Influence of Regulatory Quality and Global Power on Convergence of Stock Markets in G20 Economies

Miss Sama Haddad, A/Prof Rakesh Gupta and Prof Selva Selvanathan

Griffith University and Charles Darwin University

Abstract

International and domestic institutions have changed and challenged the growth of the economy and regulatory framework around the world. Groups such as the G20 markets, G7, and BRICS have influenced regulations and political discussions across the world. Other important organisations, such as the World Bank and the United Nations, have influenced cultural, political, and social behaviours. As we move forward to a globalised economy, these groups have sparked growth and power in developed economies. This study aims to investigate the relationship between regulatory quality (RQ), as measured by the regulatory quality index (RQI); global power (GP), as measured by the global power index (GPI), which measures a nation's power in comparison to other nations; and globalisation, as measured by the co-movements of stock markets time varying correlations. Previous studies have investigated various factors that influence stock market correlations; however, the relationship between RQ, GP, and stock market correlations has not been investigated thus far. To investigate this relationship, we created an index of correlations of each stock market with other stock markets, in G20 countries. Our empirical results indicate that RQ and GP have a positive and statistically significant relationship with stock market correlations in G20 nations. This study is the first to establish a relationship between RQ, GP, and changes in relative stock market performance. In the past, changes in relative stock market returns were mainly attributed to the economic factors and volatility of the underlying stock markets. This

study makes an important contribution to the body of knowledge by developing a theoretical argument to show how a change in RQ and or GP influences changes in stock market correlations via changes in relative risk premia and returns. The findings of the study have several implications for the development of regulations and laws because RQ influences stock market co-movements, and will also have implications for investors who aim to construct globally diversified portfolios.

Key words: regulatory quality, global power, stock markets, time varying correlations, asymmetric ADCC GARCH models, G20.

1. Introduction

The adoption of the International Financial Reporting Standards act to converge the regulatory framework over time and may act to improve the regulatory quality (RQ); however, current discussions in RQ in institutional settings and other organisations have caused regulations to deviate from common themes. For example, the 1997 Asian Financial Crisis forced Asian nations to implement regulatory and institutional reforms that would increase investor confidence and foreign direct investment (FDI; Rammal & Zurbruegg, 2006); however, RQ cannot be looked at in isolation given other global factors can influence the changes in regulations, such as global power (GP), which looks at the global interactions between different economies where powerful countries influence weaker nations. GP influences RQ through country regulatory frameworks, policymaking, diplomacy, and trade negotiations. This motivates our study, which is to investigate the role of RQ and GP on the changes in convergence of markets through stock market correlations.

Previous studies have empirically investigated the impact of RQ on stock market returns (see, for example, Lee et al., 2020) and the relative volatility changes in stock market returns (Bhargava & Konku, 2023). Pollet and Wilson (2010) investigated the changes in stock market correlations using economic variables, and Li et al. (2005) looked at the relationships between stock returns and volatility in international stock markets. RQ and GP have the potential to significantly influence the economy, regulatory framework, international trade, and investments across markets, but they have not been sufficiently investigated in the context of convergence of stock market returns. We aim to fill this research gap in the literature by looking at the relationship between RQ, GP, and stock market correlations. To the best of our knowledge, this is the first study to look at the relationship between RQ, GP, and the change in relative stock market performance. To investigate the relationship, we pose

the following question: Does regulatory quality and global power positively influence stock market correlations over time? We use a sample of G20 markets to investigate this relationship. We use an appropriate panel dataset to investigate the relationship between RQ, GP, and stock market correlations. To facilitate analysis for individual market we construct correlation index for each market with other markets using pairwise correlations for market pairs.

To the best of our knowledge, this is the first study to develop a theoretical framework to analyse the relationship between relative RQ, GP, and changes in stock market correlations through changes in intermediary variables. Changes in regulations and policies across nations are influenced by domestic and international factors. Whereas the stock market returns reflect overall returns of the firms listed in the market. Returns of overall market in an economy are influenced by the changes in investor confidence in the future of the economy. Changes in factors that influence returns can be influenced by domestic factors and or global factors. This in turn determine relative attractiveness of investments within an economy and across economies. Our study makes important contributions towards the understanding of convergence in stock markets, in particular the impact of RQ, and GP, on stock market co-movements. Prior research has investigated the changes in correlations from the perspective of changes in relative overall market risk. In contrast, our study looks at the cause of changes in correlation from a RQ and GP perspective. We provide a theoretical linkage between the independent variable and dependent variable through intermediary variables. Our study finds a positive and statistically significant relationship between RQ, GP, and stock market correlations. Findings contribute to the understanding of underlying factors that cause convergence of markets. Understanding this relationship has implications for policymakers, regulators, bilateral and multilateral trade, and investment negotiations. Findings also have implications for investors and fund managers who seek to diversify their portfolios

internationally because RQ and GP have implications for changes in correlations. Diversification benefits accrue from lower correlations among assets included in portfolio.

The remainder of the paper is organised as follows: Section 2 presents the literature review, followed by a conceptual framework, and variable discussion in Section 3; Section 4 provides the model description; Section 5 provides the estimation techniques; Section 6 presents the estimation results; and Section 7 provides concluding comments.

2. Literature Review

Firms play a crucial role in facilitating capital flows within an economy. Capital rises as companies consult with investors to provide additional capital to the business in the form of either debt or equity. Investors invest in assets with a view of risk–return trade-off and will risk assets if it rewards them with a higher return, creating a strong relationship between firms and investors; however, to ensure the stock market is reliable, RQ is important in enforcing policies that provide appropriate safeguards and transparency (Clapham et al., 2023). Globalisation has caused major shifts in the economy with greater influence from global factors and developed economies exerting more influence on developing economies, creating a power imbalance. Despite ongoing changes in convergence of markets and changes in RQ and GP over time, researchers have not investigated the relationship between GP and RQ on the changes in stock market correlations.

Policy uncertainties and RQ can significantly influence investment decisions. Al-Thaqeb and Algharabali (2019) discussed policy uncertainties as the economic risk associated with unknown future government policies and regulatory frameworks. The uncertainty leads to a further increase in the risk of revisiting businesses and individuals delaying their spending and investments due to market uncertainty. The changes in the business

environment, investment opportunities, trade and policy are important to consider for future investment. Sound RQ provides a better assessment of the risk–return of assets in businesses.

Global Power has the potential to influence regulations of the weaker nations and investments through trade negotiations and other direct or indirect influences on international trade and investments. Regulatory changes in an economy are aimed at modifying regulations and making targeted changes in the regulations for the effective functioning of the markets (Polemis & Stengos, 2020). Thus, within its role, it ensures investors receive quality information, reducing information asymmetry between investors and firms (Cascino et al., 2019)[1]. Over time global markets have seen a stronger response to financial crises, accounting and corporate governance scandals, and financial innovations (Cascino et al., 2019). The RQ and GP can also affect the efficiency of real investment decisions and traders' welfare.

Previous research has explored regulatory frameworks through the lens of regulatory focus theory (Higgins, 1998). This theory posits that self-regulation operates differently based on individual needs for alignment with personal standards and goals; however, this framework focuses primarily on individual motivation and prevention, such as safety. While studies have examined the role of economic variables in influencing regulatory frameworks (Cesario et al., 2013), they often overlook the impact of the resulting RQ on stock market behaviour.

Research has examined the impact of economic variables on stock market correlations (Dimic et al., 2016). Studies have also examined the impact of relative volatility on stock market correlations (for example, Prasad et al., 2018 and Gupta and Mollik, 2008); however, a gap exists in our understanding of how RQ and GP may impact stock market convergence.

[1] This study adopts the definition of RQ as the ability of the government to make and implement policies and regulations that allow and promote economic development.

Despite our understanding of significant influence on economic, trade, and political policies, and domestic and international markets (Rammal & Zurbruegg, 2006).

The subsequent section provides an overview of the broader literature in the area of RQ and GP. Our study addresses market integration, specifically the impact of RQ and GP on the market co-movements (time varying) occurring among financial markets. Therefore, the following section reviews literature concerned with the factors that may influence financial markets' convergence over time.

Where, Section 2.1 reviews market integration literature. Since we use time varying correlations as our measure of market integration of stock markets, we follow with literature on time varying correlations presented in Section 2.2. Section 2.3 reviews the literature on RQ, and Section 2.4 reviews the literature on GP. Section 2.5 looks at the relationship between RQ and GP. Section 2.6 discusses common global factors that act as control variables for the study. Finally, Section 2.7 discusses other factors such as cultural and political factors that may have influence on correlations but are not included in our study due to data unavailability.

2.1 Market Integration

Integration refers to how individual economies (or markets) move with other markets. This section provides a review of the literature in the broader area of economic and stock market integration followed by time varying correlations that this study uses as a measure of integration. This is followed by the literature on RQ and GP, as our two main variables of interest for our study.

Economic Integration

Several factors in the integration of the economy can influence RQ, including trade, policies (monetary and fiscal), and availability of resources. The integration of economies can be influenced by the relationship between different factors, such as trade, RQ, GP, economic policies and culture. Economic integration can be looked at in various forms; free trade area, customs union, and an economic union. In a free-trade area, tariffs between the participating countries are abolished; however, each country retains its tariff against non-member countries. The common market is a highly recognised form of economic integration, where restrictions on trade and factor movements are removed (see for example, Balassa, 1994). A monetary union, as distinct from a common market, even abolish separate currencies and differences in monetary policies. In a monetary union, monetary policies are determined in the union rather than separately by different countries.

Economic integration requires a combination of monetary, fiscal, social, and country-level policies, and is strengthened through bilateral and multilateral trade agreements (Nicita, 2013); however, corporate investment inefficiency and abnormal investment behaviour can affect monetary policy effectiveness (see, for example, Wan & Lee, 2023). Researchers use fiscal policy variable in empirical models to test how the government's macroeconomic tax policies influence economic conditions by testing for spillovers (Bashir et al., 2024).

Stock Market Integration

Market integration as a process provides an understanding of the factors that can influence integration. Market integration allows investments across nations thus benefits businesses and overall economic development. These market movements provide social benefits (Lehkonrn, 2015). Market integration changes over time due to various international and domestic factors, including COVID-19, the 2008 Global Financial Crisis (GFC), FDI, International Agreements, and other policies. Click and Plummer (2005) used cointegration

techniques to test the stock market integration in Southeast Asia. Authors find capital markets in the ASEAN are integrated in their test of "long-run" equilibrium among stock markets[2]. Vieito et al. (2023) investigated herding behaviour in the Latin American Integrated Markets (MILA) using ARCH and GARCH type models. They found strong herding behaviour under general market conditions, and moderate and partial herding behaviour under specified market circumstances, such as bull and bear markets. MILA countries have strengthened their regulatory system to ensure a more transparent information environment with better quality information (Vieito et al., 2023).

Siddiqui (2009) find that economies of India and China have segregated during the previous 25 years of growth, despite the evidence that global market have largely integrated. The globalisation of the economies can also affect the growth of the markets. Cross-border investments and changes in financial and economic development in different countries have taken a different path over time.

2.2 Time Varying Correlations

From an investment perspective understanding of long-run cointegration can provide information for a longer-term investment horizon for strategic asset allocation and longer-term fixed investment guide; however, portfolio management also aims to exploit short term inefficiencies in markets and engage in tactical asset allocation by reallocating investments. Changes in correlations among markets can be estimated using high frequency data and investors can estimate correlations using daily data for international markets. Estimates of time varying correlations have been estimated among assets using asymmetric dynamic conditional correlations generalised autoregressive conditional heteroskedasticity (ADCC GARCH) type models. GARCH type models were proposed by Engle (2002) and then an

[2] Lucey et al. (2017) look at the time-varying relationship between Gold and Inflation.

asymmetric variation of the same model was proposed by Cappiello et al. (2006). The ADCC GARCH model of Cappiello can be used for estimating time varying correlations between assets simply and has been instrumental in overcoming of the shortcoming of Pearson correlations that implicitly assumed that the correlations for the sample period remained constant and a single value estimated using Pearson' correlations represented the relationship among variables over the sample period[3].

With the emergence of GARCH type models for estimating time varying correlations researchers have used different GARCH estimation in estimating correlations over time; for example, Kalotychou et al. (2014) used DCC GARCH model for estimation of correlation for sector portfolios. Similarly, Gupta and Donleavy (2009) used ADCC GARCH to estimate correlations for assets in construction of internationally diversified portfolios. Objective of our study is to look at the factors that drive these changes in correlations. Time varying correlations are influenced by several factors, e.g., risk premiums and return, trade, macroeconomic, labour movements, policy frameworks and globalisation. Gupta and Mollik (2008) and Loretan and English (2000) discussed these factors through the underlying theories of market integration and changes in correlations. These studies document that market integration is influenced by these factors as economies change over time. Loretan and English (2000) also showed that correlations can be affected by other factors without affecting the variances of the underlying series.

2.3 Regulatory Quality

Regulatory Quality is defined as the government's ability to make and implement policies and regulations that enable and promote economic development. RQ influences

[3] Over time researchers have used moving window of time to overcome the shortcoming posed by Pearson's correlations. Moving window of time correlations used simple technique by moving time window; for example drop previous month (or week) and add month thus creating a time series of correlations (Tilfani & El Boukfaoui, 2019)

various factors, including trade and investments. The influence of trade and market integration can affect the regulation's outcome. Production factors have become more freely available with the increased level of integration in global markets. As a result, regulations can become a competitive advantage or disadvantage. They can either attract firms or become one of the reasons that they move to another country with more favourable regulations. The economy's growth depends on the effects of regulation that in turn could affect the country's stage of market integration (see, for example, Sillberberger, 2016). Ofoeda et al. (2024) found that a stronger institutional quality and regulatory framework is required to achieve an efficient financial system.

It is known that strict regulations are costly and less strict regulations are cheaper but less trustworthy. The policymakers need to maintain a balance regarding cost and regulatory benefits. Firms in developing and developed economies have different regulatory requirements. Developed economies have significantly more capital and resources, which helps to develop their portfolio and risk tolerance and allows for quick decision-making (see, for example, Hemrajani et al., 2023). Developed economies generally have stricter regimes, and firms are required to have regulated entities to demonstrate compliance with the regulations. Developing economies may need to consider adopting regulatory tools and frameworks, which will depend on many factors, including bureaucratic expertise, resource availability, political constraints, and economic impacts (see, for example, Taylor et al., 2012).

In the study of banking regulation, Teixeria et al. (2020) found a positive and statistically significant relationship between investor protection and banking risk. Regarding the determinants of a bank's efficiency, Kalyvas and Mamatzakis (2014) showed that the effect of some banking regulatory measures on banks' efficiency depends on the institutional quality. Evidence from literature in this section suggests that regulatory quality across

economies that are at a different levels of economic growth and maturity may affect firm performance differently and as such influence market performance differently.

2.4 Global Power

Global Power influences factors that involve global dynamic shifts that may lead to market integration. Global economic integration influences international trade, the development of negotiations with global actors, and assists strong legal and institutional frameworks. International trade is influenced by global powers such as the World Trade Organisation (WTO), World Bank and the International Monetary Fund (IMF). GP changes over time and creates a systematic diversity between rising and establishing powers.

Trade and industrial policies interact with overall economy. Dur (2008) looked at the European Union (EU) trade policymaking, which often suggests that delegating trade authority from the national to the European level has strengthened the autonomy of public actors in formulating trade policies. GP's influence on investment is also derived from its potential impact on diversification (Pukthuanthing & Roll, 2009). The less correlated the market is, the more benefits there are in diversifying investments across markets and vice versa.

2.5 Regulatory Quality and Global Power

Political power addresses the needs of international institutions and policymakers that ultimately affect market integration by balancing the power between politics and markets. The theoretical understanding of the political factors looks at the formation of the WTO, the International Monetary Fund (IMF) and the World Bank. The WTO's establishment was intended to formalise, deepen, and widen an international system of trade regulation and bring greater coherence in global economic policy, drawing on the work of the IMF and the

World Bank. This will also help to develop other organisations and unions, including the World Intellectual Property Organisation (WIPO), the International Telecommunications Union (ITU), and the International Organisation for Standardisation (ISO; Wilkinson, 2002).

Economic growth influences policy performance, making the administration's actions central to managing macroeconomic conditions (Agenor et al., 2012). Economic growth has an impact on consumer and investor confidence in the future of the economy; the increased global interdependency enables an enhancement of consumer confidence in the future economy (De Boef et al., 2004). Brumat and Freier (2023) examined the European influence on immigration and refugee policy liberalisation in South America and found that South American policymakers adopted liberal migration legislation in political and moral opposition to the restrictive shifts they perceived in EU migration governance, which contributed to the unintended consequences. Some migration policies often fail to achieve their declared objectives or have unintended consequences.

2.6 Common Global Factors

Stock market correlations are influenced by local and global factors, including global economic conditions, geopolitical strengths and events, trade policies and tariffs, global market sentiments, and global monetary policies. These factors may influence the returns of stocks differently in each market, and collectively market returns for each country may be affected by these factors differently.

Environmental awareness: The shift in regulations and global dynamics have brought our attention to the evolving nature of environmental sustainability and its impact on the economy, society, and environment. Several global issues have revealed the importance of environmental awareness including, climate change matter, limited resources, pollution, regulations. Corporate strategies where companies will need to set goals considering the shift

to a greener economy, shifts in investor behaviour, and, ultimately, influence stock market dynamics. Investors make their decisions in the contemporary investment landscape are becoming more interested in the company's environmental performance alongside traditional financial metrics. Environmental awareness has sparked transformation in the green economy, clean energy, preserving natural resources, sustainable transport, and resource-efficient technologies. Companies leading these transformations may experience increased investor interest and higher stock prices, as they capitalise on the growing demand for sustainable solutions. Different levels of environmental awareness are evident across nations which affect investment returns differently across nations. Shahbaz et al. (2013) found economic growth and energy consumption increase CO_2 emissions and financial development and trade openness improve quality of the environment. Paramati et al. (2017) found a link in stock market returns, investments, and CO_2 emissions globally.

Education level: the relationship between stock market returns and the average education level of the population is diverse. Education can increase financial literacy and investment awareness, though stock returns can also be influenced by the impact of education in many ways. Factors including, financial literacy, risk perception, access to information, and behavioural biases. Mushafiq et al. (2023) found risk aversion, risky investment intentions, financial literacy, and cognitive abilities guide investment choices. Ultimately, a link exists between increased levels of financial literacy results in better investment decisions. Zhang et al. (2023) found that financial education can help improve investors' stock investment performance, by building good investment habits and increasing risk tolerance to promote better investment opportunities. Kaustia et al. (2023) found individuals from educated backgrounds have a stronger effect on participating in investments and financial markets. Similarly, Chen et al. (2023) conducted a country-wise study in Taiwan to determine if

financial literacy is a determinant of market participation. In summary, education plays a major role in financial markets through the influence of investor decisions making and stock market returns. While higher level educated individuals are able to make better investment decisions and ultimately influence the dynamics of the stock market returns.

Overall economic growth: The stage of economic growth within individuals and countries can affect the stock market returns, reflecting the broader economic conditions and financial health of investors. Researchers have looked at the relationship between economic strength and stock market growth. Ramzan et al. (2024) argued that as global awareness of sustainability grows, corporate valuations and investor attraction may increase. Shapiro (1988) posited that stock market returns should align with overall economic activity over long period of time since stocks reflect expected discounted earnings from investment; however, evidence about this relationship is mixed. Fischer and Merton (1984) found a positive relationship between economic activity and stock market returns, Ritter (2004) found a negative relationship between GDP per capita and stock returns during 1900 and 2002 among 16 countries.

International trade: International trade plays a pivotal role in shaping the stock market returns of different countries, influencing diverse economic factors and market dynamics. For example, countries heavily reliant on exports often experience stock market returns closely tied to global trade dynamics. Stock markets in export-driven economies are sensitive to changes in global demand, trade policies, and exchange rates. Stronger export performance typically translates to higher stock market returns, while trade disruptions or protectionist measures can lead to volatility and lower returns. Contrary to that, international trade patterns can influence the performance of specific sectors within a country's stock market. Trade

agreements and tariff policies influence market sentiment and investment decisions. Positive developments such as trade liberalisation or tariff reductions can stimulate investor confidence and drive stock market returns higher, in particular for export-oriented countries benefiting from increased market access. Understanding the interplay between international trade dynamics and stock market returns is essential for investors navigating global markets. Kose et al. (2006) found evidence of higher stock returns in countries that are more integrated into the global economy. As such international trade can be a common factor across markets that can influence correlations of returns among stock markets.

2.7 Other Factors

Culture: As market integration develops, so do the changes in culture and its relevance in the process of globalisation. Culture as an integration to the economy has not attracted much attention as a determining factor to influence market integration and stock market co-movements. Participants from similar cultural backgrounds ought to act similarly in their decision-making process. Globalisation, as a process, attempts to keep moving forward with the development of modern transport, adaptation of culture, and trade, leading to market integration. Woodside and Zhang (2013) use cross-cultural experiments to test complex societal and cultural influences on the willingness to test market integration. Whereas, Singh et al. (2017) used data from G20 countries to analyse the impact of culture on the co-movements of the stock markets.

The increase in consumption and travel in international markets has the potential to influence culture. Conversely, culture influences the consumption of goods and services, trade, and travel. Czaika and De Haas (2014) found the increasing globalisation in the world have affected global migration patterns.

Political and other factors: Political power addresses the needs of international institutions and policymakers that ultimately affect market integration by balancing the power between politics and markets (Underhill, 2000). The theoretical understanding of the political factors looks at the formation of the WTO, the IMF and World Bank. The WTO's establishment is intended to formalise, deepen, and widen an international system of trade regulation and bring greater coherence in global economic policy, drawing the work of the IMF and World Bank. This will also help to develop other organisations and unions, including the WIPO, the International Telecommunications Union (ITU) and the International Occupation Standards (IOS) (Wilkinson, 2002).

The 2008 GFC highlighted the weaknesses in the regulatory systems which led to substantial changes in financial regulation and oversight. The impact of the crisis led to increased regulatory oversight to improve monitoring and oversight of major financial institutions. Other impacts including reforms in banking regulation to improve their risk management standards. These impacts can influence the changes international markets through market integration.

Theoretically, the linkage between international markets is influenced by the changes in economic growth, international trade and stability within the economies. Whereas changes in integration of markets is measured by the co-movements of the asset returns among these markets. Asset returns in domestic sector is influenced by the investment environment that includes relative risk and return patterns of a firm within the economy. To provide a conducive investment environment within an economy policymakers develop regulations that promote a transparent flow of information and accurate assessment of risk and return for investors. Depending on the domestic needs of the policymakers these regulations can implement policies and regulations that are determined in international factors or domestic factors. If the regulations are influenced by international factors, changes in regulations will

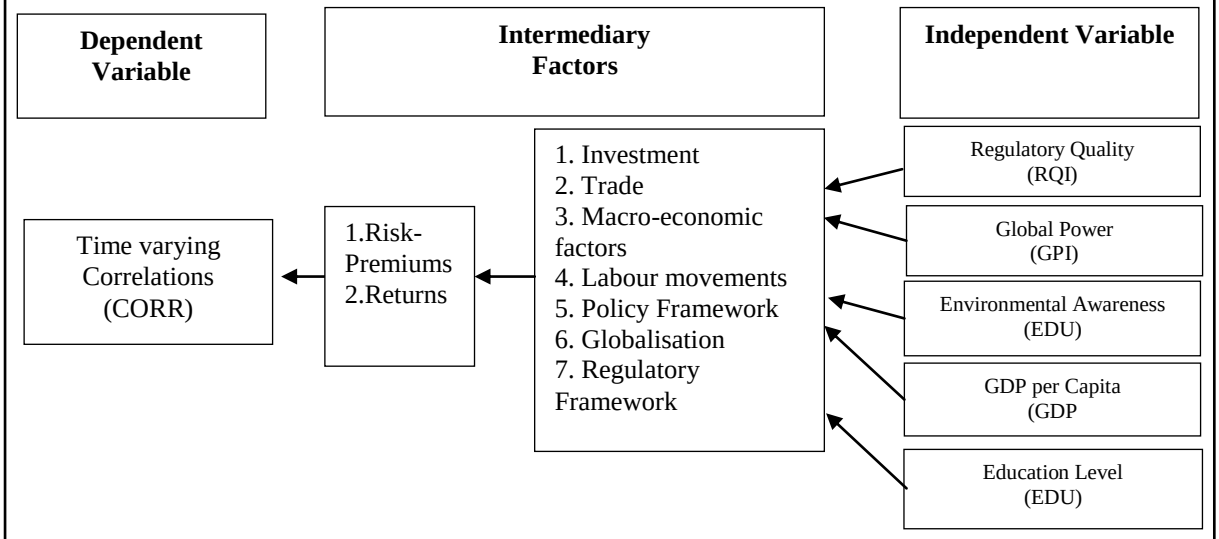
cause positive change in co-movements, whereas if the changes are more influenced by domestic factors it will cause a negative change in co-movements.

After reviewing the literature in the area, less exploration is evident about the impact of RQ and GP on market integration, specifically looking at the changes in stock market correlations over time. The literature review identifies a number of factors that form the basis of our theoretical model and identifies the variables of our study. While previous studies have examined economic and financial integration from various perspectives, such as trade policies, monetary unions, and industry-level integration, there remains a gap in the research area specifically addressing the influence of RQ and GP on stock market co-movements. This gap presents an opportunity for the current study to contribute to the literature by investigating how changes in RQ and GP affect changes in correlations of stock markets across different nations over time.

3. Conceptual Framework

In Figure 1, we present the conceptual framework for our study, which shows the relationship between the dependent and independent variables via intermediary factors. We posit these independent variables: RQ, GP, environmental awareness, overall economic growth presented as GDP per capita and education levels, influence the intermediary factors. We are most interested in the impact of RQ and GP on the return correlations of the overall stock market economies because this has not yet been well investigated.

Figure 1: Conceptual Framework



Note: This conceptual model shows the relationship between dependent and independent variables and correlations via the intermediary factors.

The conceptual framework shows the interaction of different economic variables and how the independent variables impact stock market correlations. Our dependent variable correlations are not directly influenced by independent variables, but rather through via intermediary factors. The changes in our independent variables (RQ, GP, environmental awareness, education level, and GDP per capita) influence the intermediatory variables which in turn impact returns of the stock markets differently across markets thus reflected in the time varying correlations. The impact on the returns of the markets is influenced via either the overall returns in each market differently (without affecting risk premium) and or via influencing the risk premia across markets, thus influencing returns differently across financial markets. This study's primary contribution is this theoretical linkage in terms of the influence of RQ and GP on the stock market returns directly or via changes in risk across markets.

The details for each variable used in the study, along with what they measure, and a justification for the selection of the variables are listed in Table 1. We followed Bekaert and Harvey (1995) and used time varying correlation estimates to measure the co-movements of returns of the stock market changes over time. Bekaert and Harvey (1995) used time varying correlations to provide a timeline for market integration of global markets. RQ and GP are our variable of interest for this study. The impact of RQ in financial studies may have been ignored because RQ was primarily used to create a secure and safe environment, maintain social equality, and improve the quality of firms. Since RQ has impact on investment environment, different regulations are expected to influence investments differently in

different countries. The aim is to understand RQ has changes in returns of correlations. GP was mainly based on military power, and the economic impact was ignored. Heim and Miller (2020), who recently constructed a GPI published by Rand Corporation, argued that global power ought to include economic factors, because economic strength has a significant bearing on how different nations can exert their power across nations. We have included the GPI in our study to test the correlation levels between RQI and GPI.

Table 1: Variable discussion

Variable	What it Measures	Justification
Time varying correlations (CORR)	Dependent variable: Measures change in co-movements of returns of the stock market. Pairs for the stock market (Bekaert & Harvey, 1995; Cappiello et al., 2006)	Correlations are frequently used as a measure of stock market integration.
Regulatory Quality Index (RQI) **Variable of interest**	Reflects perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development. (Kaufmann et al., 2011)	The Worldwide Governance Indicators summarises six dimensions of governance starting in 1996 including the regulatory quality etc.
Global Power Index (GPI) **Variable of interest**	Measures the changes in a nation's power compared with other nations (Song and Yuan, 2012)	A nation stronger in global power is more dominant in negotiating bilateral and cultural lateral trade agreements. They are also likely to exert more influence on global policy framework.
Environmental CO_2 emissions (ENV)	Measures aggregate awareness of individuals in a country with sustainability of the environment (Iqbal & Kalim, 2023)	More (or less) if the general public is aware of the environment, they are more (or less) likely to behave similarly with the public of other countries; this influences relative policy framework.
Education, Tertiary level School enrolment, Tertiary (total gross; EDU)	Average education of the public in the country. (Fomba et al., 2023)	A higher level of education is likely to influence individuals in making more informed decisions that are likely to influence policy makers and both investment decisions.
GDP per capita	Aggregate GDP per capita (Topuz, 2022)	Measures the per capita wealth of individuals in the country. Commonly used control variable in most economic studies.

Trade **Used as a common factor**	Sum of exports and imports of goods and services measured as a share of gross domestic product	Trade measures all exports and imports in a country, which can be used as a common factor for trade.

Note: This table provides a summary of variables used in the study: regulatory quality index as a measure of government and policy regulations that develop policies and other private sectors; global power index as a measure of the relative global power of nations; CO_2 emissions as a measure of awareness of sustainability measured as metric tonne of CO_2 emissions per capita ; Number of tertiary qualified people per thousand of population measures education levels and as an indirect proxy for technological advancement in a country, GDP per capita as a measure for overall economic growth of a country; Trade as a measure for exports and imports of goods and services. Correlation indexes measure the relationship of the stock market of a country with other stock markets and regulatory quality index that represents all the independent variables.

Research looks at the RQ and GP in some of the economic structure for example, Kaufmann et al. (2011) looked at the Worldwide Governance Indicators from a methodological manner where RQ is part of the governance measurement. Song and Yuan (2012) looked at free trade agreements in China from a GP perspective.

Regarding environmental CO_2 emissions measured by environmental awareness, Iqbal and Kalim (2023) raised awareness to the environmental levels of the economic situation of the market. Education level is measured using tertiary school enrolment, which accounts for the well-educated populations (Fomba et al., 2023). GDP per capita measures the wealth of the citizen in any particular country (Topuz, 2022).

4. Estimating Time Varying Correlation

The analysis was conducted in three steps. In the first step, we estimated pairwise time varying correlations for market pairs. We obtained 136 pairs of correlations. In the second step, we constructed a scaled correlation index for each market using 136 pairs across 17 markets[4]. This scaling used the capitalisation of each market and the total market capitalisations of all markets. Finally, we used panel estimation to test the relationship between the scaled correlation indices and independent variables: RQI, GPI, environmental awareness, education level, and GDP per capita.

[4] There is more coverage of countries in this paper, and we have backfilled for some countries (Argentina, Brazil, Japan, South Africa and Turkey) to achieve the maximum coverage.

4.1 Estimating Pairwise Time Varying Correlations

To capture the dynamic nature of stock market correlations we use Cappiello et al.'s (2006) Asymmetric Dynamic Conditional Correlation (ADCC) GARCH model to construct pairwise time varying correlations for each of the market pairs. This model has been extensively used in the estimation of time varying correlations (Wang et al., 2024). We describe Cappiello et al. (2006) ADCC GARCH approach below. First, we discuss the DCC GARCH framework. First we discuss the DCC-GARCH framework.

Let r_t be a n x 1 vector of assets returns and assume they are conditionally normal with mean 0 and conditional covariance matrix H_t. That is,

$$r_t \mid I_{t-1} \sim \text{Normal}\ (0, H_t)$$

This matrix H_t can be decomposed as follows:

$$H_t = D_t R_t D_t$$

where $D_t = diag\ (h_{1,t}^{\frac{1}{2}}, \ldots h_{n,t}^{\frac{1}{2}})$ is a n x n diagonal matrix of time varying standard deviations from univariate GARCH model with $h_{i,t}^{\frac{1}{2}}$ is on the ith diagonal and $R_t = diag\ (q_{1,t}^{-\frac{1}{2}}, \ldots q_{n,t}^{-\frac{1}{2}})$ is the time varying correlation matrix.

The Dynamic Conditional Correlation (DCC) model follows a two-stage estimation of the conditional covariance matrix H_t.

Stage 1:

Use one of univariate volatility models such as GARCH (Bollerslev et al., 1996) or EGARCH (Nelson, 1991) to fit for r_t and obtain estimate of $h_{i,t}$.

Stage 2:

Asset return r_t is transformed by their estimated standard deviations resulting from Stage 1 and use them to estimate the parameters of the conditional correlations.

For example, consider a case where the asset returns r_t follows as AR (1) process, which can be written as:

$r_t = \mu + ar_{t-1} + e_t$ $\quad e_t \mid I_{t-1} \sim \text{Normal}(0, H_t)$ (1)

and the time varying variance $h_{i,t}$follows as GARCH (1,1) model,

$h_{i,t} = w_i + \alpha_i e_{i,t-1}^2 + \beta_i h_{i,t-1}$ $\quad \alpha_i + \beta_i < 1$ (2)

When Model (1) is estimated under (2), the standardised residuals ε_{it} can be calculated as

$\varepsilon_{it} = e_{it}/\sqrt{(h_{it})}$ or $\varepsilon_t = D_t^{-1} e_t$

Obviously, $E(\varepsilon_t \varepsilon_t') = D_t^{-1} E(e_t e_t') D_t^{-1} = D_t^{-1} H_t D_t^{-1} = R_t$

Following Engle (2002), we can write the resulting correlation matrix in the standard DCC model as

$$Q_t = S(1 - \alpha - \beta) + \alpha(\varepsilon_{t-1}\varepsilon_{t-1}') + \beta Q_{t-1} \quad (3)$$

where Q_t is a symmetric positive definite matrix and S is the unconditional correlation matrix of the standardised residuals ε_t.

As this model does not allow for asymmetries and asset-specific news impact, the modified model that Cappiello et al. (2006) used for incorporating the asymmetrical effect and the asset-specific news impact can be written as:

$h_{i,t} = w_i + \alpha_i \varepsilon_{i,t-1}^2 + \beta_i h_{i,t-1} + d_i \varepsilon_{i,t-1}^2 I(\varepsilon_{i,t-1})$ (4)

The indicator function $I(\varepsilon_{i,t-1})$ is equal to 1 if $\varepsilon_{i,t-1} < 0$ and 0 otherwise. For this specification, a positive value for d means that negative residuals tend to increase the variance more than positive ones. The asymmetric effect or leverage effect is designed to capture an often-observed characteristic of financial assets that an unexpected drop in asset prices tends to increase volatility more than an unexpected increase in asset prices of the

same magnitude. This can be interpreted to mean that bad news increases volatility more than good news. For the ADCC model, the dynamics of Q are given by:

$$Q_t = (\overline{Q} - A'\overline{Q}A - B'\overline{Q}B - G'\overline{N}G) + A'\varepsilon_{t-1}\varepsilon'_{t-1}A + B'Q_{t-1}B + G'n_{t-1}n'_{t-1}G \quad (5)$$

Equation (5) estimates the correaltions for the dependent varibale. The matrices A, B and G are diagonal parameter matrices. The indicator function $n_t = I(\varepsilon_{i,t-1})$ is equal to 1 if $\varepsilon_{i,t-1} < 0$ and 0 otherwise and $\overline{N} = E[n_t n'_t]$. For $\overline{Q}$ and $\overline{N}$, expectations are infeasible and are replaced with sample analogues, $T^{-1}\sum_{t=1}^{T}\varepsilon_t\,\varepsilon'_t$ and $T^{-1}\sum_{t=1}^{T}n_t\,n'_t$, respectively. In this context, Cappiello et al. (2006) only look for the asymmetrical effects and not the asset-specific news impacts.

4.2 Construction of Scaled Correlation Index

We construct capitalisation-weighted scaled correlation indices using the correlations of each market pair from the pairwise correlations calculated using the ADCC GARCH model. We estimate 136 pairs[5] of correlations for 17 markets[6]. Using time series from 1996 to 2022 for 136 pairs of correlations, we construct an index for each stock market in our study. To get these capitalisations weighted scaled index for market $i(i = 1,2,..,17)$, we first multiply the correlation of the market i and j, by the capitalisation of market $i(Cap_i)$ and divide by the total of capitalisation of all markets (Cap_m). Since $i = 1,2,..,17$, we have 17 such indices in relation to market i. We then sum these 17 scaled indices to get an index of correlation for Market i. Since $i = 1,2,..,17$, we will construct 17 indices, one for each market (see Gupta et al., 2024).

[5] We constructed the correlation matrix we look at the unique pairs, to construct the correlation indices we use 136 pairs.

[6] The G20 comprises 19 countries and the European Union (EU). Putting aside the EU countries, we studied data from the other 19 countries. For each, there is available data for RQI, GPI, ENV and GDP for the years 1996 to 2022 however, data for EDU is not available for Russia and Saudi Arabia. Thus, we have omitted them, and the stock markets included in the study are Argentina, Australia, Brazil, Canada, China, France, Germany, India, Indonesia, Italy, Japan, Mexico, South Africa, Korea, Turkey, the United Kingdom and the USA.

We use the following formula to calculate the index for country i (I_i).

$$I_i = \frac{\sum_{j=2}^{17} \rho_{i.j} \times Cap_j}{Cap_m} \quad (6)$$

For example, to construct the index for Argentina, $I_{Argentina}$; j = Australia, Brazil, Canada, China, France, Germany, India, Indonesia, Italy, Japan, Korea, Mexico, South Africa, Turkey, the United Kingdom and the United States of America.

4.3 Data Source and Preliminary Data Analysis

In this paper, we estimated panel data using data on 17 subjects (stock markets) over 27 years (1996 to 2022). The variables of interest are the correlations index, regulatory quality index (RQI), global power index (GPI), education (EDU), environment (ENV) and GDP per capita. The RQI measures government policies and regulations and promotes private sector development. The World Bank provides freely accessible data for RQI in percentile ranks, which indicates the country's rank among all other countries[7]. The GPI is a measure of the relative power of nations compared with other nations globally. The Rand Corporation (Heim & Miller, 2020) constructed this index, which incorporates economic factors and is a valid proxy for an individual country's power relative to the overall GP. The EDU represents educational level, which is determined by the tertiary level of education per thousand population in a country (Barro and Lee, 2013). ENV is the overall awareness of sustainability in a country proxied by the CO_2 emissions in tonnes (Paramati et al., 2017) and GDP per capita proxies for the overall growth of the country (Topuz, 2022). CO_2 emissions and GDP per capita data was obtained from the World Bank database[8], and GPI came from

[7] Data for RQI, https://data.worldbank.org/indicator/RQ.PER.RNK

[8] Data for these variables have been collected from the various world bank tables: The World Bank. (n.d). World Bank national accounts data and OECD National Accounts data files. https://data.worldbank.org/indicator/NY.GDP.MKTP.CD. The World Bank. (n.d). 2020. Washington, DC:

Rand Corporation[9]. We used annual data for 1996 to 2022 for all variables under consideration, except stock market indices that were used to calculate the correlations collected from Refinitiv workspace databases. Monthly stock market data was used monthly to estimate an ADCC GARCH model (Gupta and Donleavy, 2009). After estimating monthly correlations, we selected end of year correlations to construct annual time series.

World Resources Institute. https://data.worldbank.org/indicator/EN.ATM.CO2E.PC The World Bank. (n.d). 2022. UNESCO Institute for Statistics. https://data.worldbank.org/indicator/SE.TER.ENRR

[9] We thank Jacob L Heim at the Rand Corporation for providing data and methodology for estimation of GPI which allowed us to complete GPI for all 20 economies. Published paper only shows for a limited number of nations.

The descriptive statistics for each variable to be used in our model for estimation is presented in Table 2. The data for RQI, GPI, environment (CO_2emissions in tonnes)[10], education (population of adults with tertiary education)[11], and GDP per capita[12] for all the 17 markets, namely, Argentina, Australia, Brazil, Canada, China, France, Germany, India, Indonesia, Italy, Japan, Korea, Mexico, South Africa, Turkey, the United Kingdom, and the United States for the sample period 1996 to 2022. India had the lowest level of mean RQI at 40.28, and the highest RQI in the United Kingdom at 96.42, followed by Australia at 95.67. Australia had the lowest level of mean GPI at 0.014, and the GPI of the United States had highest at 0.27, followed by China at 0.16. The magnitude of standard deviation (SD) for GPI was small because the mean value of GPI for all markets was very small in magnitude; therefore, we calculate the coefficient of variation (CV) for GPI to understand the dynamics of changes in GPI. CV for RQI ranges between 3% and 16%, and CV for GPI ranges between 4% and 32%, showing a considerable variation in RQI and GPI over time.

CO_2 emissions were lowest for India and highest for the United States, as shown in Table 2. The education level for South Africa was the lowest, with 14.74 people per thousand population with a tertiary qualification, against the highest level of 101.85 for Australia. The United States of America had the highest per capita GDP, and India had the lowest. The CV of ENV for all countries was close to 10% and higher except for Australia, Canada, Germany, Japan and Mexico. The CV of GDP for all countries was high, showing high volatility in GDP during the sample period. The CV of the stock market index for all countries was high. Stock market returns are generally volatile and dependent on different underlying factors. The J-B statistic suggests a normal distribution; the p-value was not statistically significant in all cases. The J-B test statistic for ENV is above "3" for Argentina, Brazil, Canada, India, Indonesia, Japan, Mexico, and Turkey and below "3" for other

[10] https://data.worldbank.org/indicator/EN.ATM.CO2E.PC
[11] OECD (2023), Population with tertiary education (EDU; indicator). http://doi.org/10.1787/0b8f90e9-en
[12] OECD (2023), Gross domestic product (GDP; indicator). http://doi.org/10.1787/dc2f7aec-en

markets; the p-value in all countries is statistically insignificant. The EDU J-B test statistic was above “3” in Canada, France, India, Italy, Korea, Turkey and the United Kingdom. It was below “3” in all other cases, with the p-value not statistically significant in most cases except for Canada and Korea. The J-B statistic in the case of GDP was above “3” for France, Indonesia, and Japan and below “3” in all other countries and was not statistically significant. The stock market index for all countries was not normally distributed. We used stock market returns in our analysis to estimate correlations.

Table 2: Descriptive statistics for country-wise data for all variables

Country	RQI (1)			GPI (2)			EDU (3)			ENV (4)			GDP per capita (5)			Stock Market Index (6)			Trade (7)		
	Mean	CV (%)	J-B test (p-value)	Mean	CV (%)	J-B test (p-value)	Mean	CV (%)	J-B test (p-value)	Mean	CV (%)	J-B test (p-value)	Mean	CV (%)	J-B test (p-value)	Mean	CV (%)	J-B test (p-value)	Mean	CV (%)	J-B test (p-value)
(1) Argentina	35.158	45.989	4.628 (0.098)	0.007	8.496	4.380 (0.111)	73.440	24.145	0.783 (0.675)	3.917	11.943	11.769 (0.002)	9.247E4	36.485	0.942 (0.624)	1.397E5	196.150	282.996 (3.533E-64)	31.260	22.717	2.094 (0.350)
(2) Australia	95.678	3.038	2.765 (0.250)	0.014	4.780	1.628 (0.443)	101.849	12.698	1.991 (0.369)	17.168	6.063	2.124 (0.345)	4.344E5	39.495	2.740 (0.253)	4.657E4	31.897	1.178 (0.554)	41.554	5.520	0.202 (0.903)
(3) Brazil	54.710	12.217	1.690 (0.429)	0.031	5.394	2.370 (0.305)	35.366	42.487	2.176 (0.336)	2.060	23.677	102.116 (6.693)	7.427E4	42.966	1.443 (0.485)	4.877E5	67.059	1.553 (0.459)	25.856	21.039	2.997 (0.223)
(4) Canada	94.431	1.781	0.173 (0.916)	0.221	12.503	3.015 (0.221)	67.116	12.769	11.612 (0.003)	15.965	5.081	5.308 (0.070)	3.922E5	29.712	2.886 (0.236)	1.189E5	34.082	0.731 (0.693)	68.202	9.328	2.690 (0.260)
(5) China	42.048	9.835	0.883 (0.642)	0.160	31.129	2.787 (0.248)	29.963	69.602	2.551 (0.279)	5.544	39.926	1.800 (0.406)	-4.994E4	-80.022	2.590 (0.273)	2.463E4	40.568	1.176 (0.555)	44.333	22.370	3.103 (0.211)
(6) France	83.387	4.529	1.923 (0.382)	0.051	15.714	2.258 (0.323)	57.915	11.401	3.499 (0.173)	5.438	12.375	2.058 (0.357)	3.565E5	21.509	3.348 (0.187)	4.448E4	25.604	0.381 (0.826)	56.762	10.876	1.151 (0.562)
(7) Germany	92.824	2.222	0.282 (0.868)	0.060	14.448	1.788 (0.408)	59.942	14.461	2.240 (0.326)	9.476	8.943	2.463 (0.291)	3.867E5	21.509	2.792 (0.247)	7.671E4	46.179	2.103 (0.349)	74.806	19.445	2.003 (0.367)
(8) India	40.288	15.136	1.243 (0.537)	0.071	21.215	1.957 (0.375)	17.877	47.813	3.139 (0.208)	1.373	44.508	56.838 (4.545E-14)	1.181E4	55.180	2.178 (0.336)	4.651E4	85.430	4.764 (0.092)	39.963	26.764	1.773 (0.412)
(9) Indonesia	43.244	26.715	1.203 (0.547)	0.018	13.924	1.864 (0.393)	24.700	41.126	2.909 (0.233)	1.796	33.507	93.806 (4.267E-21)	2.451E4	57.187	3.088 (0.213)	2.988E4	76.379	2.791 (0.247)	52.658	25.014	21.003 (2.749E-5)
(10) Italy	75.288	4.478	1.513 (0.469)	0.032	21.733	2.901 (0.234)	60.979	12.988	3.480 (0.175)	6.767	16.057	2.609 (0.271)	3.106E5	20.162	2.484 (0.288)	264.984	30.738	2.468 (0.291)	53.045	12.971	11.243 (0.003)
(11) Japan	82.007	8.838	2.713 (0.257)	0.064	21.737	2.086 (0.352)	56.300	12.111	2.913 (0.233)	9.247	4.729	4.501 (0.105)	3.866E5	10.666	6.479 (0.039)	1.339E4	25.6326	1.252 (0.534)	28.746	26.337	0.485 (0.784)
(12) Korea	75.718	8.867	1.973 (0.372)	0.025	10.612	1.524 (0.466)	90.077	14.533	7.716 (0.021)	2.450	32.869	1.244 (0.536)	2.233E5	36.873	2.132 (0.344)	8.660E5	63.881	1.097 (0.577)	76.746	19.478	1.467 (0.4802)
(13) Mexico	59.300	8.948	13.058 (0.001)	0.017	4.397	2.567 (0.276)	29.138	32.116	2.563 (0.277)	3.941	8.673	23.703 (7.124E-6)	9.028E4	20.541	2.342 (0.309)	3.097E5	68.017	2.975 (0.225)	60.948	21.606	2.553 (0.278)
(14) South Africa	63.657	11.795	5.343 (0.069)	0.007	3.279	2.462 (0.291)	14.744	48.092	1.244 (0.536)	7.573	10.077	2.202 (0.332)	5.739E4	30.575	1.689 (0.429)	1.540E4	46.764	2.247 (0.325)	52.231	12.373	0.318 (0.852)
(15) Turkey	59.046	9.552	6.262 (0.043)	0.015	7.492	0.851 (0.653)	62.789	61.154	3.371 (0.185)	4.122	23.099	6.679 (0.035)	8.156E4	39.533	2.995 (0.223)	609.162	108.950	379.480 (3.952E-83	52.276	17.616	18.960 (7.634E-5)
(16) The UK	96.428	2.405	1.040 (0.594)	0.045	14.962	3.349 (0.187)	60.630	9.590	38.121 (5.273E-11)	7.573	20.186	2.791 (0.247)	3.900E5	19.235	2.658 (0.264)	3.049E4	22.252	1.103 (0.575)	56.912	9.702	1.388 (0.499)
(17) The USA	92.016	3.295	1.829 (0.400)	0.273	9.972	3.188 (0.203)	82.434	7.334	2.918 (0.232)	17.463	13.277	2.474 (0.290)	4.915E5	24.989	0.825 (0.661)	1.744E4	54.505	10.325 (0.005)	26.139	10.376	1.638 (0.440)

Notes: The Table provides descriptive statistics for all variables for the data used in the study. RQI measures the regulatory quality percentile; GPI measures relative power of countries over other countries; EDU measures school enrolment at Tertiary level; ENV measure CO_2 emissions metric tonnes per capita of population; GDP per capita measures current US dollar; Stock Market Index measures the index levels of broad based markets. It is used as the price levels for the aggregate stock marke

Table 3 presents the relationship between GPI and RQI and group correlations between GPI and RQI are presented in column 2. RQI and GPI are highly correlated in some markets, mostly in developed markets, including Australia, Germany, Japan, Korea, the UK, and the USA. However, group correlations are not too high at 0.135.

Table 3: The Correlation between GPI and RQI at Individual Country Level

Country	**Correlations**
1. Argentina	0.487
2. Australia	0.863
3. Brazil	0.358
4. Canada	-0.663
5. China	0.112
6. France	-0.589
7. Germany	-0.764
8. India	0.503
9. Indonesia	0.839
10. Italy	0.509
11. Japan	-0.858
12. Korea	0.944
13. Mexico	0.343
14. South Africa	-0.176
15. Turkey	-0.365
16. The UK	0.719
17. The USA	0.739
Variable	**Group Correlations**
GPI and RQI	0.135

Note: This table shows the correlations for Argentina, Australia, Brazil, Canada, China, France, Germany, India, Indonesia, Italy, Japan, Korea, Mexico, South Africa, Turkey, the United Kingdom and the United States of America for the period 1996-2022.

We also investigated multicollinearity issues with the data by estimating the variance inflation factor (VIF). Table 4 presents the centred VIF values. Table 5 presents the centred VIF values with trade. As can be seen, all VIF values are well below 5 in both tables, indicating a low multicollinearity level.

Table 4: Testing for Multicollinearity (with GDP per captia)

Multicollinearity Test (coefficient table)								
Unstandardised Coefficients				**Standardised Coefficients**			**Collinearity Statistics**	
Model		B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1	(Constant)	0.334	0.021		15.666	<0.001		
	RQI	0.004	0.000	0.666	10.709	<0.001	0.248	4.036
	GPI	-1.110	0.073	-0.541	-15.111	<0.001	0.748	1.337
	EDU	-0.001	0.000	-0.190	-4.481	<0.001	0.532	1.880
	ENV	-0.008	0.001	-0.304	-6.115	<0.001	0.387	2.581
	GDP	-3.207E-7	0.000	-0.042	-0.631	0.529	0.213	4.705
a. Dependent Variable: Corr								

Note: Intuitively GPI and RQI may have a relationship we separately estimated correlations among GPI and RQI. Correlations GPI and RQI =0.135. This is low and should not cause any issues.

Table 5: Testing for Multicollinearity (with Trade)

Multicollinearity Test (coefficient table)								
Unstandardised Coefficients				**Standardised Coefficients**			**Collinearity Statistics**	
Model		B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1	(Constant)	0.318	0.018		17.555	<0.001		
	RQI	0.004	0.000	0.595	12.512	<0.001	0.416	2.402
	GPI	-1.066	0.073	-0.520	-14.523	<0.001	0.737	1.357
	EDU	-0.001	0.000	-0.215	-5.846	<0.001	0.695	1.440
	ENV	-0.007	0.001	-0.273	-5.381	<0.001	0.367	2.724
	Trade	0.001	0.000	0.098	2.784	0.006	0.761	1.313
a. Dependent Variable: Corr								

Note: Intuitively GPI and RQI may have a relationship we separately estimated correlations among GPI and RQI. Correlations GPI and RQI =0.135, this is low and should not cause any issues.

5. Model and Estimation

For estimation, since we have data on 17 subjects (stock markets) over 27 years (1996-2022), we perform panel data estimation.[13]

We consider the following model for estimation:

$$Corr_{i,t} = \beta c + \beta_{RQI} RQI_{i,t} + \beta_{GPI} GPI_{i,t} + \beta_{EDU} EDU_{i,t} + \beta_{ENV} ENV_{i,t} + \beta_{GDP} GDP_{i,t} + u_{i,t} \quad (7)$$

In Equation (7), we have the dependent variable $Corr_{i,t}$is the time varying pairwise correlation and $RQI_{i,t}$, $GPI_{i,t}$, $EDU_{i,t}$, $ENV_{i,t}$ and $GDP_{i,t}$ per capita are the explanatory/ independent variables. The details on these variables are given in Table 1.

Strong countries are known to have the potential to influence policies in weaker countries, and stronger economies may behave in a similar manner to achieve common objectives together. Due to similar interests, there may be a positive influence of RQI on correlations; however, weaker level of GP may not significantly impact other countries' policy formations and may have influence from stronger economies. The factors influencing GP will stem from trade, migration, economy and monetary policies, which will influence the other economies, especially with weaker GP. Due to this fact, a weak GP has no power to influence any activity. Evidence suggests that market integration will have effects on the analysis and the shared relationships among the variables, including ENV, EDU, and the GDP per capita.

Returns on assets (overall stock market) across different economies may be differently impacted by global factors. These differential changes in market returns will influence correlations in stock markets over time. Research thus far has looked at underlying factors that influence correlation (for example, see Luo et al., 2003). Similarly, RQ has the potential to change the correlations of markets over time and the relative GP of the

[13] Multivariate GARCH models are able to estimate relationship between more than two variables however, Cappiello, Engle and Sheppard (2006) proposed model reduced multivariate GARCH models to estimate time varying correlations in a bivariate context.

economies has the potential to change correlations of markets over time. As such, we test the following two sets of hypothesise the following.

Set 1

H_0: $\beta_{RQI} = 0$ (Changes in correlation are not influenced by changes in RQI)

H_1: $\beta_{RQI} > 0$ (Changes in correlations are influenced by changes in RQI)

Set 2

H_0: $\beta_{GPI} = 0$ (Changes in correlation are not influenced by changes in GPI)

H_1: $\beta_{GPI} > 0$(Changes in correlations are influenced by changes in GPI)

The regulatory framework is expected to positively influence the return correlations of stock markets. The RQI used to measure regularity quality influences policy and economic behaviour. These changes are likely to influence the collective returns of the stock market within an economy; however, these changes that happen in returns aggregate stock markets create a different environment for other different countries reliant on how relative RQ impacts policy framework and investor behaviours in each of the markets.

This study hypothesises that RQ and GP positively influence stock market correlations of returns across markets. The null hypothesis is that there is no relationship between RQ and correlations of asset returns. To the best of our knowledge, this is the first study to provide the theoretical and empirical evidence to support our theoretical argument of these linkages. The influence of powerful nations on trade policies and international organisations is well known. The study's findings have implications for trade policy negotiations, development, investment, and economic policies on domestic and international levels.

We expect the relationship between RQI, GPI, and correlations to be positive. We do not make a priori expectations for the signs of the relationship between correlations and the control variables (EDU, ENV, GDP per capita). The controlled variables, including carbon (CO_2) emissions measured in tonnes per capita, which is a proxy for a country's overall

environmental awareness (Paramati et al., 2017). The impact of high CO_2 emissions may influence investors to invest in stocks that prioritise a green economy by opting for energy-efficient markets and or investments. Tertiary level education proxies for differences in education levels and perceptions between nations. The increased educational opportunities in developed countries have made it difficult for developing countries to experience a fast-growing education system. Better education system, training, and skills, leads to increased innovation and productivity and as such better investment decision-making (Stewart, 1996). Higher education also brings more evidence and information for the public to use in turn to make informed decisions. As such, their decisions may similarly affect the returns, resulting in positive correlations; however, politically, it may cause conflicts given the context and information provided for education, thus deviating from convergence, and resulting in a negative relationship. The GDP per capita is used as a source of economic growth and net worth of individuals in the economy. GDP per capita is commonly used as a proxy for economic activity. Its impact on correlations can be positive or negative depending on the economic maturity of the economy.

6. Estimation Results

Results for the analyses are first presented for the correlation indices that we estimated for the 17 markets as discussed in Section 4. In the construction of indices, we used the ADCC model for estimating time varying correlations for each market pair from the 17 markets, namely Argentina, Australia, Brazil, Canada, China, France, Germany, India, Indonesia, Italy, Japan, Korea, Mexico, South Africa, Turkey, the United Kingdom, and the United States of America. We further used the time varying correlations for market pairs to construct scaled correlations index for each market with other markets. The scaled correlation

index was used as the dependent variable in the panel analysis to test if correlations are influenced by the RQI and GPI.

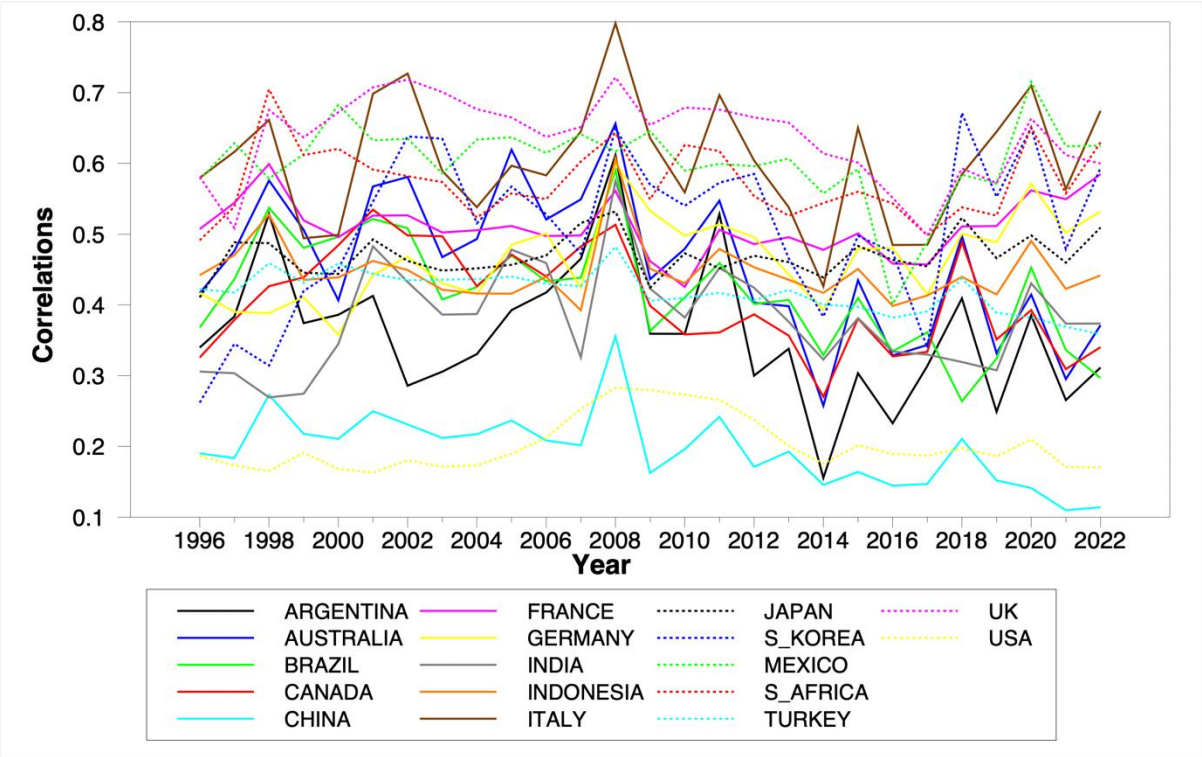
6.1 Time Varying Correlations

To fulfil the research objective for this study we see conducted a test for relationship between RQ and GP's influence on markets, measured by time varying correlations. The paper was motivated by the impact of RQ and GP on the convergence of the stock market. The research question directly aims to address the impact of stock market correlations influenced by RQ and GP. This impact on the stock markets was not uniform and was reflected in the correlations of stock market returns. This can be seen in the variations in correlations across different markets overtime.[14]

From the 136 pairs of correlations estimated we have constructed scaled correlation indexes for each stock market with other markets. This resulted in 17 correlation indexes for 1996 to 2022. These are given in Figure 2. This shows year-wise line graphs from 1996 to 2022 for each of the market. The correlation indexes show that correlations for Australia and the United States of America with other markets are stable and lower than for other markets, and correlations for India are most volatile, followed by China and Argentina. The correlations in Italy are much higher than in most markets except for China and the United States of America; however, towards the end, most markets have higher correlations.

[14] Detailed results for correlation pairs have not been presented here but can be requested from authors.

Figure 2: Year-wise index of correlations



Note: The graph shows the year-wise index of correlations for each country Australia, China, Canada, China, Germany, France, the United Kingdom, India, Italy, Mexico, Korea, and the United States of America.

6.2 Results

Since we are performing panel data estimation, the first step is to investigate the cross-sectional panel independence. This was required as the selection of tests for stationarity (or panel unit root test) of the time series variables is based on whether a panel time series is cross-sectionally independent (CI) or cross-sectional dependent (CD). We conducted a Breusch-Pagan (1979; BP) LM test and Pesaran Scaled LM test for cross-sectional independence. The null hypothesis for the test is H_0: time-series is CI and $H_{A:}$ time series is CD. The results are presented in Table 6. Since the p-value for the two CI tests is less than < 1%, we rejected the null hypothesis at 1% level and conclude that the time series are CD (see for example, Selvanathan et al., 2022; Pesaran, 2007).

Table 6: Test for Cross-sectional dependence (CD)

Variable	Cross-sectional dependence (CD) test	
	Breusch-Pagan LM test	**Pesaran Scaled LM**
(1)	**(2)**	**(3)**
CORR	757.032 (0.000)	37.655 (0.000)
RQI	861.807 (0.000)	44.008 (0.000)
GPI	1981.047 (0.000)	111.872 (0.000)
EDU	2315.062 (0.000)	132.125 (0.000)
ENV	1386.094 (0.000)	75.798 (0.000)
GDP	2322.034 (0.000)	132.547 (0.000)
TRADE	1308.735 (0.000)	71.107 (0.000)

Note: Statistical significance is given in the parenthesis.

Based on the panel dataset there is evidence to suggest for CD, we cannot use conventional tests for the existence of panel unit roots. We performed the commonly used CIPS panel unit test which assumes cross-sectional dependence. The CIPS panel unit test results for each variable under cross-sectional dependence are presented in Table 7. As can be seen, the variables Corr, EDU, ENV and GDP per capita are I(0) and RQI, GPI and TRADE are I(1).

Table 7: CIPS Panel unit root test under Cross-sectional Dependence

Variable	CIPS	P-value	Conclusion
(1)	**(2)**	**(3)**	**(4)**
CORR	-11.536	<0.01	I(0)
RQI	-5.70	>0.10	I(1)
D(RQI)	-3.820	<0.01	
GPI	-0.177	>0.10	I(1)
D(GPI)	-2.743	<0.01	
EDU	-3.126	<0.01	I(0)
ENV	-3.873	<0.01	I(0)
GDP	-178.573	<0.01	I(0)
TRADE	1.432	>0.10	I(1)
D(TRADE)	-2.946	<0.01	

Note: Statistical significance is given in the parenthesis.

We have included a Kao-residual cointegration test (Kao, 1999) in Table 8 with correlations as the dependent variable, to test for the null of no cointegration for dynamic panels, considering Augmented Dicky-Fuller test. As can be seen, the variables under consideration are panel cointegrated.

Table 8: Kao Residual Cointegration test Dependent variable Correlations

	t-Statistic	Probability
ADF (independent variables RQI, GPI, EDU, ENV and GDP)	-4.882	0.000
ADF (independent variables RQI, GPI, EDU, ENV and Trade)	-6.028	0.000

Since some of the variables in Equation (7) are I(1) and others are I(0) (see, Table 7) we could consider using the ARDL formulation of Equation (7) which can be written in the following two forms:

The first ARDL formulation of Equation (8) with long-run and short-run terms can be written as:

$$\Delta(Corr_{i,t}) = \beta_0 + \beta_1 Corr_{i,t-1} + \beta_2 RQI_{i,t-1} + \beta_3 GPI_{i,t-1} + \beta_3 EDU_{i,t-1} + \beta_4 ENV_{i,t-1} + \beta_5 GDP_{i,t-1} + \sum_{j=1}^{q} \gamma_{0j} \Delta (Corr_{i,t-j}) + \sum_{j=0}^{q} \gamma_{1j} \Delta(RQI_{i,t-j}) + \sum_{j=0}^{q} \gamma_{2j} \Delta(GPI_{i,t-j}) + \sum_{j=0}^{q} \gamma_{3j} \Delta(EDU_{i,t-j}) + \sum_{j=0}^{q} \gamma_{4j} \Delta(ENV_{i,t-j}) + \sum_{j=0}^{q} \gamma_{4j} \Delta(GDP_{i,t-j}) + u_{it} \quad (8)$$

If cointegration between Corr, RQI, GPI, EDU, ENV and GDP exists, then an error-correction model can be used to estimate the speed of adjustments of the disequilibrium caused by previous period shocks that re-converges to the long-run equilibrium (see for example, Selvanathan et al., 2023). The error correction form which corresponds to Equations (7) and (8) can be written as:

$$\Delta(Corr_{i,t}) = \alpha_0 + \sum_{j=1}^{q} \gamma_{0j} \Delta (Corr_{i,t-j}) + \sum_{j=0}^{q} \gamma_{1j} \Delta (RQI_{i,t-j}) + \sum_{j=0}^{q} \gamma_{1j} \Delta (GPI_{i,t-j}) + \sum_{j=0}^{q} \gamma_{1j} \Delta (EDU_{i,t-j})$$

$$+\sum_{j=0}^{q}\gamma_{1j}\Delta\left(ENV_{i,t-j}\right)$$

$$+\sum_{j=0}^{q}\gamma_{1j}\Delta\left(GDP_{i,t-j}\right)+\ \mu\mathrm{EC}_{t-1}+u_{i,t}$$

(9)

To test the relationship between RQI, GPI, and the time varying correlations, we estimated panel regression using time varying correlation indexes and the variable of interest (RQI) with other control variables for a panel of 17 markets from 1996 to 2022 (27 years).

The long-run and short-run panel estimation results with GDP per capita are shown in Table 9. RQI and GPI showed a positive and statistically significant relationship with correlation indexes among the panel of the 17 countries. Lag selection was based on the Akake information criterion (AIC) representing "1" lag. The estimated long-run coefficients of EDU were positive and statistically significant, and GDP and ENV coefficients were negative and statistically significant. Results for short-run coefficients were not statistically significant except for RQI. The error correction term was negative, less than "1" in absolute value and statistically significant.

Table 9: Panel ARDL Estimation Results with GDP per capita (Dependent variable = Corr)

Variable (1)	**Estimates (2)**	**P-value (3)**	**Variable (4)**	**Estimate (5)**	**P-value (6)**
Long-run			Short-run		
RQI	0.007***	0.000	D(RQI)	-0.006***	0.000
GPI	1.185**	0.035	D(GPI)	8.896	0.354
EDU	0.543E-3***	0.000	D(EDU)	0.003	0.326
ENV	-0.009***	0.000	D(ENV)	-0.012	0.172
GDP	-4.21E-06***	0.000	D(GDP)	2.01E-05	0.354
Error correction	-0.405***	0.000			

Note: *** represents 1% significance; ** represents 5% significance and * represents 10% significance.

We also considered trade as an alternative control variable because international trade can be considered as a common factor that may impact the relative returns of stock markets.

Results of the estimated model with trade are presented in Table 10. It shows that long-run and short-run stock market returns relationship with RQI and TRADE were positive and significant at 1% level. EDU was negative and significant in the long-run and in the short-run still negative but insignificant. The error correction term was negative, less than one in absolute value and statistically significant.

Table 10: Panel ARDL Estimation Results with Trade variable

Variable (1)	Estimates (2)	P-value (3)	Variable (4)	Estimate (5)	P-value (6)
Long-run			Short-run		
RQI	0.004***	0.000	D(RQI)	-0.006***	0.001
GPI	1.481***	0.004	D(GPI)	10.938	0.418
EDU	-0.001***	0.000	D(EDU)	-0.031	0.302
ENV	0.004***	0.000	D(ENV)	-0.031***	0.006
TRADE	0.004***	0.000	D(TRADE)	0.002***	0.009
Error correction	-0.401***	0.000			

Note: *** represents 1% significance; ** represents 5% significance and * represents 10% significance.

We use Ramsey RESET test (Ramsey, 1969) to detect for omitted variables and functional form of the model. Null hypothesis that coefficients are insignificant is rejected accepting the alternative that the functional form is correct, and our model does not suffer from omitted variable bias.

The RQI provides a measure for RQ that influences markets, investment decisions and firms. The GPI compiled by the Rand Corporation accounts for a country's economic activity. The independent variables GDP, EDU and ENV are influenced by the changes in correlations. International trade is an alternative variable considered as a common factor across financial markets that can also impact returns and the changes in stock market correlations. International trade creates better firm performance and allows for comparative advantage, including other market characteristics such as, firm strategies, resources and capabilities (Kaleka & Morgan, 2017). Caporale and Girardi (2015) looked at the bilateral trade flows and financial linkages in business cycle co-movements across economies, in particular Latin America, taking into consideration the increased level of global market

integration. Results with the trade variable are presented in Table 10. In this case, we find that the relationship between trade and correlations is also positive and significant; however, the coefficient for trade is small. From an economic standpoint, we would expect the coefficient of trade to be small as RQI and GPI and correlations are indexes, whereas trade figures are expressed as total of exports and imports as proportion of GDP. Variations in RQI were small. As such, we divided the data based on RQI into four-quarters to re-estimate the ARDL models to see if the results for each of the quartiles were different. This analysis based on quartiles is presented in Appendix A. The notable difference is the relatively low significant result for GPI for the 3rd quartile (significant at 10% level) with the GDP per capita and fourth quartile with trade control variable (significant at 5% level). RQI was consistently significant at 1% level in all quartiles; however, the overall findings do not change.

7. Concluding Remarks

Our study was motivated by the lack of understanding of impact of RQ and GP on financial markets and the economy. By answering the question, "Does regulatory quality and global power positively influence stock market correlations overtime?" we filled the research gap in the literature on the impact of RQ and GP on market integration. This is the first study to develop such a theoretical relationship between RQ, GP, and market integration. We provide empirical evidence for this theoretical relationship using a selected number of markets from the G20 countries. Findings from our study enabled us to understand the factors that drive changes in time varying correlations. Previously, changes in market integration have been looked at from a financial market perspective and or from a consideration of macroeconomic factors. The impact of RQ and GP was not looked at from the standpoint of market integration.

Research in time varying correlations, thus far, has implicitly assumed that the changes in correlations among market pairs are caused by the changes in the volatility of the underlying market pairs; however, the literature in this area does not adequately address the reasons for the changes in relative risk (underlying volatility) of these markets. Our study specifically provides a theoretical argument to establish the relationship between RQ, GP, and the intermediary variables that feed into the risk premium and returns of the underlying markets. The changes in risk premium in the underlying markets may cause changes in relative returns of the markets, thus changing the co-movements over time. RQ and GP also have the potential to influence the overall returns of the markets without influencing the risk premia thereby influencing the co-movements of the markets.

Time varying correlations have been estimated from the returns of the stock markets using Cappiello et al.'s (2006) ADCC GARCH model. We estimated scaled correlation indexes for each of the stock markets with other stock markets in the study. The correlation indexes were used as a dependent variable in the panel regression. Independent variables include RQI, GPI, EDU, ENV, and GDP per capita. We also used trade as an alternative control variable in the model.

Based on panel unit root tests with cross-sectional dependence, we used the ARDL model for our analysis. Our estimated results support the hypothesis that RQ and GP have a positive impact on the correlations of the stock markets. The coefficients of RQI and GPI are statistically significant. Similarly, the coefficient of RQI and GPI are positive when trade is included as an alternative variable to account for common factors that can influence stock returns.

The estimated coefficients for other variables education and environment were statistically significant and the magnitude of the estimated coefficients for control variables were found to be very small. This suggests that the relationship may not be economically

significant. We did not have an *a priori* expectations of the direction of the impact of environmental awareness variable (ENV), education (EDU) and GDP per capita, on correlations. The results suggest that environmental awareness has a negative relationship. It may be because environmentally aware people may focus more on local factors thus affecting correlations negatively.

Findings of the study make important contribution to the understanding of the factors that cause changes in integration of the stock markets over time. Our findings are similar to Gupta et al (2024) who find GP to positively influence stock market convergence over time in a group of 11 markets among G20 economies. The findings of the study have important implications for practitioners who seek investment opportunities around the world. RQ and GP are important factors to consider when making any investment decisions as they influence the changes in policies and investment behaviour. For example, a portfolio manager from a market with a strong GP or RQ who seeks diversification benefits is less likely to benefit from diversifying into markets that have stronger and increasing GP or stronger RQ. Collectively investors from stronger markets will benefit from investing into markets with weaker GP and weaker RQ. Our findings also have implications for policymakers who seek to develop policies that are conducive to future investments. Policymakers need to be mindful of the impact of the policies on market integration when negotiating trade policies in bilateral and multilateral trade negotiations.

The shortcomings in our study begin with the data time period availability. Stock market data is generally available on a daily, weekly, and monthly frequency basis (we used monthly data for stock prices) but data for other variables was only available on a quarterly or annual basis except for data for GPI and RQI, that is, only available on an annual basis. Secondly, due to the unavailability of data for certain markets, we had to eliminate two markets and work with only 17 markets. Finally, some of the unique differences in pairwise

correlations were lost in the construction of scaled indexes. The benefit of index construction is that we can draw conclusions for the global markets, which would not be possible otherwise; however, these shortcomings should not cause problems in drawing conclusions for this study. These 17 markets give a good representation of the G20 markets. The construction of indexes enables analysis in a broader context, and we can estimate cross-country relationships over a length of time. Twenty-seven years of data provided a sufficient window of time for our analysis and the conclusions drawn to be valid.

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Appendix A: Panel ARDL Estimation Results for quartiles (Dependent variable = Corr)

Table A1: Panel ARDL Estimation for 1st Quartile with GDP per capita

Variable (1)	Estimates (2)	P-value (3)	Variable (4)	Estimate (5)	P-value (6)
Long-run			Short-run		
RQI	0.009	0.000	D(RQI)	-0.009	0.172
GPI	-1.548	0.000	D(GPI)	32.893	0.027
ENV	0.013	0.1759	D(ENV)	-0.014	0.057
EDU	-0.006	0.013	D(EDU)	-0.002	0.581
GDP	-1.09E-06	0.638	D(GDP)	7.68E-07	0.680
Error correction term	-0.442 (0.031)				

Note: Statistical significance for error correction term is given in the parenthesis. For all other coefficients it is in columns 3 and 6 labelled as p-value.

Table A2: Panel ARDL Estimation for 1st Quartile with Trade

Variable (1)	Estimates (2)	P-value (3)	Variable (4)	Estimate (5)	P-value (6)
Long-run			Short-run		
RQI	0.010	0.000	D(RQI	-0.010	0.121
GPI	-1.766	0.000	D(GPI)	25.614	0.114
ENV	0.019	0.022	D(ENV)	0.010	0.409
EDU	-0.008	0.000	D(EDU)	0.001	0.291
TRADE	0.001	0.618	D(TRADE)	-0.002	0.212
Error correction term	-0.353 (0.036)				

Note: Statistical significance for error correction term is given in the parenthesis. For all other coefficients it is in columns 3 and 6 labelled as p-value.

Variable (1)	Estimates (2)	P-value (3)	Variable (4)	Estimate (5)	P-value (6)
Long-run			Short-run		
RQI	0.001	0.070	D(RQI)	-0.008	0.002
GPI	0.784	0.424	D(GPI)	13.052	0.155
ENV	-0.0129	0.000	D(ENV)	-0.024	0.431
EDU	0.001	0.2742	D(EDU)	0.000	0.984
GDP	-2.14E-06	0.011	D(GDP)	-2.59E-06	0.386
Error correction term	-0.893 (0.001)				

Table A3: Panel ARDL Estimation for 2nd Quartile with GDP per capita

Note: Statistical significance for error correction term is given in the parenthesis. For all other coefficients it is in columns 3 and 6 labelled as p-value.

Table A4: Panel ARDL Estimation for 2nd Quartile with Trade

Variable (1)	Estimates (2)	P-value (3)	Variable (4)	Estimate (5)	P-value (6)
Long-run			Short-run		
RQI	0.007	0.000	D(RQI	-0.009	0.000
GPI	3.050	0.000	D(GPI)	-6.338	0.662
ENV	-0.028	0.000	D(ENV)	-0.012	0.822
EDU	-0.002	0.007	D(EDU)	-0.011	0.074
TRADE	0.001	0.032	D(TRADE)	0.001	0.771
Error correction term	-0.762 (0.004)				

Note: Statistical significance for error correction term is given in the parenthesis. For all other coefficients it is in columns 3 and 6 labelled as p-value.

Table A5: Panel ARDL Estimation for 3rd Quartile with GDP per capita

Variable (1)	Estimates (2)	P-value (3)	Variable (4)	Estimate (5)	P-value (6)
Long-run			Short-run		
RQI	0.005	0.000	D(RQI)	-0.004	0.098
GPI	5.917	0.070	D(GPI)	-53.204	0.590
ENV	0.011	0.376	D(ENV)	-0.105	0.021
EDU	3.29E-04	0.418	D(EDU)	-0.024	0.042
GDP	-9.10E-06	0.006	D(GDP)	4.45E-06	0.569
Error correction term	-0.916 (0.077)				

Note: Statistical significance for error correction term is given in the parenthesis. For all other coefficients it is in columns 3 and 6 labelled as p-value.

Table A6: Panel ARDL Estimation for 3rd Quartile with Trade

Variable (1)	Estimates (2)	P-value (3)	Variable (4)	Estimate (5)	P-value (6)
Long-run			Short-run		
RQI	0.018	0.000	D(RQI	-0.009	0.208
GPI	-91.124	0.000	D(GPI)	101.875	0.285
ENV	-0.201	0.000	D(ENV)	-0.050	0.337
EDU	0.002	0.0072	D(EDU)	-0.031	0.029
TRADE	0.026	0.000	D(TRADE)	0.011	0.161
Error correction term	-0.214 (0.180)				

Note: Statistical significance for error correction term is given in the parenthesis. For all other coefficients it is in columns 3 and 6 labelled as p-value.

Table A7: Panel ARDL Estimation for 4th Quartile with GDP per capita

Variable (1)	Estimates (2)	P-value (3)	Variable (4)	Estimate (5)	P-value (6)
Long-run			Short-run		
RQI	0.004	0.000	D(RQI)	-0.001	0.7988
GPI	15.807	0.000	D(GPI)	123.221	0.291
ENV	0.010	0.032	D(ENV)	-0.035	0.824
EDU	0.004	0.043	D(EDU)	-0.022	0.001
GDP	-1.94E-05	0.000	D(GDP)	-1.91E-04	0.221
Error correction term	-0.423 (0.497)				

Note: Statistical significance for error correction term is given in the parenthesis. For all other coefficients it is in columns 3 and 6 labelled as p-value.

Table A8: Panel ARDL Estimation for 4th Quartile with Trade

Variable (1)	Estimates (2)	P-value (3)	Variable (4)	Estimate (5)	P-value (6)
Long-run			Short-run		
RQI	0.016	0.000	D(RQI	-0.004	0.472
GPI	-2.092	0.034	D(GPI)	-20.149	0.498
ENV	0.404	0.000	D(ENV)	-0.091	0.577
EDU	-0.028	0.000	D(EDU)	-0.008	0.600
TRADE	-0.001	0.397	D(TRADE)	0.001	0.723
Error correction term	-0.476 (0.031)				

Note: Statistical significance for error correction term is given in the parenthesis. For all other coefficients it is in columns 3 and 6 labelled as p-value.

Variable	Quantile (25%)	Quantile (50%)	Quantile (75%)
RQI	0.004 (0.000)	0.003 (0.000)	0.004 (0.000)
GPI	-0.866 (0.000)	-1.117 (0.000)	-1.309 (0.000)
ENV	-0.009 (0.000)	-0.005 (0.001)	-0.006 (0.001)
EDU	-7.58E-04 (0.017)	-8.13E-04 (0.000)	-0.001 (0.000)
GDP	-7.87E-07 (0.158)	-6.13E-07 (0.300)	1.02E-07 (0.900)

Appendix B: Quantile Regression results with GDP per capita (Dependent variable =Corr)

Note: Statistical significance is given in the parenthesis.

Appendix C: Quantile Regression results with Trade variable (Dependent variable =Corr)

Variable	Quantile (25%)	Quantile (50%)	Quantile (75%)
RQI	0.003 (0.000)	0.003 (0.000)	0.003 (0.000)
GPI	-0.914 (0.000)	-1.096 (0.000)	-1.259 (0.000)
ENV	-0.008 (0.000)	-0.004 (0.005)	-0.003 (0.143)
EDU	-7.68E-04 (0.005)	-0.001 (0.000)	-0.001 (0.000)
TRADE	5.10E-04 (0.176)	6.07E-04 (0.065)	0.001 (0.002)

Note: Statistical significance is given in the parenthesis.