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Macroeconomic determinants of the stock market: A comparative study of Anglosphere and BRICS

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ABSTRACT

This study examines and compares the macroeconomic determinants of stock markets in BRICS (Brazil, Russia, India, China, and South Africa) and Anglosphere (Australia, Canada, New Zealand, the United Kingdom, and the United States) countries given their different economic structures. Using quarterly data from 1995Q3 to 2023Q3, we employ a panel Autoregressive Distributed Lag (ARDL) cointegration approach to analyse the long-run relations between real stock prices and the key macroeconomic variables of real GDP, consumer price index (CPI), policy rates, and money supply. Our findings show that in Anglosphere countries, there is a significant positive elastic long-run relation between stock prices and real GDP, and a significant negative elastic relation with CPI. Thus, economic growth enhances stock market performance while inflation adversely affects it in these developed economies. For BRICS countries, we identify a significant positive inelastic long-run relation between stock prices and CPI, indicating that stock markets in these emerging economies act as an inflation hedge. Policy rates and money supply are not significant for either group. These results highlight that different macroeconomic dynamics influence stock markets across developed and emerging economies, implying different risk characteristics. The Anglosphere stock markets are driven by the competing macroeconomic effects arising from GDP and CPI, whereas for the BRICS stock markets, inflationary conditions are of primary importance. The study offers insights for investors and policymakers regarding asset allocation strategies and the formulation of policies tailored to different economic blocs.

1. Introduction

The acronym BRIC was initially introduced by Golman Sachs economist Jim O'Neil in 2001 and refers to the country grouping of Brazil, Russia, India and China. South Africa was added to the group later to form the BRICS. In contrast to the emerging BRICS countries, the Anglosphere countries refer to the English speaking developed economies of Australia, Canada, New Zealand, UK and US. Although, BRICS countries are considered emerging economies with middle per capita income and high economic growth, in aggregate they already contribute one-third-of world GDP and are home to >40 percent of the world population (see Table 1). In addition to the economic differences, the two blocks have different financing and governance characteristics (see Table 2). While Anglosphere countries have a capital market-based system, BRICS countries typically have a more bank and state-influenced system, with some differences. In Russia, a significant number of companies are state owned, while Oligarchs with political ties to the

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government are influential financiers. Brazil, historically, has a bank-based system, although has developed towards a more capital market-based system over the last two decades. China maintains a state-controlled banking system, while India has a more mixed capital-market and bank-based system with strong political ties. In contrast, South Africa has the most capital market-based system of all BRICS countries. Given these differences, i.e., between the capital market-based Anglosphere countries and the more bank or state-influenced BRICS countries, it is of interest to examine how the interaction between key macroeconomic series and the stock market may differ. Such an analysis can have important insights into the behaviour of markets and the theoretical models that underlie our understanding of them.

The relation between macroeconomic variables and the stock market is typically governed by a discount model (see, inter alia, Humpe and MacMillan, 2009). The discounted cash flow (DCF) model, for example, derives the present value of a firm by its discounted expected future cash flows using a risk-adjusted discount rate (see, for example, Gordon, 1959; Campbell and Shiller, 1988). As noted by, for example, Bali et al. (2008) any macroeconomic variable that can proxy for future cash flows or risk (discount rate) can impact stock market dynamics. Macroeconomic variables can be further divided into two main types in this context: real macroeconomic variables, such as gross domestic product (GDP) or the unemployment rate; and financial macroeconomic variables, including interest rates or the money supply.

High economic growth, which be measured by changes in GDP or industrial production, is an indicator of strong corporate earnings growth and thus rising cash flows, creating a positive relation with stock prices and negative with future returns. In contrast, an increase in inflation decreases the real value of future cash flows, raising input costs and eroding profits. As a result, increased inflation uncertainty can increase investors risk perceptions, who therefore demand a higher risk premium, creating a negative relation with stock prices and positive with future returns. This also leads into the opposing views of the inflation hedge argument, where stocks compensate for higher inflation, on one side, and the proxy hypothesis of Fama (1981), where a negative stock return and inflation relation arises from the separate link of both variables to economic activity, on the other. Changes in interest rates directly affect the discount rate in the discount cash flow model where, for example, increasing rates lower the present value of future cash flows. Money supply is also linked to the stock market via, for example, the money illusion effect (Campbell and Vuolteenaho, 2004) where investors erroneously discount with nominal instead of real interest rates.

The results of this paper will be of particular interest to investors and those engaged in portfolio building. Should the stock markets of the BRICS and Anglosphere countries respond the same to the macroeconomic variables, then this lessens the potential for diversification across markets. However, if they respond differently to, for example, inflation, then there is the potential for investors to build diversified portfolios that are robust to bouts of higher inflation. The results will be of equal importance to policymakers and those engaged in market modelling in understanding the interaction between financial markets and the macroeconomy.

2. Literature review

The basic premise is that stock prices depend on discounted cash flows, typically taken as dividends, such that:

$$p_t = \sum_{i=1}^{\infty} \delta^i E_t d_{t+i} \tag{1}$$

where p_t and d_t refer to the stock price and dividends respectively, E_t is the expectations operator and $\delta = (1/1 + r)$ is the discount factor, with r the discount rate. As discussed in, for example, Chen et al. (1986) movements in macroeconomic variables will impact subsequent dividends and discount rates and hence, stock prices. Noting in particular that where we consider stock market indices, then their diversified nature will mean that only economic state or systematic variables will impact (aggregate) stock prices. Further related work equally highlights the role that macroeconmic variables play in conditioning stock markets. This includes work dating back to Fama (1990) and Schwert (1990), as well as the more recent work of Ma et al. (2022) and Hashmi and Chang (2023). Following the observations in Chen et al. (1986), we examine state macroeconomic variables that have been previously considered within the

Table 1
Population and GDP of BRICS and Anglosphere countries.

		Population 2023 (thousands)	GDP 2023 (PPP billion USD)	GDP per Capita	2009–2019 GDP per Capita growth p.a.
Anglosphere	Australia	26,308.57	1719.26	65,349.88	2.58 %
	Canada	38,617.81	2378.97	61,603.00	2.52 %
	New Zealand	5206.89	279.18	53,617.96	4.10 %
	UK	67,623.57	3871.79	57,255.04	3.45 %
	US	339,080.24	26,949.64	79,478.66	3.27 %
	Total	476,837.07	35,198.85	73,817.35	3.18 %
BRICS	Brazil	215,802.22	4101.02	19,003.61	1.48 %
	Russia	144,694.11	5056.48	34,945.99	4.48 %
	India	1422,026.53	13,119.62	9226.00	5.89 %
	China	1425,849.29	32,897.93	23,072.51	7.21 %
	South Africa	60,140.97	997.44	16,585.10	1.54 %
	Total	3268,513.12	56,172.50	17,185.95	4.12 %
	World	8008,552.00	174,789.87	21,825.40	3.72 %

Source: United Nations & IMF.

Table 2
Economic Freedom of BRICS and Anglosphere countries.

		Economic Freedom Index (Total)	Property Rights	Investment Freedom	Financial Freedom
Anglosphere	Australia	74.8	90.7	80	90
	Canada	73.7	88.5	80	80
	New Zealand	78.9	87.8	70	80
	UK	69.9	95.1	80	80
	US	70.6	94.7	85	80
	Average	73.6	91.4	79	82
BRICS	Brazil	53.5	49.7	60	50
	Russia	53.8	30.6	30	30
	India	52.9	49.7	40	40
	China	48.3	45.3	20	20
	South Africa	55.7	42.5	45	50
	Average	52.8	43.6	39	38

Source: Heritage Foundation (https://www.heritage.org).

literature. This includes inflation (Gjerde and Sættem 1999; Duong et al. 2021; Mohnot et al. 2023), gross domestic product (Funke and Matsuda, 2006; Fifield et al., 2002; Heinlein and Lepori, 2022), interest rates (Pericoli, 2020; Bhuiyan and Chowdhury, 2020), and money supply (Kwon and Shin, 1999; Mohnot et al. 2023). Some studies further incorporate exchange rates (Ditimi and Ifeoluwa, 2018; Hadi et al., 2019), or oil prices (Hassan and Al Refai, 2012; Gjerde and Sættem,1999) in their analysis.

The most studied countries include developed markets like the US (Abbas and Wang, 2020), UK (Forero-Laverde, 2019), Germany (Funke and Matsuda, 2006) and Japan (Humpe and MacMillan, 2009), as well as emerging markets like India (Ghosh et al., 2021), Brazil (Agudelo and Gutiérrez, 2011), Indonesia (Wongbangpo and Sharma, 2022) and Turkey (Heidari and Dadashzadeh-Rishekani, 2022). Although less prominent in the literature, some studies analyse country blocks like ASEAN-5 (Wongbangpo and Sharma, 2022), G7 (Feng et al., 2017) or BRICS (Lone et al., 2023) countries. However, the relation between macroeconomic variables and the stock market in the Anglosphere block has not been studied yet. Hence, a comparison of the capital market-based Anglosphere and more bank or state-influenced BRICS countries remains missing.

3. Methods

3.1. Data collection

For the analysis, we collect quarterly macroeconomic and stock market data for the BRICS (Brazil, Russia, India, China, and South Africa) and Anglosphere (Australia, Canada, New Zealand, UK, and US) countries for the period 1995Q3 to 2023Q3. This time period is sufficient to account for both short-term dynamics and long-term relations as it covers significant global economic events, enhancing the robustness and relevance of our analysis. Share index data and CPI are obtained from OECD, with policy rates and GDP[1] provided by the IMF. Money supply data is obtained from the central banks of the individual countries. Nominal stock prices, GDP, policy rates and money supply are transformed to real data by adjusting for inflation.

3.2. Empirical methodology

To analyse the relation between macroeconomic variables and stock prices in Anglosphere and BRICS countries, we follow a ARDL cointegration approach (Pesaran et al., 1999). With country groups, $i = 1, 2, \ldots, N$, and time periods, $t = 1, 2, \ldots, T$, we estimate an ARDL model in the following form:

$$y_{i,t} = \sum_{j=1}^{p} \lambda_{i,j} y_{i,\ t-j} + \sum_{j=0}^{q} \delta'_{i,j} x_{i,t-j} + \mu_i + \ \varepsilon_{i,t} \tag{2}$$

where the dependent variables are represented by y with scalars λ for their lags. Regressors are represented by the vector of explanatory variables x where δ is a vector of unknown parameters and μ incorporates fixed effects (for a discussion see Pesaran et al., 1999).

For our study we analyse the relation between stock markets (*sm*) and GDP (*gdp*), inflation (*cpi*), interest rates (*ir*), and money supply (ms) for BRICS and Anglosphere countries:

$$sm_{i,t} = \beta_0 + \beta_1 gdp_{i,t} + \beta_2 cpi_{i,t} + \beta_3 ir_{i,t} + \beta_4 ms_{i,t} + \varepsilon_{i,t} \tag{3}$$

Thus, $y_{i,t}$in Eq. (2) is represented by $sm_{i,t}$ from Eq. (3), whereas the explanatory variables $x_{i,t}$ are given by $gdp_{i,t}$, $cpi_{i,t}$, $ir_{i,t}$ and $ms_{i,t}$. Before estimating the ARDL cointegration relation, the integration of the variables must be determined. For our analysis we make use of three different panel unit root tests (ADF – Fisher Chi-square, PP – Fisher Chi-square and Im, Pesaran and Shin W-statistic).

[1] For GDP quarterly data is the highest frequency available, but the reporting period might only be yearly.

4. Results

The panel unit root tests in Tables 3–6 reveal that all variables are I (1) with the exception of the BRICS policy rate that may be I(0). Tables 7 and 8 show the results of the Pedroni (1999) cointegration test, where all seven different tests indicate a cointegration relation. For the ARDL model, as an alternative to the PMG (pooled mean group) estimator, Pesaran and Smith (1995) suggest the mean group (MG) estimator. This is because the PMG estimator is only consistent and efficient when the long-run coefficients are identical across the different countries (long-run homogeneity). According to the Hausman test, the PMG is more efficient if the long-run homogeneity hypothesis is supported. Even at the 10 % level, the test findings ($\chi 2$ (2) = 0.56, p-value = 0.76 for Anglosphere and $\chi 2$ (1) = 0.69, p-value = 0.40 for BRICS) show that the long-run homogeneity null hypothesis cannot be rejected. Thus, we conclude that the MG estimator is inferior to the PMG.

The results of the panel PMG ARDL model are summarised in Tables 9 and 10. For the Anglosphere countries the cointegration results indicate a statistically significant positive elastic (elasticity of 1.2) long-run relation between stock prices and GDP as well as a negative elastic (elasticity of −1.6) relation with CPI (Table 9). The short-run error correction is approximately 9 % per quarter and only CPI shows a significant positive short-run effect on stock returns. In contrast, for BRICS countries there exists only a positive inelastic (elasticity of 0.5) long-term relation between stock prices and CPI with a similar short-run error correction of close to 9 % per quarter. Money supply and policy rates are not significant in either BRICS or Anglosphere countries.

5. Discussion

The cointegration analysis for Anglosphere countries shows a positive elastic reaction between stock prices and economic growth measured by real GDP. This is in line with expectations, as economic growth should help companies increase profits and thus, enhance firm value. Further, a negative relation between real stock prices and inflation is found, which aligns with the idea that higher inflation leads to increased uncertainty and higher expected discount rates and lower stock prices. However, policy rates and money supply are not significant in the cointegration analysis. A possible reason for this is that the effects of policy rates and money supply are absorbed by GDP and CPI. The Taylor Rule (Taylor, 1993) advises central banks to adjust policy rates based on deviations of inflation from target levels, indicating that inflation and policy rates might be highly correlated. Additionally, the Quantity Theory of Money (Friedman, 1968) links GDP with inflation and money supply, suggesting that the long-run effect of money supply might be captured by GDP and CPI in the cointegration.

In the short-run component, we see that while there is a negative coefficient for the change in GDP, indicating that an increase in growth leads to lower future stock returns, it is not statistically significant. With regard to the change in CPI, an increase leads to higher future stock returns. These results are consistent with a risk interpretation. Here, for example, lower GDP growth and higher inflation are consistent with increased economic risk and therefore higher future returns in compensation.

Overall, GDP and CPI might be considered endogenous to the macroeconomy, reflecting the aggregate economic activity of firms, governments, and households. In contrast, policy rates and money supply are components of monetary policy set by central banks and might therefore be classified as exogenous to the macroeconomy. In this regard, Anglosphere stock markets appear to build a long-term equilibrium with endogenous rather than exogenous macroeconomic variables. However, the exogenous variables might influence the endogenous variables and thus still indirectly impact stock markets.

The results for BRICS countries lead to a different conclusion. Here, we only find a positive long-term relation with CPI, indicating that stock markets primarily act as an inflation hedge. Stocks are real assets that might protect against high inflation. Some BRICS countries have a history of economic crises with high inflation and monetary turmoil, which might explain why long-term stock market

Table 3
Anglosphere Panel Unit Root Tests in Level.

Variable	Individual effects and trends	Individual effects	None
ADF – Fisher Chi-square			
Stock prices	36.0910***	35.8923***	3.41056
GDP	10.0885	8.24817	0.01935
CPI	10.5629	0.06438	0.06147
Policy rate	31.2317***	6.16011	29.1715***
Money supply	24.8755***	6.72217	0.25916
PP – Fisher Chi-square			
Stock prices	21.2775**	25.6816***	3.16563
GDP	52.1691***	15.0159	0.0057
CPI	1.39481	0.03881	0.00001
Policy rate	22.6899**	8.86326	26.4955***
Money supply	7.79422	7.66179	0.00398
Im, Pesaran and Shin W-statistic			
Stock prices	−4.16994***	−3.89559***	–
GDP	−0.59889	−0.0101	–
CPI	−0.48788	6.05679	–
Policy rate	−3.62414***	0.18399	–
Money supply	−0.72916	0.564	–

Notes: Entries are the panel unit root tests of Eq. (3), statistical significance is denoted at 10 % *, 5 % ** and 1 % ***.

Table 4
Anglosphere Panel Unit Root Tests in 1st difference.

Variable	Individual effects and trends	Individual effects	None
ADF – Fisher Chi-square			
Stock prices	70.2349***	89.9648***	124.705***
GDP	63.7312***	76.8596***	54.5471***
CPI	24.3639***	32.8436***	17.6841*
Policy rate	105.679***	129.062***	177.160***
Money supply	23.6378***	33.5011***	33.7892***
PP – Fisher Chi-square			
Stock prices	192.718***	217.650***	419.149***
GDP	302.854***	367.174***	1316.95***
CPI	220.923***	240.204***	173.155***
Policy rate	248.272***	272.256***	643.677***
Money supply	201.854***	220.081***	284.561***
Im, Pesaran and Shin W-statistic			
Stock prices	−7.45728***	−8.32043***	–
GDP	−6.87753***	−7.42432***	–
CPI	−3.00221***	−3.82127***	–
Policy rate	−10.1076***	−10.8459***	–
Money supply	−2.84203***	−3.80475***	–

Notes: Entries are the panel unit root tests of Eq. (3), statistical significance is denoted at 10 % *, 5 % ** and 1 % ***.

Table 5
BRICS Panel Unit Root Tests in Level.

Variable	Individual effects and trends	Individual effects	None
ADF – Fisher Chi-square			
Stock prices	16.3999*	15.3741	1.49836
GDP	7.01786	5.82214	0.1695
CPI	18.8667**	13.3496	0.05007
Policy rate	39.5152***	38.6236***	48.9019***
Money supply	4.72066	13.8837	0.14753
PP – Fisher Chi-square			
Stock prices	16.3303*	15.3697	1.214
GDP	84.3486***	25.2052***	0.05205
CPI	9.62225	23.1284**	0.00014
Policy rate	27.0288***	24.0771***	24.8211***
Money supply	1.62466	37.4507***	0.00103
Im, Pesaran and Shin W-statistic			
Stock prices	−1.73131**	−1.17155	–
GDP	2.31895	0.59012	–
CPI	−1.88873**	1.26741	–
Policy rate	−4.09540***	−3.76299***	–
Money supply	1.73039	−0.77072	–

Notes: Entries are the panel unit root tests of Eq. (3), statistical significance is denoted at 10 % *, 5 % ** and 1 % ***.

prices are driven by inflation.

The findings presented here provide support for the earlier work, such as Chen et al. (1986) and Schwert (1990) on the relation between macroeconomic factors and stock markets. Of notable interest, these findings suggest that the macroeconomic determinants of stock markets differ significantly between developed and emerging economies. The evidence of GDP and CPI in Anglosphere countries aligns with their stable economic environments and mature financial systems. In contrast, the prominence of inflation in BRICS countries reflects their historical economic volatility and the role of stocks as a hedge against inflation. Moreover, the lack of significance of policy rates and money supply in both blocs could indicate that these variables have indirect effects mediated through GDP and CPI.

In regard of the implications of the results, they suggest that investors will be able to use the information presented here to adjust their portfolio holdings between developed and emerging markets depending on the inflationary environment creating diversification opportunities. With the Anglosphere markets, higher inflation leads to lower stock prices, while the opposite is the cases for the BRICS markets, presenting diversification opportunities. Additionally, the results provide potentially useful information to investors in using macroeconomic variables to guide stock market factor investment decisions, see, for example, Amenc et al. (2019). Notably, inflation indicating different market directions.

6. Conclusion

Our analysis demonstrates that in Anglosphere countries, stock prices are significantly influenced by real GDP (positive relation)

Table 6
BRICS Panel Unit Root Tests in 1st difference.

Variable	Individual effects and trends	Individual effects	None
ADF – Fisher Chi-square			
Stock prices	97.2377***	118.265***	158.831***
GDP	49.6302***	57.8249***	52.2637***
CPI	54.7740***	64.0130***	36.8758***
Policy rate	96.7735***	118.551***	170.726***
Money supply	59.7385***	60.9699***	50.0858***
PP – Fisher Chi-square			
Stock prices	265.609***	289.716***	884.984***
GDP	227.446***	281.237***	1316.95***
CPI	163.652***	185.401***	183.668***
Policy rate	179.821***	203.195***	543.787***
Money supply	284.522***	293.006***	676.015***
Im, Pesaran and Shin W-statistic			
Stock prices	−9.51902***	−10.1909***	–
GDP	−5.58679***	−5.91281***	–
CPI	−6.07362***	−6.45194***	–
Policy rate	−9.44434***	−10.1846***	–
Money supply	−6.50710***	−5.96260***	–

Notes: Entries are the panel unit root tests of Eq. (3), statistical significance is denoted at 10 % *, 5 % ** and 1 % ***.

Table 7
Anglosphere Pedroni cointegration test.

Pedroni cointegration test results				
	statistic	p-value	weighted statistic	p-value
Panel v-Statistic	3.5395	0.0002	3.0006	0.0013
Panel rho-Statistic	−2.8159	0.0024	−2.6064	0.0046
Panel pp-Statistic	−2.5411	0.0055	−2.3295	0.0099
Panel ADF-Statistic	−3.2220	0.0006	−2.9092	0.0018
Group rho-Statistic	−1.9794	0.0239		
Group pp-Statistic	−2.3838	0.0086		
Group ADF Statistic	−3.3485	0.0004		

Table 8
BRICS Pedroni cointegration test.

Pedroni cointegration test results				
	statistic	p-value	weighted statistic	p-value
Panel v-Statistic	4.4881	0.0000	4.3387	0.0000
Panel rho-Statistic	−4.0476	0.0000	−3.7342	0.0001
Panel pp-Statistic	−2.8337	0.0023	−2.6247	0.0043
Panel ADF-Statistic	−3.1019	0.0010	−2.7530	0.0030
Group rho-Statistic	−2.3062	0.0106		
Group pp-Statistic	−2.2495	0.0122		
Group ADF Statistic	−2.6928	0.0035		

Table 9
Anglosphere Panel ARDL estimates.

Anglosphere panel ARDL (1995Q3 – 2023Q3): Dependent variable: stock prices				
Variable	Coefficient Long Run Equation	Standard Error	t-Statistic	Probability
GDP	1.1953	0.4770	2.5059	0.0125
CPI	−1.5774	0.5502	−2.8669	0.0043
Error-Correction (−1)	−0.0943	0.0085	−11.0577	0.0000
D(GDP)	−0.0197	0.1008	−0.1954	0.8452
D(CPI)	1.9374	0.8818	2.1972	0.0284
C	0.6201	0.0585	10.5953	0.0000

Notes: Selected Model: ARDL(1,1,1), SIC automatic model selection.

Table 10
BRICS Panel ARDL estimates.

BRICS panel ARDL (1995Q3 – 2023Q3): Dependent variable: stock prices				
Variable	Coefficient Long Run Equation	Standard Error	t-Statistic	Probability
CPI	0.4912	0.1407	3.4916	0.0005
Error-Correction (−1)	−0.0876	0.0211	−4.1568	0.0000
D(CPI)	−1.4184	0.9644	−1.4708	0.1419
C	0.2651	0.0460	5.7588	0.0000

Notes: Selected Model: ARDL(1,1), SIC automatic model selection.

and CPI (negative relation), while in BRICS countries, CPI is the only significant determinant (positive relation). This underscores the differing macroeconomic dynamics between developed and emerging economies. For Anglosphere countries, the positive relation with GDP indicates that economic growth enhances stock market performance, while the negative relation with CPI suggests that inflation adversely affects stock markets due to higher uncertainty and discount rates. In BRICS countries, the positive relation with CPI suggests that stock markets act as an inflation hedge, possibly due to historical economic instability. Policy rates and money supply are not significant determinants for either group, which may be due to their effects being captured by GDP and CPI. Our findings have important implications for investors, policymakers, and academics (and those engaged in modelling market relations). Of note, investors should consider the differing macroeconomic influences when making investment decisions in developed versus emerging markets. The results presented here suggest the potential for diversification opportunities and switching between markets according to the inflationary environment. Further, the differing impact of inflation also presents differing investment signals when considering a macroeconomic factor investment approach. Policymakers should be aware of how macroeconomic variables, and therefore policy, can affect stock market behaviour, while this is also of interest to those modelling stock market and macroeconomy interactions.

CRediT authorship contribution statement

Andreas Humpe: Writing – review & editing, Writing – original draft, Project administration, Methodology, Formal analysis, Data curation, Conceptualization. **David G. McMillan:** Writing – review & editing, Methodology, Formal analysis, Conceptualization. **Alfred Schöttl:** Writing – review & editing, Validation, Supervision, Methodology, Conceptualization.

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 study.

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Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of an earlier version of this work the authors used ChatGPT to check grammar, readability, and spelling. After using this tool, the authors reviewed and edited the content as needed. This version has not used ChatGPT or any similar tool. The authors take full responsibility for the content of the published article.

Data availability

The authors do not have permission to share data.

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