\mathbf{E}|\Sigma \sim N_{T,q}(0, I_T, \Sigma)$, Lim et al. (2021) for the symbol $vec(Y) = (I_q \otimes Z)vec(B) + vec(E)$. The Kronecker product $vec(E)|\Sigma \sim N_{Tq}(0, \Sigma \otimes I_T)$ is described in an analogous vector expression. We can express the VAR (k) probability as,

$$f(Y|B, \Sigma) = (2\pi)^{\frac{Tq}{2}} |\Sigma|^{\frac{T}{2}} \exp\left\{ -\frac{1}{2} tr\left[\Sigma^{-1} \left(\left(\mathrm{B} - \widehat{B}\right)' Z'Z\left(\mathrm{B} - \widehat{B}\right) + \mathrm{E'E} \right) \right] \right\} \tag{4}$$

Where $tr(\cdot)$ is the detectable function $E = Y - ZB$ and is an estimate of the coefficient matrix $\widehat{B} = (Z'Z^{-1}Z'Y)$ of the OLS, well-defined $\mathrm{T} \geq \mathrm{kq}$ given? In other terms, it may be said that the probability of the VAR framework is the probability of a multivariate regression analysis, with the lagging factors being a predictive. They also take into account the following budgetary rule,

$$\tau_\mathrm{t} = \alpha_0(\mathrm{S_{f,t}}) + \alpha_1(\mathrm{S}_{f,t})\mathrm{b}_{t-1} + \alpha_2(\mathrm{S}_{f,t})\mathrm{y}_t + \alpha_3(\mathrm{S}_{f,t})\mathrm{g}_t + \varepsilon_{f,t} \tag{5}$$

Where τ_t is a proportion of taxation to output b_t, deficit proportion, state purchase-to-output proportion g_t and the non-compliance state $s_{f,t}$, the very first degree, homogeneous two-state Markov chain was also supposed to obey. The appropriate transfer function is as follows,

$$\prod\nolimits_f = \begin{bmatrix} p_{f,11} & p_{f,12} \\ p_{f,21} & p_{f,22} \end{bmatrix} \tag{6}$$

Where $p_{m,ij} = P[s_{m,t} = j | s_{m.t-1} = i], i, j = 1, 2$ and $p_{m,11} = 1 - p_{m,21}$ and $p_{m,12} = 1 - p_{m,22}$ Equation shows that monetary and fiscal policy reacts in various regimes to inflationary π_t and production gaps y_t significantly $\alpha_1(s_{m,t})$ because and therefore,

different regimes fluctuate $\alpha_2(s_{m,t})$ Equation indicates that fiscal policy reacts extensively in various countries to the delayed debt-to-output ratio b_{t-1}, the output gap y_t, and the state buys-to-output percentage g_t, as $\alpha_1(s_{f,t})$, $\alpha 2(s_{f,t})$ and $\alpha 3(s_{f,t})$ correspondingly, change all over countries. Study focusses on the different fiscal policy possibilities Gonzalez & Enríquez-De-Salamanca (2018), Hanssen et al. (2018), and Marttunen and Mustajoki (2018). The first situation, looked at the consequences of implementing a shortfall fiscal policy, in which state spending rises by 1% but state revenues stay constant for a year (four quarters) within the first shock. Over a year, under the second fiscal scenario, government income decreases by 1% while federal spending increases by 1%. Mountford and Uhlig developed a functional VAR and recognition technique that was employed. The VAR's reduced form description is provided by

$$y_t = \sum_{i=0}^{L} B_i y_{t-1} + u_{\mathrm{t,}} \text{for } \mathrm{t} = 1, \ \ldots, \mathrm{T} \tag{7}$$

In which $\mathbf{Y}_t$ the VAR is a vector $\mathbf{m \times 1}$, the L lag length is VAR (selected by the Bayesian information criteria), B_t is $m \times m$ factor vectors u_t *is* $m \times 1$ are and one-step forecasting errors are variable using. $E\left[u_t u_t'\right] = \Sigma$ Study contemplate a global economy comprised of $n+1$ neighbouring nations and on the account factors: the log of real ($\mathrm{gdp_{it}}$), nominal long-term interest rate ($\mathrm{lr_{it}}$), the log of real equity prices ($\mathrm{eq_{it}}$), the log of the real exchange rate ($\mathrm{ep_{it}}$), and the periodically adopted primary balance as a ratio of potential GDP ($\mathrm{capb_{it}}$). This framework covers the period from 1988 to 2020. The country variables were indicated by;

$$\mathbf{y}_{it} = (\Delta gdp_{it}, \Delta lr_{it}, \Delta eq_{it}, \Delta ep_{it}, \Delta capb_{it})' \tag{9}$$

United States financial system is indicated by $i = 0$ while the rest of the countries are indexed by $i = 1, 2, \ldots, n$. In the individual $k \times 1$ all country-specific were gathered $\mathbf{y}_t = (\mathbf{y}_{0t}', \mathbf{y}_{1t}', \mathbf{y}_{2t}', \ldots, \mathbf{y}_{nt}')'$ than added fluctuations in the pricing of log oil, $\Delta poil_t$, ad the worldwide unpredictability of equity returns, $grve_t$ as global variables seen in the $\mathbf{g}_t = (\Delta poil_t, grve_t)'$. In order to record the impacts of unnoticed shared elements (global and commercially weighted), two extra variables are included in the model: I the country-specific variables PPP-GDP weighted average,

$$\tilde{\mathbf{y}}_t = (\Delta g\tilde{d}p_t, \Delta \tilde{l}r_t, \Delta \tilde{e}q_t, \Delta \tilde{e}p_t, \Delta c\tilde{a}pb_t)' \tag{10}$$

$$\mathbf{y}_t^* = (\Delta gdp_t^*, \Delta lr_t^*, \Delta eq_t^*, \Delta ep_t^*)' \tag{11}$$

It was presumed that up to 2019 Q4 ($\mathrm{t} = 1, 2 \ldots, \mathrm{T}$), $\mathrm{e_t}$ for Q1 to Q4 of 2020, it is given by

$$\mathbf{e}_{T+q} = \boldsymbol{\omega}_{T+q} + \boldsymbol{\Gamma} v_{T+q} + \boldsymbol{\varepsilon}_{T+q}, \ \text{for } q = 1, 2, 3, 4, \tag{12}$$

Where $\boldsymbol{\omega}_{T+q}$ the Covid-19 shock and policy measures are appropriate to minimise its economic impact throughout the term $T+q$. It was supposed that $\boldsymbol{\omega}_t = 0 \, for \, t \leq T$ but it's non zero for $t = T+1, T+2, T+3, T+4$. In general way, $\mathbf{S}$ is written as the matrix that chooses all main vector balance variables x_t modified by periodic, respectively.

$$S\mathbf{X}_t = \Delta \mathrm{capb}_t = (\Delta capb_{0t}, \Delta capb_{1t}, \ldots, \Delta capb_{nt})'. \tag{13}$$

In addition to the periodically adapted primary balance $\boldsymbol{\omega}_{T+1}$, established individual components which correlate to the related one $K_{i,1}$, and utilize the previous associations of the threshold regression errors to calculate the attribute. This results in,

$$\widehat{\boldsymbol{\omega}}_{T+1} = \widehat{\mathbf{D}}_e K_1, \tag{14}$$

Where $\widehat{\mathbf{D}}_e = \widehat{\Sigma}_e S'(S\widehat{\Sigma}_e S)^{-1}$, in which $\widehat{\Sigma}_e$ is the estimate of $\Sigma_v = E(v_t v_t'), \Sigma_e = \Gamma \Sigma_v \Gamma' + \Sigma_\varepsilon$ and $\Sigma_\varepsilon = E(\varepsilon_t \varepsilon_t')$, the transformations, $\widehat{\boldsymbol{\omega}}_{T+q}$ for $q = 2, 3, 4$ calculated recurrently as;

$$\widehat{\boldsymbol{\omega}}_{T+2} = \widehat{\mathbf{D}}_e \left(\boldsymbol{\kappa}_2 - \mathbf{S}\widehat{\mathbf{G}}\widehat{\boldsymbol{\omega}}_{T+1} \right) \tag{15}$$

$$\widehat{\boldsymbol{\omega}}_{T+3} = \widehat{\mathbf{D}}_e \left(\boldsymbol{\kappa}_3 - \mathbf{S}\widehat{\mathbf{G}}\widehat{\boldsymbol{\omega}}_{T+2} - \mathbf{S}\widehat{\mathbf{G}}^2 \widehat{\boldsymbol{\omega}}_{T+1} \right) \tag{16}$$

$$\widehat{\boldsymbol{\omega}}_{T+4} = \widehat{\mathbf{D}}_e \boldsymbol{\kappa}_4 - \mathbf{S}\widehat{\mathbf{G}}\widehat{\boldsymbol{\omega}}_{T+3} - \mathbf{S}\widehat{\mathbf{G}}^2 \widehat{\boldsymbol{\omega}}_{T+2} - \mathbf{S}\widehat{\mathbf{G}}^3 \widehat{\boldsymbol{\omega}}_{T+1} \tag{17}$$

The macroeconomic impacts of Covid-19 related fiscal effects were characterized by

$$\boldsymbol{\eta}^c(T,h) = \mathbf{X}^c_{T+h} - \mathbf{X}^0_{T+h}, \tag{18}$$

Where $\mathbf{X}^c_{T+h}$ is a counterfactual realization of global economy after fiscal support, namely $\left\{ \boldsymbol{\omega}_{T+j} \widehat{\boldsymbol{\omega}}_{T+j} \right\}_{j=1}^4$, and, $\mathbf{X}^0_{T+h} = E(\mathbf{X}_{T+h} | \mathcal{I}_T)$ is the conditional expectation of global economy without fiscal support, given the information set $I_T = \{\mathbf{x}_T, \mathbf{x}_{T-1}, \ldots\}$. The distribution of $\boldsymbol{\eta}^c(T,h)$ can be computed by stochastically simulating $\mathbf{X}^c_{T+h}$ and $\mathbf{X}^0_{T+h}$.

3.1. Data and estimation results

Quarterly statistics for America during 1988 to 2020 was utilise, including the international economic meltdown and portion of the pandemic problem. The rate of interest, specifically, is the multiple banknote percentage of the government. Hyperinflation was interpreted as the logarithmic variance of the CPI. The output gap is the log departure from prospective gross domestic product of formal GDP, is the nominal GDP share of government revenues, is the delayed gross domestic product portion of the overall public debt selling price, and is the annual gross domestic

Table 1. Descriptive statistics.

Variable	Mean	Standard deviation	Skewness	Kurtosis
Three-month treasury bill rate	0.045	0.032	2.798	3.674
Inflation rate	0.007	0.002	2.087	11.654
Output gap	−0.004	0.017	−1.432	11.376
Taxes-to-output ratio	0.082	0.014	0.409	−0.543
Debt-to-output ratio	2.0897	0.275	0.265	−0.176
Government purchases-to-output ratio	0.207	0.176	1.876	3.598

product share of government expenditure. A comprehensive url set of data sources is provided, as well as aggregated characteristic data. Results of Li and Dewan (2017) and Chiu et al. (2012) were adopted and utilised the Hamilton filter to recurrently build the log probability function. The maximum probability estimate thus includes the log probability function. The variables of monetary and fiscal policy presented the predicted chances of changeover are shown in Panel B. Monetary policy shifts from extensive to high inflation in line with the Taylor principle (with) and passive, not the Taylor principle (with). Our calculations also indicate that monetary policy reacts to the passive output gap, but just not the dynamic one, indicating that the Bank of America's passive government attaches importance to the stabilisation of the financial system. With reference to fiscal policy, it alternated between proactive deficit responses and inactive responses to a favourable deficit response. In addition, an effective taxation policy adversely affects the production gap (Table 1).

The uniform probability of direct and indirect fiscal and monetary policy, which are presented at a period, depending on the complete extraction of information. Our calculations indicate that monetary policy was active before the international economic meltdown, but inactive after the international economic meltdown. In addition to this, study find that the current (Kao, 2009) financial system has been passive, possibly reflecting the boosting monetary and fiscal policies of the Bank of America during the epidemic. Study also observes that almost all of the period's fiscal and monetary policy was active, with the exception of a brief period before and after the international economic meltdown (until 2015).

4. Results and discussion

Mountford and Uhlig's authentication mechanism were strictly watched Kao (2013) and Chan and Karim (2012). A business cycle shock was defined as one which for a year after the original shock pushes together production, expenditure, capital and tax receipts. A criteria scheme is applied that places greater weight on big impulses than on relatively tiny replies and penalises reactions that do not correspond to the indication limits established. An external debt shock will drive state bond yields (10 years), the M2++ supply of money and different cost indexes (the consumer cost matrix and the gross national product) up for a year on account of the first shock. Furthermore, deflationary pressures remain high and legacy debt problems and unperforming loans may combine negatively with the epidemic in certain nations (Table 2).

The efficiency of the policy approach to research is limited as the epidemic persists and the future remains unclear, although there are some outliers. Table 3 provides a summary of our identification of indication limitations on impulses.

Table 2. The result of the Panel Data regression.

Variable	Emission reduction policy		Renewable energy policy	
REP	−0.0387***			
	(0.003)			
GEM		−0.0367***		
		(0.005)		
CO_2			−0.0281***	
			(0.003)	
EC				−0.0342***
				(0.0761)
GDP	−0.029***	−0.028***	−0.0288***	−0.0332***
	(0.001)	(0.001)	(0.004)	(0.004)
R&D Sub for EE	0.532	0.213*	0.332	0.371*
	(0.034)	(0.008)	(0.072)	(0.002)
Tax reduction	0.221***	0.432***	0.2452***	0.321***
	(0.002)	(0.002)	(0.003)	(0.002)
E&E grant	−0.422**	−0.433***	−0.376***	−0.331***
	(0.001)	(0.000)	(0.000)	(0.002)
Constant	1.331	1.332***	1.143***	1.232***
	(0.012)	(0.132)	(0.0324)	(0.0217)
AR (1) test	−2.0773	−2.0732	−1.985	−2.658
	[0.043]	[0.052]	[0.067]	[0.039]
AR (2) test	−1.543	−1.256	−1.324	−1.2543
	[0.132]	[0.184]	[0.143]	[0.153]
Sargan test	18.432	21.432	21.532	15.443
	[0.054]	[0.032]	[0.14]	[0.132]
Wald test	15674	187453	164837	353746
	[0]	[0]	[0]	[0]
N	472	472	472	472

Note: Standard errors are in parentheses (). *** = 1% significant level; ** = 5% significant level and * =10% significant level.

Table 3. The result of the Panel Data regression (R&D subsidy for energy and environment).

Variable	Emission reduction policy		Renewable energy policy	
REP	−0.0417***			
	(0.002)			
GEM		−0.0261***		
		(0.004)		
CO_2			−0.0341***	
			(0.002)	
EC				−0.0242***
				(0.0761)
GDP	−0.026***	−0.024***	−0.0254***	−0.0432***
	(0.002)	(0.001)	(0.004)	(0.003)
R&D Sub for EE	0.032	0.213*	0.332	0.372*
	(0.014)	(0.007)	(0.072)	(0.002)
Tax reduction	0.321***	0.332***	0.245***	0.321***
	(0.002)	(0.002)	(0.003)	(0.002)
E&E grant	−0.322**	−0.333***	−0.332***	−0.432***
	(0.000)	(0.001)	(0.002)	(0.002)
Constant	1.231	1.323***	1.123***	1.156***
	(0.015)	(0.154)	(0.0324)	(0.000)
AR (1) test	−2.0773	−2.0732	−1.985	−2.658
	[0.012]	[0.022]	[0.016]	[0.043]
AR (2) test	−1.543	−1.256	−1.324	−1.2543
	[0.172]	[0.154]	[0.183]	[0.133]
Wald test	15674	187453	164837	353746
	[0]	[0]	[0]	[0]
N	468	462	468	462

Note: Standard errors are in parentheses (). *** = 1% significant level; ** = 5% significant level and * =10% significant level.

America's GDP growth rate statistics, absolute final consumer spending expenses, real gross fixed capital (internal economic estimate), actual state ultimate consumer expenses, executive consumer costs for the overall commodities, implied gross domestic product deflator, true limited efficacious trade openness, overall government expenditures, and deep-rooted banking rates and cost factors were utilised to detect disruptions in debt levels. This section provides an example model setup for America. The pandemic has undoubtedly brought about transitory and lasting employment market adjustments. Work supply drops significantly and falls in one quarter, but it appears to be progressively rebounding.

4.1. Econometric estimation

Our VAR framework comprises of such 10 quarterly parameters, no fixed or temporal pattern, from 1988: q1 to 2020: q4. The 20% decline in revenue tax collections, on the other hand, supports the modelling outcome and job losses. Therefore, a government prohibition on redundancies and on brief work may have restricted possible increases in the jobless rate, which implies there is a measuring prejudice among the workforce and the workforce. Our research studied the effects of every strategy utilising downtime and stopping methods on these factors. The decrease in interest rates does not have a beneficial influence on manufacturing and utilization, but has a beneficial effect on inflation and an adverse influence on the reimbursement likelihood collapse, in accordance with economic principles. Declining reserve requirements have the same effect on manufacturing and utilisation as inflation decreases, whereas monetary policy is induced by the rate drop. Not surprisingly, credit risk is a significant financial element for institutions, and any decrease in inflation of fuels is a decrease in inflation caused by the induction of access to credit facilities. The consequence of a fall in the unsecured borrowing percentage, as stated, has a significant effect on demand and supply. The reduction in the limits of residential assets fosters consumption for dwellings and related industries like sustainable goods and semi-durable products, which increase output.

The financial consequences of a pandemic on supply and demand appear effectively mitigated under fiscal aggregates solely by ancillary actions. Regarding fiscal action, the increase in state spending is beneficial in mitigating the unfavourable demand and supply consequences of the pandemic. Therefore, salary and expenditure cutbacks or exclusions have no beneficial effect on demand and supply (Taghizadeh-Hesary et al., 2021).

4.2. A Deficit-spending fiscal policy scenario

The impulses for all ten factors throughout the first fiscal and monetary sort of situation for shortfalls are displayed in the Figure 3. Formalized. The figure represents the twentieth, 43rd, and 87th quantities of the impulses computed for the first dozen quarters at every perspective, following the upsets. Reviewing the data, found that federal spending increased by 1 percent across four quarters during development,

Table 4. Monetary policy.

Coefficient	Active	Passive
A. Mean equation		
a0	0.038 (0.000)	0.005 (0.000)
a1	1.119 (0.002)	0.071 (0.258)
a2	0.309 (0.034)	0.265 (0.000)
B. Transition probabilities		
Psm,t = active|sm,t − 1 = passive	0.045 (0.000)	
Psm,t = active|sm,t − 1 = active	0.876 (0.000)	

Table 5. Fiscal policy.

Coefficient	Active	Passive
A. Mean equation		
α0	0.060 (0.000)	0.043 (0.000)
α1	−0.002 (0.267)	0.023 (0.000)
α2	−0.054 (0.005)	0.038 (0.178)
α3	−0.084 (0.243)	0.065 (0.254)
B. Transition probabilities		
Psf,t = active|sf,t − 1 = passive	0.050 (0.000)	
Psf,t = active|sf,t − 1 = active	0.850 (0.000)	

whereas economic growth remained constant around the same timeframe (Tables 4 and 5).

The stock market is important for preserving the international sustainability of a business. As the currency rate is linked immediately to the trade surplus, industrial performance, fiscal deficit, and equity markets, keeping a sound financial system is among the key priorities of the authorities. Throughout this epidemic, most countries suffered instability in the investment rate and currency devaluation owing to losses of money and market emotions. As an example, the unfavourable feelings in relation to the pandemic impacted significantly on money institutions Guan and Chen (2010), Keh et al. (2006), Zhang and Choi (2013), Zhang et al. (2016a) said that the pandemic outbreak is linked to important data and may be utilised in the prediction of currency exchange stock return eccentricity efficiently. The fluctuating exchange rate and currency devaluation may damage stock prices, financial revenues, budget deficits, credit bonds and economic uncertainty. Global development levels can be viewed as a large surrogate for allocated budgets and buffers to respond to pandemics, as well as long-term developmental disparities, economic deepening, and administrative practices. Higher-growth nations were anticipated to be effective in responding, as Benmelech and Cull et al. (2017) and Chen et al. (2019) pointed out.

The remarkable anomaly might be the policy prescription in the area of digital currencies. With more advanced countries having better established banking systems, further policy actions may be less necessary in this area.

The connection among socioeconomic development and the government response seen may thus be unfavourable. As a metric of socioeconomic development, gross domestic product was employed (stated in existing global dollars, adjusted using PPP as of end-2019. First, the ability to undertake a sensible policy approach may be limited by the banking system, current account deficits and elevated amounts of external debt. In turn, foreign liabilities and financial sustainability development and congestion impacts may exacerbate the economic catastrophe of a pandemic, causing the

Table 6. The result of the Panel Data regression (Fiscal Policy).

Variable	Emission reduction policy		Renewable energy policy	
REP	−0.0328***			
	(0.001)			
GEM		−0.0239***		
		(0.003)		
CO_2			−0.0321***	
			(0.001)	
EC				−0.0221***
				(0.0761)
GDP	−0.027***	−0.025***	−0.029***	−0.046***
	(0.003)	(0.002)	(0.001)	(0.005)
R&D Sub for EE	0.142	0.113*	0.131	0.199*
	(0.014)	(0.006)	(0.073)	(0.001)
Tax reduction	0.321***	0.332***	0.232***	0.421***
	(0.004)	(0.003)	(0.003)	(0.002)
E&E grant	−0.422**	−0.482***	−0.332***	−0.232***
	(0.001)	(0.003)	(0.001)	(0.002)
Constant	1.243	1.212***	1.153***	1.1421***
	(0.012)	(0.121)	(0.0321)	(0.001)
AR (1) test	−2.032	−2.042	−1.325	−2.321
	[0.019]	[0.025]	[0.017]	[0.021]
AR (2) test	−1.321	−1.243	−1.354	−1.432
	[0.172]	[0.154]	[0.183]	[0.133]
Wald test	15674	187453	164837	353746
	[0]	[0]	[0]	[0]
N	448	462	448	462

Note: Standard errors are in parentheses (). ***= 1% significant level; **= 5% significant level and *=10% significant level.

institutions to react more quickly and to a greater extent. With regard to enduring borrowing costs, it was noticed that, in reaction to the crisis of budget deficits, the long-term mortgage rate is increasing. This is mostly similar to results from Hu et al. (2017) and Ang and Chen (2016) which show detrimental consequences for commercial treasury yields and long-term state macroeconomic variables from welfare spending shocks. Zhang et al. (2018) and Chen et al. (2018) utilise the Bayesian VAR framework with adequate data to show that knowledge regarding state expenditure rises leads to highly relevant rises in short and medium-term bond yields (Table 6).

The researchers extensively deconstruct short or medium-term investment rises into improvements in the overall fiscal policy assumptions and variations in term prices. Researchers find that when market participants get information about a favourable public investment shock, the rise in short- or medium-term lending rates is a result of better anticipated future yield rates. The researchers note that if the state's fiscal deficit were substantial and enduring, shareholders may lose confidence in the administration's capacity to reimburse its liabilities. This one, in essence, could raise Treasury bond rates in the long run because shareholders need greater compensation to keep long-term treasury securities. Additional factual proof exists by Zhang et al. (2008) that an increase in state expenditure recognises the actual currency exchange rate and increases relatively high prices. Furthermore, the imbalanced expenditure increases the gross domestic product deflator and the stock market performance for manufacturers. This may be linked to the desire to draw rising prices, which encourages more budget deficits on federal revenue, greater household spending, and ultimately higher gross domestic product. Increasing government expenditure may create

inflationary pressures in the financial system when the central bank attempts to achieve or exceed the growth rate of gross domestic product. Zhang et al. (2016b) and Wang et al. (2013) argue that financial institutions that implement inflation-focused fiscal policy systems may want to raise interest rates over time to fight these inflationary pressures, thereby boosting public mortgage rates over the long term. Tsolas (2011) say that when nominal interest rates are stable, the lower limit is enforceable, and more government budgets lead to higher outputs and inflation expectations. As per Fisher's equation, a rise in the anticipated consumer price index would result in a decrease in real interest rates when the cost of borrowing is at 0 and expenditure is increased. In consequence, it will contribute to a further increase in production and rising prices.

4.3. Deficit-financed government revenue decline

Given the coronavirus epidemic, the international monetary fund expects that tax income in certain countries will fall significantly. One cause may be the decrease in business growth. Compulsory social separation policies might have substantial impacts on taxation, the tax system, and cooperation with taxpayers. This leads us to examine a new fiscal policy situation involving a series of fundamental financial crises wherein tax collections are 1 percent lower and government spending is 1 percent higher for one year after the first shock. It was observed that GDP growth and utilisation both increase briefly before reverting to stable levels. Expenditure may have increased directly for many reasons, like salary grants, medical vacation payouts, workers' compensation, and substantial child welfare advantages. Two market rates—the gross domestic product measure of inflation and the manufacturer consumer price index—are rising, indicating strong consumer price index supply. Our long-standing bond yields findings are comparable with Yang et al. (2017) and Yao et al. (2015) estimates that a 1 percentage rise in the central state debt, level of prices, is anticipated to raise the long-term real interest rate by approximately 3 main terms. Wang et al. (1997) and Wu et al. (2020) examine, for a group of 32 developing and developed countries, the impact of deficit spending and public debt on longer-term debt. Researchers conclude that increased government expenditures and state debt have a substantial and beneficial arithmetical impact on long-term interest rates. The rise in public spending, along with a decrease in the government's income, serves to boost short-term production and consumption, but also generates rising inflation, which the banking system has to deal with (Table 7).

The Coronavirus epidemic is used as an external shock by Xiao et al. (2019) to examine how a budgetary administration may assist in stabilizing national revenue and utilisation during this outbreak. The author concludes that unemployment compensation is the best way to stabilise earnings for people who experience even during the epidemic. There will be no safety anywhere on the globe, and the economic and political ramifications are yet unclear. The size of the impact, on the other hand, will be unbalanced, both inside and across different nations and areas (Furceri et al., 2020). The consequences of the collapse are dependent on a variety of factors, including the financial realities and governance institutions that existed before the

Table 7. Estimated threshold variables.

Threshold variables		Estimated thresholds	95% confidence interval
Model 1	$\gamma 1$	0.242	[0.188, 2.121]
	γ_2	0.643	[0.671, 2.322]
Model 2	γ_1	0.532	[0.542, 2.144]
	γ_2	0.661	[0.722, 2.203]

pandemic. Although some industries may only suffer a supply or demand upset, others will face both price and quantity disruptions. At the core of this imbalance is the economic situation of European countries in general, and oil-dependent nations in specific. Oil-dependent nations are experiencing a double jolt: the present global medical crisis and its effect on their economies, as well as a precipitous drop in the price of oil. Not only did the epidemic cause the very first historical moment in the oil market's fall, but it also generated doubt about the destiny of the oil sector. It can be described that why the epidemic has thrice hampered the transfer of financial regulation to the financial system. Firstly, shareholders did not anticipate the embryonic, insufficient, and unclear monetary measures that were implemented during the epidemic era. This limited knowledge has rendered market players less sensitive than at various moments to monetary policy. Lower risky investment industry participants remained in the near term on the outside to a higher degree than normal.

5. Conclusion and policy implications

Unlike during the 2008 global financial crisis and the current coronavirus epidemic, several industrialised nations, as well as America, responded with exceptional policy measures to a slowdown in the economy. The fiscal authorities launched substantial programmes of fiscal incentives while the financial institutions lowered policy rates rapidly to 0 and conducted unorthodox monetary measures. This article examines the fiscal and monetary impact of these measures on scheme and structural VAR frameworks. By applying American statistics, study founds that fiscal policy was more effective in America than monetary policy from 1988 to 2020. Research also utilises a systemic VAR to study how expansionary fiscal policy may influence key monetary variables. Results discovered that fiscal stimulus really helps to increase short-term business growth. Therefore, with the termination of the stimulus measures, the beneficial impacts on GDP growth and social spending are gone. Long-term interest rates are rising, capital is falling, prices are rising, causing central-bank pricing issues. For instance, as Serletis and Xu (2021) previously noted in their US research, an inflationary rise of 3% to 6% would entail (on median) a social assistance price equal to a reduction of 0.60% of production.

The aforementioned results have four major policy consequences.

Firstly, during the epidemic phase, financial markets should adopt a further monetary easing currency policy or rely on other microeconomics as the transfer of macroeconomic factors into the financial system is hindered. In reality, in several nations, state banks have begun to 'issue bonds' for the epidemic. Bond yields, for example, have already been regulated to unfavourable levels in Geneva, Germany, and Hungary, while they are on the verge of falling precipitously in Wellington, Iceland,

and Sydney. Even though these never-ending aggressive economic measures have had no substantial short-term impact on financial markets (representative timeframe of this study), banking system hysteria has abated slightly by the close of 2020. For instance, even by the close of 2020, the stock price had rebounded and equity benchmarks in key developing countries, except Armenia, had also rebounded substantially. Larger investment regulatory adjustments are thus required for the financial system to be regulated. Secondly, the little effect on macroeconomic performance of increasing epidemic intensity indicates that financial institutions would decrease overall reactions to financial authorities in the near run as long as the majority of cases reported exceeds their limit, however severe or not.

The potential explanations include the overreactions of the banking industry participants to epidemic data and wealth of shareholders, such as hoarding behaviour. This provides strong evidence that a small number of proven instances may drive many stockholders to move to safe investments via the replacement of capital instruments that further lowers the boosting effects on accounting marketplaces of financial regulation. For instance, whereas the epidemic intensity in Russia, the US, France, and Europe is varied, the relatively brief stimulus impacts of their macroeconomic measures enacted on equity markets in January and June 2020 are always negligible. All three stock indexes 6 only started to rebound by June 2020 at the beginning of April. Consequently, even if a nation is not at the maximum level of epidemic intensity, the short-term lowering impact of money regulation on currency institutions must be taken into full account in the execution of strategy.

Lastly, unorthodox money supply may be employed to boost the stock system and counteract post-pandemic economic crises, since this is somewhat higher than regular financial regulation. But unlike bond yield strategies, many unorthodox financial authorities aim to encourage specific kinds of business, including those engaged in combating the COVID-19 pandemic or tiny and small companies. Undoubtedly, the impact on financial markets of these non-conventional financial authorities may not be substantial, but adjustments may be immediately communicated to the microeconomics and provide a beneficial part in the economic recovery. In the coming years, financial institutions may pursue less flexible and dynamic unorthodox banking systems and provide more targeted assistance to the rest of the economy. In addition, additional macro measures may be necessary. A mix of unorthodox fiscal policy may, for instance, be a better option for regulating the capital sector and stimulating the economy in the post-pandemic era.

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References

Agyekum, E. B., Amjad, F., Mohsin, M., & Ansah, M. N. S. (2021). A bird's eye view of Ghana's renewable energy sector environment: A multi-criteria decision-making approach. *Utilities Policy*, *70*, 101219. https://doi.org/10.1016/j.jup.2021.101219

Alemzero, D. A., Iqbal, N., Iqbal, S., Mohsin, M., Chukwuma, N. J., & Shah, B. A. (2020). Assessing the perceived impact of exploration and production of hydrocarbons on households perspective of environmental regulation in Ghana. *Environmental Science and Pollution Research*, https://doi.org/10.1007/s11356-020-10880-3

Alemzero, D. A., Sun, H., Mohsin, M., Iqbal, N., Nadeem, M., & Vo, X. V. (2021). Assessing energy security in Africa based on multi-dimensional approach of principal composite analysis. *Environmental Science and Pollution Research*, *28*, 2158–2171. https://doi.org/10.1007/s11356-020-10554-0

Ang, S., & Chen, C. M. (2016). Pitfalls of decomposition weights in the additive multi-stage DEA model. *Omega*, *58*, 139–153. https://doi.org/10.1016/j.omega.2015.05.008

Azad, N. F., Serletis, A., & Xu, L. (2021). Covid-19 and monetary–fiscal policy interactions in Canada. *The Quarterly Review of Economics and Finance*, https://doi.org/10.1016/j.qref.2021.06.009

Baloch, Z. A., Tan, Q., Iqbal, N., Mohsin, M., Abbas, Q., Iqbal, W., & Chaudhry, I. S. (2020). Trilemma assessment of energy intensity, efficiency, and environmental index: Evidence from BRICS countries. *Environmental Science and Pollution Research*, *27*, 34337–34347. https://doi.org/10.1007/s11356-020-09578-3

Borio, C. (2020). The Covid-19 economic crisis: Dangerously unique. *Business Economics*, *55*(4), 181–190. https://doi.org/10.1057/s11369-020-00184-2

Bortolini, M., Gamberi, M., Graziani, A., Mora, C., & Regattieri, A. (2013). Multi-parameter analysis for the technical and economic assessment of photovoltaic systems in the main European Union countries. *Energy Conversion and Management*, *74*, 117–128.

Boshoff, D. S. (2019). Of smoke and mirrors: (Mis)communicating EIA results of solar energy projects in South Africa. *Journal of Environmental Assessment Policy and Management*, *21*(03), 1950014. https://doi.org/10.1142/S1464333219500145

Bourcet, C., & Bovari, E. (2020). Exploring citizens' decision to crowdfund renewable energy projects: Quantitative evidence from France. *Energy Economics*, *88*, 104754. https://doi.org/10.1016/j.eneco.2020.104754

Chakraborty, L., & Thomas, E. (2020). Covid-19 and macroeconomic uncertainty: Fiscal and monetary policy response. *Economic Political Weekly*.

Chan, S. G., & Karim, M. Z. A. (2012). Public spending efficiency and political and economic factors: Evidence from selected East Asian countries. *Economic Annals*, *57*(193), 7–24. https://doi.org/10.2298/EKA1293007C

Chen, K., Kou, M., & Fu, X. (2018). Evaluation of multi-period regional R&D efficiency: An application of dynamic DEA to China's regional R&D systems. *Omega (Omega)*, *74*, 103–114. https://doi.org/10.1016/j.omega.2017.01.010

Chen, C., Wang, L., Luo, Z., Zhao, Y., Lv, B., Fu, Y., & Xu, X. (2019). The effect of the characteristics of the partition plate unit on the separating process of-6 mm fine coal in the compound dry separator. *Minerals*, *9*. https://doi.org/10.3390/min9040215

Chien, F., Pantamee, A. A., Hussain, M. S., Chupradit, S., Nawaz, M. A., & Mohsin, M. (2021). Nexus between financial innovation and bankruptcy: Evidence from information, communication and technology (ict) sector. *The Singapore Economic Review*. https://doi.org/10.1142/S0217590821500181

Chiu, Y. h., Huang, C., Wei., & Chen, Y. C. (2012). The R&D value-chain efficiency measurement for high-tech industries in China. *Asia Pacific Journal of Management*, *29*(4), 989–1006. https://doi.org/10.1007/s10490-010-9219-3

Cull, R., Xu, L. C., Yang, X., Zhou, L. A., & Zhu, T. (2017). Market facilitation by local government and firm efficiency: Evidence from China. *Journal of Corporate Finance*, *42*, 460–480. https://doi.org/10.1016/j.jcorpfin.2015.06.002

Deloitte. (2020). Impact of COVID-19 on the insurance sector. *International Journal of Forecasting*.

Dewianawati, D. (2020). Kebijakan Fiskal dan Kebijakan Moneter Terhadap Produktivitas Pelaku UMKM Melalui Variabel Mediasi Keberhasilan Penanganan Covid-19 (Studi pada Pelaku UKM di Kota Mojokerto). *Journal of Entrepreneurship Business Development and Economic Educations Research*,

Ehsanullah, S., Tran, Q. H., Sadiq, M., Bashir, S., Mohsin, M., & Iram, R. (2021). How energy insecurity leads to energy poverty? Do environmental consideration and climate change concerns matters. *Environmental Science and Pollution Research*, *28*(39), 55041–55052. https://doi.org/10.1007/s11356-021-14415-2

Ferrat, Y., Daty, F., & Burlacu, R. (2022). Short- and long-term effects of responsible investment growth on equity returns. *The Journal of Risk Finance*, *23* (1), 1–13. https://doi.org/10.1108/JRF-07-2021-0107

Furceri, D., Loungani, P., Ostry, J. D., & Pizzuto, P. (2020). Will Covid-19 affect inequality? Evidence from past pandemics. *Covid Economics*, *12*(1), 138–157.

Gonzalez, A., & Enríquez-De-Salamanca, Á. (2018). Spatial multi-criteria analysis in environmental assessment: A review and reflection on benefits and limitations. *Journal of Environmental Assessment Policy and Management*, *20*(3), 1840001. https://doi.org/10.1142/S146433321840001X

Guan, J., & Chen, K. (2010). Measuring the innovation production process: A cross-region empirical study of China's high-tech innovations. *Technovation*, *30*(5-6), 348–358. https://doi.org/10.1016/j.technovation.2010.02.001

Hanssen, F., May, R., Van Dijk, J., & Rød, J. K. (2018). Spatial multi-criteria decision analysis tool suite for consensus-based siting of renewable energy structures. *Journal of Environmental Assessment Policy and Management*, *20*(3), 1840003. https://doi.org/10.1142/S1464333218400033

Hasnaoui, J. A., Rizvi, S. K. A., Reddy, K., Mirza, N., & Naqvi, B. (2021). Human capital efficiency. Performance, market, and volatility timing of asian equity funds during COVID-19 outbreak. *Journal of Asset Management*, https://doi.org/10.1057/s41260-021-00228-y

He, W., Abbas, Q., Alharthi, M., Mohsin, M., Hanif, I., Vo, X. V., & Taghizadeh-Hesary, F. (2020). Integration of renewable hydrogen in light-duty vehicle: nexus between energy security and low carbon emission resources. *International Journal of Hydrogen Energy*, *45*(51), 27958–27968. https://doi.org/10.1016/j.ijhydene.2020.06.177

Heyden, K. J., & Heyden, T. (2021). Market reactions to the arrival and containment of COVID-19: An event study. *Finance Research Letters*, *38*, 101745. https://doi.org/10.1016/j.frl.2020.101745

Hilbers, A. M., Sijtsma, F., Busscher, T., & Arts, J. (2019). Understanding added value in integrated transport planning: Exploring the framework of intelligence, design and choice. *Journal of Environmental Assessment Policy and Management*, *21*(03), 1950011. https://doi.org/10.1142/S146433321950011X

Hsu, C. C., Quang-Thanh, N., Chien, F. S., Li, L., & Mohsin, M. (2021). Evaluating green innovation and performance of financial development: Mediating concerns of environmental regulation. *Environmental Science and Pollution Research*, https://doi.org/10.1007/s11356-021-14499-w

Hu, A., Tang, X., Yang, Z., & Yan, Y. (2017). The relationship between the government and the market. In *The Modernization of China's State Governance* (pp. 93–118). Singapore: Springer. https://doi.org/10.1007/978-981-10-3370-4_4

Ielasi, F., Rossolini, M., & Limberti, S. (2018). Sustainability-themed mutual funds: an empirical examination of risk and performance. *The Journal of Risk Finance*, *19*(3), 247–261. https://doi.org/10.1108/JRF-12-2016-0159

Iqbal, W., Tang, Y. M., Chau, K. Y., Irfan, M., & Mohsin, M. (2021). Nexus between air pollution and NCOV-2019 in China: Application of negative binomial regression analysis. *Process Safety and Environment Protection*, https://doi.org/10.1016/j.psep.2021.04.039

Ji, X., Chen, X., Mirza, N., & Umar, M. (2021a). Sustainable energy goals and investment premium: Evidence from renewable and conventional equity mutual funds in the Euro zone. *Resources Policy*, *74*, 102387. https://doi.org/10.1016/j.resourpol.2021.102387

Ji, X., Zhang, Y., Mirza, N., Umar, M., & Rizvi, S. K. A. (2021b). The impact of carbon neutrality on the investment performance: Evidence from the equity mutual funds in BRICS. *Journal of Environmental Management*, *297*, 113228. https://doi.org/10.1016/j.jenvman.2021.113228

Kao, C. (2009). Efficiency decomposition in network data envelopment analysis: A relational model. *European Journal of Operational Research*, *192*(3), 949–962. https://doi.org/10.1016/j.ejor.2007.10.008

Kao, C. (2013). Dynamic data envelopment analysis: A relational analysis. *European Journal of Operational Research*, *227*(2), 325–330. https://doi.org/10.1016/j.ejor.2012.12.012

Karim, S., Naeem, M. A., Mirza, N., & Paule-Vianez, J. (2022). Quantifying the hedge and safe-haven properties of bond markets for cryptocurrency indices. *The Journal of Risk Finance*, ahead-of-print (ahead-of-print). https://doi.org/10.1108/JRF-09-2021-0158

Keen, J. F., & Apt, J. (2019). How much capacity deferral value can targeted solar deployment create in Pennsylvania?. *Energy Policy*, *134*, 110902.

Keh, H. T., Chu, S., & Xu, J. (2006). Efficiency, effectiveness and productivity of marketing in services. *European Journal of Operational Research*, *170*(1), 265–276. https://doi.org/10.1016/j.ejor.2004.04.050

Khalid, U., Okafor, L. E., & Burzynska, K. (2021). Does the size of the tourism sector influence the economic policy response to the COVID-19 pandemic? *Current Issues in Tourism*, https://doi.org/10.1080/13683500.2021.1874311

Lacalle, D. (2021). Monetary and fiscal policies in the COVID-19 crisis. Will they work? *Journal of New Finance*, *2*(1), 4. https://doi.org/10.46671/2521-2486.1014

Lei, X., Tu, X. Q., Yuan, Jin, C. & Ze, (2021). Nature of property right and the motives for holding cash: Empirical evidence from Chinese listed companies. *Managerial and Decision Economics*, https://doi.org/10.1002/mde.3469

Li, W., Chien, F., Hsu, C. C., Zhang, Y. Q., Nawaz, M. A., Iqbal, S., & Mohsin, M. (2021). Nexus between energy poverty and energy efficiency: Estimating the long-run dynamics. *Resources Policy*, *72*, 102063. https://doi.org/10.1016/j.resourpol.2021.102063

Li, B., & Dewan, H. (2017). Efficiency differences among China's resource-based cities and their determinants. *Resources Policy*, *51*, 31–38. https://doi.org/10.1016/j.resourpol.2016.11.003

Lim, G., Nguyen, V., Robinson, T., Tsiaplias, S., & Wang, J. (2021). The Australian economy in 2020–21: The COVID-19 pandemic and prospects for economic recovery. *The Australian Economic Review*, *54*(1), 5–18. https://doi.org/10.1111/1467-8462.12405

Liu, H., Yao, P., Latif, S., Aslam, S., & Iqbal, N. (2021). Impact of Green financing, FinTech, and financial inclusion on energy efficiency. *Environmental Science and Pollution Research*, https://doi.org/10.1007/s11356-021-16949-x

Lobato, M., Rodríguez, J., & Romero, H. (2021). A volatility-match approach to measure performance: the case of socially responsible exchange traded funds (ETFs). *The Journal of Risk Finance*, *22*(1), 34–43. https://doi.org/10.1108/JRF-04-2020-0066

Martin, N., & Rice, J. (2018). Solar feed-in tariffs: Examining fair and reasonable retail rates using cost avoidance estimates. *Energy Policy*, *112*, 19–28.

Marttunen, M., & Mustajoki, J. (2018). Use of analyst-generated stakeholder preference profiles in multi-criteria decision analysis - experiences from an urban planning case. *Journal of Environmental Assessment Policy and Management*, *20*(03), 1840002. https://doi.org/10.1142/S1464333218400021

Mirza, N., Abbas Rizvi, S. K., Saba, I., Naqvi, B., & Yarovaya, L. (2022). The resilience of Islamic equity funds during COVID-19: Evidence from risk adjusted performance, investment styles and volatility timing. *International Review of Economics & Finance*. https://doi.org/10.1016/j.iref.2021.09.019

Mirza, N., Naqvi, B., Rahat, B., & Rizvi, S. K. A. (2020a). Price reaction, volatility timing and funds' performance during Covid-19. *Finance Research Letters*, *36*, 101657. https://doi.org/10.1016/j.frl.2020.101657

Mirza, N., Rahat, B., Naqvi, B., & Rizvi, S. K. A. (2020b). Impact of Covid-19 on corporate solvency and possible policy responses in the EU. *The Quarterly Review of Economics and Finance*, https://doi.org/10.1016/j.qref.2020.09.002

Mohsin, M., Hanif, I., Taghizadeh-Hesary, F., Abbas, Q., & Iqbal, W. (2021a). Nexus between energy efficiency and electricity reforms: A DEA-Based way forward for clean power development. *Energy Policy*, *149*, 112052. https://doi.org/10.1016/j.enpol.2020.112052

Mohsin, M., Taghizadeh-Hesary, F., Panthamit, N., Anwar, S., Abbas, Q., & Vo, X. V. (2021). Developing low carbon finance index: Evidence from developed and developing economies. *Finance Research Letters*, *43*, 101520. https://doi.org/10.1016/j.frl.2020.101520

Mohsin, M., Ullah, H., Iqbal, N., Iqbal, W., & Taghizadeh-Hesary, F. (2021b). How external debt led to economic growth in South Asia: A policy perspective analysis from quantile regression. *Economic Analysis and Policy*, *72*, 423–437. https://doi.org/10.1016/j.eap.2021.09.012

Mwanyoka, I., Selestine, W. E., & Nuhu, S. (2019). EIA practices in the natural gas extraction sector in Tanzania: Does local community contribution matter? *Journal of Environmental Assessment Policy and Management*, *21*(3), 1950015. https://doi.org/10.1142/S1464333219500157

Naqvi, B., Mirza, N., Rizvi, S. K. A., Porada-Rochoń, M., & Itani, R. (2021). Is there a green fund premium? Evidence from twenty seven emerging markets. *Global Finance Journal*, *50*, 100656. https://doi.org/10.1016/j.gfj.2021.100656

Nawaz, S. (2021). Energy poverty, climate shocks, and health deprivations. *Energy Economics*, *100*, 105338. https://doi.org/10.1016/j.eneco.2021.105338

Ozoike-Dennis, P., Spaling, H., Sinclair, A. J., & Walker, H. M. (2019). SEA, urban plans and solid waste management in Kenya: Participation and learning for sustainable cities. *Journal of Environmental Assessment Policy and Management*, *21*(04), 1950018. https://doi.org/10.1142/S1464333219500182

Padhan, R., & Prabheesh, K. P. (2021). The economics of COVID-19 pandemic: A survey. *Economic Analysis and Policy*. https://doi.org/10.1016/j.eap.2021.02.012

Rizvi, S. K. A., Mirza, N., Naqvi, B., & Rahat, B. (2020). Covid-19 and asset management in EU: a preliminary assessment of performance and investment styles. *Journal of Asset Management*, *21*, 281–291. https://doi.org/10.1057/s41260-020-00172-3

Sahana, M., Rehman, S., Paul, A. K., & Sajjad, H. (2021). Assessing socio-economic vulnerability to climate change-induced disasters: evidence from Sundarban Biosphere Reserve, India. *Geology, Ecology, and Landscapes*, *5*(1), 40–52. https://doi.org/10.1080/24749508.2019.1700670

Sarkodie, S. A., & Owusu, P. A. (2021). Global assessment of environment, health and economic impact of the novel coronavirus (COVID-19). *Environment, Development and Sustainability*, *23*(4), 5005–5015. https://doi.org/10.1007/s10668-020-00801-2

Serletis, A., & Xu, L. (2018). The zero lower bound and crude oil and financial markets spillovers. *Macroeconomic Dynamics*, *22*(3), 654–665.

Shan, Y., Liu, J., Liu, Z., Shao, S., & Guan, D. (2019). An emissions-socioeconomic inventory of Chinese cities. *Scientific Data*, *6*(1), 1–10. https://doi.org/10.1038/SDATA.2019.27

Shao, S., Yang, Z., Yang, L., Zhang, X., & Geng, Y. (2020). Synergetic conservation of water and energy in China's industrial sector: From the perspectives of output and substitution elasticities. *Journal of Environmental Management*, *259*, 110045. https://doi.org/10.1016/j.jenvman.2019.110045

Sun, L., Cao, X., Alharthi, M., Zhang, J., Taghizadeh-Hesary, F., & Mohsin, M. (2020a). Carbon emission transfer strategies in supply chain with lag time of emission reduction technologies and low-carbon preference of consumers. *Journal of Cleaner Production*, *264*, 121664. https://doi.org/10.1016/j.jclepro.2020.121664

Sun, W., Li, Y., Wang, D., & Fan, J. (2012). The efficiencies and their changes of China's resources-based cities employing DEA and Malmquist index models. *Journal of Geographical Sciences*, *22*(3), 509–520. https://doi.org/10.1007/s11442-012-0943-0

Sun, H., Pofoura, A. K., Adjei Mensah, I., Li, L., & Mohsin, M. (2020). The role of environmental entrepreneurship for sustainable development: Evidence from 35 countries in Sub-Saharan Africa. *The Science of the Total Environment*, *741*, 140132. https://doi.org/10.1016/j.scitotenv.2020.140132

Sun, L., Qin, L., Taghizadeh-Hesary, F., Zhang, J., Mohsin, M., & Chaudhry, I. S. (2020b). Analyzing carbon emission transfer network structure among provinces in China: new evidence from social network analysis. *Environmental Science and Pollution Research*, https://doi.org/10.1007/s11356-020-08911-0

Sun, Hp., Tariq, G., Haris, M., & Mohsin, M. (2019). Evaluating the environmental effects of economic openness: evidence from SAARC countries. *Environmental Science and Pollution Research*, *26*, 24542–24551. https://doi.org/10.1007/s11356-019-05750-6

Taghizadeh-Hesary, F., Rasoulinezhad, E., Yoshino, N., Sarker, T., & Mirza, N. (2021). Determinants of the Russia and Asia–Pacific energy trade. *Energy Strategy Reviews*, *38*, 100681. https://doi.org/10.1016/j.esr.2021.100681

Taghizadeh-Hesary, F., & Yoshino, N. (2019). The way to induce private participation in green finance and investment. *Finance Research Letters*, https://doi.org/10.1016/j.frl.2019.04.016

Taghizadeh-Hesary, F., & Yoshino, N. (2020). Sustainable solutions for green financing and investment in renewable energy projects. *Energies*, *13*(4), 788. https://doi.org/10.3390/en13040788

Tan, K., & Liu, A. (2020). Countermeasures and key technologies of port economic development under anti-dumping policy. *Journal of Coastal Research*, *103*(sp1), 11. https://doi.org/10.2112/SI103-003.1

Tangonyire, D. F., & Akuriba, G. A. (2021). Socioeconomic factors influencing farmers' specific adaptive strategies to climate change in Talensi district of the Upper East Region of Ghana. *Ecofeminism and Climate Change*, *2*(2), 50–68. https://doi.org/10.1108/EFCC-04-2020-0009

Tao, K., Xiao, H., & Ye, J. (2020). Network transaction cost advantage and its effects on shopping intention in coastal economic zone. *Journal of Coastal Research*, https://doi.org/10.2112/SI103-013.1

Tiep, N. C., Wang, M., Mohsin, M., Kamran, H. W., & Yazdi, F. A. (2021). An assessment of power sector reforms and utility performance to strengthen consumer self-confidence towards private investment. *Economic Analysis and Policy*, *69*, 676–689. https://doi.org/10.1016/j.eap.2021.01.005

Tsolas, I. E. (2011). Relative profitability and stock market performance of listed commercial banks on the Athens Exchange: A non-parametric approach. *IMA Journal of Management Mathematics*, *22*(4), 323–342. https://doi.org/10.1093/imaman/dpq017

Tu, Q., Mo, J., Liu, Z., Gong, C., & Fan, Y. (2021). Using green finance to counteract the adverse effects of COVID-19 pandemic on renewable energy investment-The case of offshore wind power in China. *Energy Policy*, *158*, 112542. https://doi.org/10.1016/j.enpol.2021.112542

Umar, M., Ji, X., Mirza, N., & Naqvi, B. (2021a). Carbon neutrality, bank lending, and credit risk: Evidence from the Eurozone. *Journal of Environmental Management*, *296*, 113156. https://doi.org/10.1016/j.jenvman.2021.113156

Umar, M., Ji, X., Mirza, N., & Rahat, B. (2021b). The impact of resource curse on banking efficiency: Evidence from twelve oil producing countries. *Resources Policy*, *72*, 102080. https://doi.org/10.1016/j.resourpol.2021.102080

Umar, M., Su, C. W., Rizvi, S. K. A., & Lobonţ, O. R. (2021c). Driven by fundamentals or exploded by emotions: Detecting bubbles in oil prices. Energy. *Energy*, *231*, 120873. https://doi.org/10.1016/j.energy.2021.120873

Umar, M., Su, C. W., Rizvi, S. K. A., & Shao, X. F. (2021d). Bitcoin: A safe haven asset and a winner amid political and economic uncertainties in the US? *Technological Forecasting and Social Change*, *167*, 120680. https://doi.org/10.1016/j.techfore.2021.120680

Varnalii, Z., Cheberyako, O., Bazhenova, O., Nikytenko, D., & Bilyk, R. (2020). Strategic priorities of budget policy of ukraine in the conditions of the Covid-19 pandemic. *Financial and Credit Activity Problems of Theory and Practice*, https://doi.org/10.18371/fcaptp.v4i35.221964

Victor, V., Karakunnel, J. J., Loganathan, S., & Meyer, D. F. (2021). From a recession to the COVID-19 pandemic: Inflation-unemployment comparison between the UK and India. *Economies*, *9*(2), 73. https://doi.org/10.3390/economies9020073

Wang, C. H., Gopal, R. D., & Zionts, S. (1997). Use of data envelopment analysis in assessing information technology impact on firm performance. *Annals of Operations Research*, *73*, 191–213. https://doi.org/10.1023/A:1018977111455

Wang, Q. W., Zhou, P., Shen, N., & Wang, S. S. (2013). Measuring carbon dioxide emission performance in Chinese provinces: A parametric approach. *Renewable and Sustainable Energy Reviews*, *21*, 324–330. https://doi.org/10.1016/j.rser.2012.12.061

Wei, X., & Han, L. (2021). The impact of COVID-19 pandemic on transmission of monetary policy to financial markets. *International Review of Financial Analysis*, *74*, 101705. https://doi.org/10.1016/j.irfa.2021.101705

Wu, B., Liang, H., & Chan, S. (2022). Political connections, industry entry choice and performance volatility: Evidence from China. *Emerging Markets Finance and Trade*. https://doi.org/10.1080/1540496X.2021.1904878

Wu, F., Zhou, P., & Zhou, D. Q. (2020). Modeling carbon emission performance under a new joint production technology with energy input. *Energy Economics*, *92*, 104963. https://doi.org/10.1016/j.eneco.2020.104963

Xiang, D., Zhang, Y., & Worthington, A. C. (2021). Determinants of the use of fintech finance among chinese small and medium-sized enterprises. *IEEE Transactions on Engineering Management*, https://doi.org/10.1109/TEM.2020.2989136

Xiao, H., Shan, Y., Zhang, N., Zhou, Y., Wang, D., & Duan, Z. (2019). Comparisons of CO2 emission performance between secondary and service industries in Yangtze River Delta cities. *Journal of Environmental Management*, *252*, 109667. https://doi.org/10.1016/j.jenvman.2019.109667

Yan, D., Kong, Y., Ren, X., Shi, Y., & Chiang, S. W. (2019). The determinants of urban sustainability in Chinese resource-based cities: A panel quantile regression approach. *Science of the Total Environment*, *686*, 1210–1219. https://doi.org/10.1016/j.scitotenv.2019.05.386

Yang, Z., Abbas, Q., Hanif, I., Alharthi, M., Taghizadeh-Hesary, F., Aziz, B., & Mohsin, M. (2021). Short- and long-run influence of energy utilization and economic growth on carbon discharge in emerging SREB economies. *Renewable Energy*, https://doi.org/10.1016/j.renene.2020.10.141

Yang, Z., Fan, M., Shao, S., & Yang, L. (2017). Does carbon intensity constraint policy improve industrial green production performance in China? A quasi-DID analysis. *Energy Economics*, *68*, 271–282. https://doi.org/10.1016/j.eneco.2017.10.009

Yao, X., Zhou, H., Zhang, A., & Li, A. (2015). Regional energy efficiency, carbon emission performance and technology gaps in China: A meta-frontier non-radial directional distance function analysis. *Energy Policy*, *84*, 142–154. https://doi.org/10.1016/j.enpol.2015.05.001

Yarovaya, L., Mirza, N., Abaidi, J., & Hasnaoui, A. (2021). Human Capital efficiency and equity funds' performance during the COVID-19 pandemic. *International Review of Economics & Finance*, https://doi.org/10.1016/j.iref.2020.09.017

Yarovaya, L., Mirza, N., Rizvi, S. K. A., & Naqvi, B. (2020). COVID-19 pandemic and stress testing the eurozone credit portfolios. https://doi.org/10.2139/ssrn.3705474

Yu, B., Li, C., Mirza, N., & Umar, M. (2022). Forecasting credit ratings of decarbonized firms: Comparative assessment of machine learning models. *Technological Forecasting and Social Change*, *174*, 121255. https://doi.org/10.1016/j.techfore.2021.121255

Zaytsev, Y. K. (2020). Monetary and fiscal policy measures during the COVID-19 economic crisis in Russia. *Finance: Theory and Practice*, *24*(6), 6–18. https://doi.org/10.26794/2587-5671-2020-24-6-6-18

Zhang, B., Bi, J., Fan, Z., Yuan, Z., & Ge, J. (2008). Eco-efficiency analysis of industrial system in China: A data envelopment analysis approach. *Ecological Economics*, *68*(1–2), 306–316. https://doi.org/10.1016/j.ecolecon.2008.03.009

Zhang, N., & Choi, Y. (2013). Total-factor carbon emission performance of fossil fuel power plants in China: A metafrontier non-radial Malmquist index analysis. *Energy Economics*, *40*, 549–559. https://doi.org/10.1016/j.eneco.2013.08.012

Zhang, D., Mohsin, M., Rasheed, A. K., Chang, Y., & Taghizadeh-Hesary, F. (2021). Public spending and green economic growth in BRI region: Mediating role of green finance. *Energy Policy*, *153*, 112256. https://doi.org/10.1016/j.enpol.2021.112256

Zhang, N., Wang, B., & Chen, Z. (2016a). Carbon emissions reductions and technology gaps in the world's factory, 1990–2012. *Energy Policy*, *91*, 28–37. https://doi.org/10.1016/j.enpol.2015.12.042

Zhang, N., Wang, B., & Liu, Z. (2016b). Carbon emissions dynamics, efficiency gains, and technological innovation in China's industrial sectors. *Energy*, *99*, 10–19. https://doi.org/10.1016/j.energy.2016.01.012

Zhang, T., Yue, H., Zhou, J., & Wang, H. (2018). Technological innovation paths toward green industry in China. *Chinese Journal of Population Resources and Environment*, *16*(2), 97–108. https://doi.org/10.1080/10042857.2018.1475902