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# Heterogeneous Dependence Between Green Finance and Cryptocurrency Markets: New Insights from Time-Frequency Analysis

**Nguyen Mau Ba Dang***

**Abstract:** Green finance is becoming more and more important as a way to fund environmentally friendly initiatives and lower carbon emissions. Green bonds have emerged as a significant financing tool in this context, and it is critical to understand how they interact with other components of the finance ecosystem, such as cryptocurrency and carbon markets, particularly during recent crises such as the COVID-19 outbreak and the Ukraine invasion. This study aims to empirically investigate the lead-lag associations between major cryptocurrency markets and green finance measured in terms of green bonds. For empirical estimation, the wavelet analysis and spectral Granger-causality test are employed to analyze the daily data, covering the period from 2018 to 2023. The results show that the correlation between the returns of the green bond market and cryptocurrencies is not stable over time, which rises from the short- to long-run horizon. However, the co-movements between these assets tend to be different and, in some cases, strong, especially during recent crises. Furthermore, the Granger causality test demonstrates the existence of a bi-directional causality between the prices of the cryptocurrencies and green bonds. These findings have significance for portfolio managers, investors, and researchers interested in investing strategies and portfolio allocation, suggesting that green markets may be used as a hedge and diversification tool for cryptocurrencies in the future.

**Keywords:** green bonds; cryptocurrencies; wavelet analysis; causality.

**JEL classification:** G10; G11; G15.

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## 1. INTRODUCTION

Climate change has become one of the most severe concerns confronting the world in recent decades, necessitating a worldwide agenda for green and sustainable development in the future (Gozgor and Karakas, 2023; Thi Xuan and Thai Hung, 2024). The question of whether green bonds would be used as a method of hedging in the context of financial risk management has grown increasingly relevant as their popularity in the financial markets grows (Udeagha and Muchapondwa, 2023). Since the introduction of this new way of banking and investing, public interest in crypto currencies has grown significantly. Due to their success and ability to diversify, cryptocurrencies have drawn in investors from all around the world (Patel *et al.*, 2023). Since then, there has been a growing interest in investigating the influence these financial innovations have on the global environment in the direction of a climate-resilient economy (Ye *et al.*, 2023).

Institutional and individual investors can also diversify their portfolios with green bonds and cryptocurrencies (Yadav *et al.*, 2023a). The need for safe haven securities and the diversification of portfolios have long been important elements of investment strategy. Among the alternative investments are cryptocurrencies and green bonds (Hung, 2023; Ul Haq *et al.*, 2023; Ye *et al.*, 2023). Investors and portfolio managers utilize these investment alternatives for hedging to lower risk due to their safe haven features. This paper examines the lead-lag relationship between green bonds and the main cryptocurrency markets in light of the increased demand for environmentally conscious investments in financial markets and the need to allocate financial resources for green initiatives.

Our motivation is that participants in cryptocurrency and sustainable financial markets have a variety of investment horizons and goals, which necessitates not only differentiating between social and financial returns due to environmental effects but also using a wavelet analysis to draw conclusions in a time-frequency space. The scholarly research on hedging shows potential distinctions between traditional cryptocurrencies. Additionally, during the past five years, the hedging and diversification functions of Bitcoin and other cryptocurrencies have grown (Ren and Lucey, 2022; Ye *et al.*, 2023); nevertheless, the hedging and diversification functions of green bonds with sustainable cryptocurrencies are still underutilized (Ye *et al.*, 2023; Zhang and Umair, 2023). We examine the leading and lagging roles of all asset types to answer these concerns.

To the best of our knowledge, no prior articles have looked at the intercorrelation and co-movement between crypto markets and green bonds, despite the fact that many studies have looked at the relationship between green and conventional financial markets, such as the stock, energy, and precious metals markets (Arfaoui *et al.*, 2023; Huang *et al.*, 2023; Lee *et al.*, 2023). This study attempts to address a gap in the literature by analyzing the interplay between green markets and the key cryptocurrencies (Ethereum - ETH, Bitcoin cash - BCH, Ripple - XRP, Bitcoin - BIT, and Ethereum Operating System - EOS) in recent crises (COVID-19 outbreak and the Ukraine invasion).

Accordingly, this study explores the causal causality and lead-lag linkage between the green bond market and cryptocurrency indices using a time-frequency analysis. The primary goal of this study is to determine differences in the pattern of the green-crypto nexus over recent crises (the COVID-19 pandemic and the Russia-Ukraine war) and to give a clear picture of the complex, time-varying, and multiscale relationships of green bond markets and cryptocurrencies. Hence, the current work investigates the multiscale links between the green

bond index and the cryptocurrency markets. Our research provides straightforward insights into the financial implications of introducing green bonds, as well as the possible advantages they offer over other green financial vehicles. Therefore, we contribute to new strands of literature on green bond markets by investing in their relationship with key cryptocurrencies.

This article contributes to the related literature in several ways. Firstly, the present study expands understanding by examining the dynamic co-movements between cryptocurrencies and green financial instruments within the context of sustainable finance. Prior studies have concentrated on traditional cryptocurrencies, which is consistent with increased environmental and financial concerns in the presence of particular and ambiguous shocks – that is, the COVID-19 pandemic and the Ukraine invasion. Secondly, the co-movements of green bonds and cryptocurrencies are time-dependently analyzed in the study. Instead of passive investors, who are more concerned with the long-term success of their portfolios, active investors, like huge investment banks, are more focused on the short term. Investors from various groups, therefore, have various risk management. A simultaneous evaluation of the strength of co-movements across various frequencies and the size of this strength over time is possible thanks to the wavelet analysis. We therefore use wavelet techniques in this investigation, more specifically continuous wavelet transformation and wavelet coherence. The evaluation of the time-varying co-movement among the researched variables is made possible by the wavelet coherence and cross-wavelet plots. We also check the robustness of the results using spectral Granger causality test. Thirdly, this study improves our understanding of the interplay of sustainable investment markets by taking into account the specific dynamics and intercorrelations among these financial factors. It also helps to provide a more sophisticated understanding of portfolio diversification, risk management, and investment strategies in the context of sustainable finance.

The research is divided into five sections: Section 2 presents the related literature. Section 3 represents methodology and Section 4 the data. Section 5 shows the empirical results. Section 6 concludes the study.

## 2. LITERATURE REVIEW

Many studies have previously looked at the cryptocurrency markets from different perspectives, including their function as hedges (Gozgor and Karakas, 2023; Yadav *et al.*, 2023a), safe havens (Ren and Lucey, 2022; Huang *et al.*, 2023; Yadav *et al.*, 2023b), particularly during the COVID-19 crisis (Sharif *et al.*, 2023), and diversification from conventional financial markets (Abakah *et al.*, 2023; Patel *et al.*, 2023). Due to the significant energy use involved in most of the cryptocurrency mining and transactions, traditional energy assets have been frequently taken into account in the literature that currently exists on the relationship between cryptocurrencies and other assets. Although the green energy sector has grown significantly in recent years, little research has been done on the relationship between cryptocurrencies and the green energy markets (Sharif *et al.*, 2023).

Despite the fact that the green market has seen a significant increase in recent years, there has been little literature on the relationship between green markets and cryptocurrencies. Siddique *et al.* (2023) examine the relationship between cryptocurrency, carbon, and green markets using TVP-VAR approach and provide evidence of strong intra-class connectedness clusters with little interconnectedness among the markets. Similar findings are made by Zhang and Umair (2023), who also find important dynamic spillover effects between carbon markets

and renewable energy stocks as well as between green bonds and renewable energy stocks. As per Gozgor and Karakas (2023), the returns on US Treasury bonds and the US dollar are inversely correlated with the returns on green bonds.

The impact of green bonds on cryptocurrency markets was heavily debated during the COVID-19 and Ukraine invasions. For example, Huang *et al.* (2023) use a TVP-VAR model to investigate the dynamic interlinkages between green markets and Bitcoin during the COVID-19 outbreak. The authors put forward the idea that green assets will continue to serve as an efficient hedge for Bitcoin regardless of the pandemic. Arfaoui *et al.* (2023) document that green bonds have the least integration with other financial markets, which points to their importance in helping investors diversify their portfolios. For the American, European, and Asian markets, Sharif *et al.* (2023) examine the intercorrelations and spillover effects between green economy indices, five clean cryptocurrencies, and five black cryptocurrencies. They show that, compared to dirty cryptocurrencies, the overall correlation between green economic indices and clean cryptocurrencies is higher. According to Ul Haq *et al.* (2023), there will be a moderate short-term (positive) and long-term (negative) co-movement between the markets for green bonds and sustainable cryptocurrency. Ye *et al.* (2023) look into the role of asymmetries in identifying the association between blockchain technology and green investment in the global environment. They show that assuming symmetric and weak coherence relationships between blockchain technology and green investment in the global environment leads to biased and misleading findings that do not reflect the real-world scenario.

While the available research has yet to identify obvious linkages between crypto markets, green investments, and sustainable equity, their nexus can be seen in a number of studies. Using Granger-causality in quantiles, Lee *et al.* (2023) investigate the heterogeneous causal linkages among cryptocurrencies, green bonds, and sustainable stocks and propose that the three investing tools interact under different market conditions. The findings indicate a high tail dependence between green bonds, sustainable stocks, and cryptocurrency. Patel *et al.* (2023) investigate the spillovers between Green-Dirty cryptocurrencies and socially responsible investments during the war in Ukraine and demonstrate that the magnitude of spillovers and relative roles of each cryptocurrency and socially responsible investments change during the war. Based on the rolling window wavelet correlation and QVAR models, Abakah *et al.* (2023) point out that the blockchain market has considerable adverse effects on the environment that could cause financial assets that support the ecosystem to experience shocks. Additionally, they discover a substantial association between the blockchain market and green financial assets during the Russia-Ukraine war and the COVID-19 epidemic, and a low correlation between the two before the emergence of the disease. Similarly, Yadav *et al.* (2023a) explore the nexus between the green bond, energy, crypto, and carbon markets. It was discovered that Bitcoin has the least connectivity compared to other asset classes, whereas the energy market has the best connectivity. The authors also came to the conclusion that there is more short-term diversity potential than medium- and long-term diversity among green bonds, energy stocks, bitcoin, and the carbon markets. Furthermore, Ye *et al.* (2023) examine the impact of asymmetries in influencing the relationship between blockchain and green investment and conclude that there is an asymmetric relationship between crypto currency and biofuel usage in the short and long run. Udeagha and Muchapondwa (2023) look at how economic development impacts green finance and financial technology for the BRICS countries and reach the same finding that environmental sustainability is enhanced by green finance. Yadav *et al.* (2023b) demonstrate the prevalence of long-run spillovers from green

bonds to renewable energy and the cryptocurrency market. The findings of Lorente *et al.* (2023) reveal that the green bond and clean energy markets are inversely related to the GPR at the extreme 10th and 90th quantiles.

Although a definite association between green bonds and cryptocurrencies has not yet been established in the literature, there are hints of such a relationship in a number of research. A substantial body of literature points to significant linkages between cryptocurrencies and other assets in terms of tail dependency (Siddique *et al.*, 2023), return and volatility spillover effects (Abakah *et al.*, 2023; Lorente *et al.*, 2023), and linear correlation (Lee *et al.*, 2023). Furthermore, although time-frequency connections are minimal, Urom (2023) and Ye *et al.* (2023) report that there exist symmetry and asymmetry in shocks between green bonds and financial asset classes, such as foreign currency markets, equities, commodities, and cryptocurrencies. From this, it can be speculated that a time-frequency impact exists between green bonds and cryptocurrencies, and we conduct our research using wavelet analysis and the spectral Granger causality test. Put differently, the body of knowledge regarding the connection between green bond markets and cryptocurrency markets is rapidly expanding. Prior research, however, says nothing about examining the time-frequency characteristics of this nexus. As a result, this article aims to close the gap in the existing literature.

## 3. METHODOLOGY

Cross wavelet transform (XWT), wavelet coherence (WTC) are utilized in this work to show how the domestic variance and covariance of two examined variables change in time-frequency space, as well as the lead-lag interactions between them. The majority of studies use traditional statistical approaches to investigate how green bonds connect to cryptocurrency assets (Husain *et al.*, 2023; Almeida *et al.*, 2024). Nevertheless, these methods presume that the distribution parameters remain the same throughout time, which may not represent the dynamic nature of these connections (Hung, 2022b; Ul Haq *et al.*, 2023). Participants in the financial market come in several forms, each with their own investment time horizons, such as short-term traders and long-term investors (Arif *et al.*, 2021). Using a wavelet method, our study addresses these issues (Almeida *et al.*, 2024). This approach preserves the temporal component while enabling the analysis of non-linear behavior at different frequencies and time scales. The wavelet approach has a number of benefits, such as its robustness to shocks, being applicable to non-stationary data, and being able to show the link between time series on a single graph in both the time and frequency domains (Almeida *et al.*, 2024). Additionally, it allows the investigation of Granger causality over a range of frequencies and time scales and captures the strength of co-movement (Almeida *et al.*, 2024). These advanced econometric techniques have been employed in various fields of knowledge, including in finance. As a result, we employ the wavelet analysis in accordance with previous research (Arif *et al.*, 2021; Hung, 2022a, 2022b; Husain *et al.*, 2023; Ul Haq *et al.*, 2023) and in the context of our study, given that the linkages between different markets may vary across time and frequency. This section provides a quick overview of wavelet techniques.

*Continuous wavelet transform (XWT)*

$W_x(s)$ denotes the XWT which allows us to estimate the joint behavior of time series for both frequency and time. The wavelet is given as:

$$W_x(s) = \int_{-\infty}^{\infty} x(t) \frac{1}{\sqrt{s}} \psi^* \left( \frac{t}{s} \right) \quad (1)$$

where * shows the complex conjugate and s is the scale parameter which determines whether the wavelet can detect higher or lower elements of the series $x(t)$, possible when the admissibility condition yields.

*Wavelet coherence*

WTC is efficient in estimating the localized interconnection between indicators in a time and frequency domains. The cross-wavelet of two series $x(t)$ and $y(t)$ can be written as:

$$W_n^{XY}(u,s) = W_n^X(s,\tau) W_n^{Y*}(s,\tau) \quad (2)$$

where the scale is s, u presents the position, and * demonstrates the complex conjugate. The WTC can be written as follows:

$$R_n^2(s,\tau) = \frac{|S\left(s^{-1} W_n^{XY}(s,\tau)\right)|^2)}{S\left(s^{-1}|W_X(s,\tau)|^2\right) S\left(s^{-1}|W_Y(s,\tau)|^2\right)} \quad (3)$$

where S connotes smoothing process for both time and frequency simultaneously. $R_n^2(s,\tau)$ is in the range $0 \leq R^2(s,\tau) \leq 1$.

## 4. DATA

This study aims to explore the time and frequency relationship between green financial instruments and major cryptocurrency markets for daily data from August 1, 2018, to August 30, 2023. The S&P Green Bond Index was used as a proxy to represent green financial instruments (GF). The performance of international green bonds, which finance environmentally friendly projects, is measured by the S&P Green Bond Index (Husain *et al.*, 2023). For cryptocurrencies, we employed five cryptocurrencies, which were gathered from the website www.coindesk.com, are Ethereum (ETH), Bitcoin Cash (BCH), Ripple (XRP), Bitcoin (BIT), and Ethereum Operating System (EOS). Existing studies utilize these markets for green and cryptocurrencies' representations. For details, see: Arif *et al.* (2021), Husain *et al.* (2023), Hung (2023) and Siddique *et al.* (2023).

The daily data for the green bond index is collected from the S&P Global website (https://www.marketplace.spglobal.com/) while cryptocurrencies are extracted from the link www.coindesk.com. We convert index prices into logarithmic first differences as a proxy for returns.

The dynamic prices and returns are shown in Figure no. 1, which provides evidence of fluctuations and volatility clustering in the market under investigation during different timeframes. More importantly, the peaks of prices and volatility can be seen from January 2020 in all markets, suggesting that COVID-19 remarkably impacted the green bond and cryptocurrencies markets.

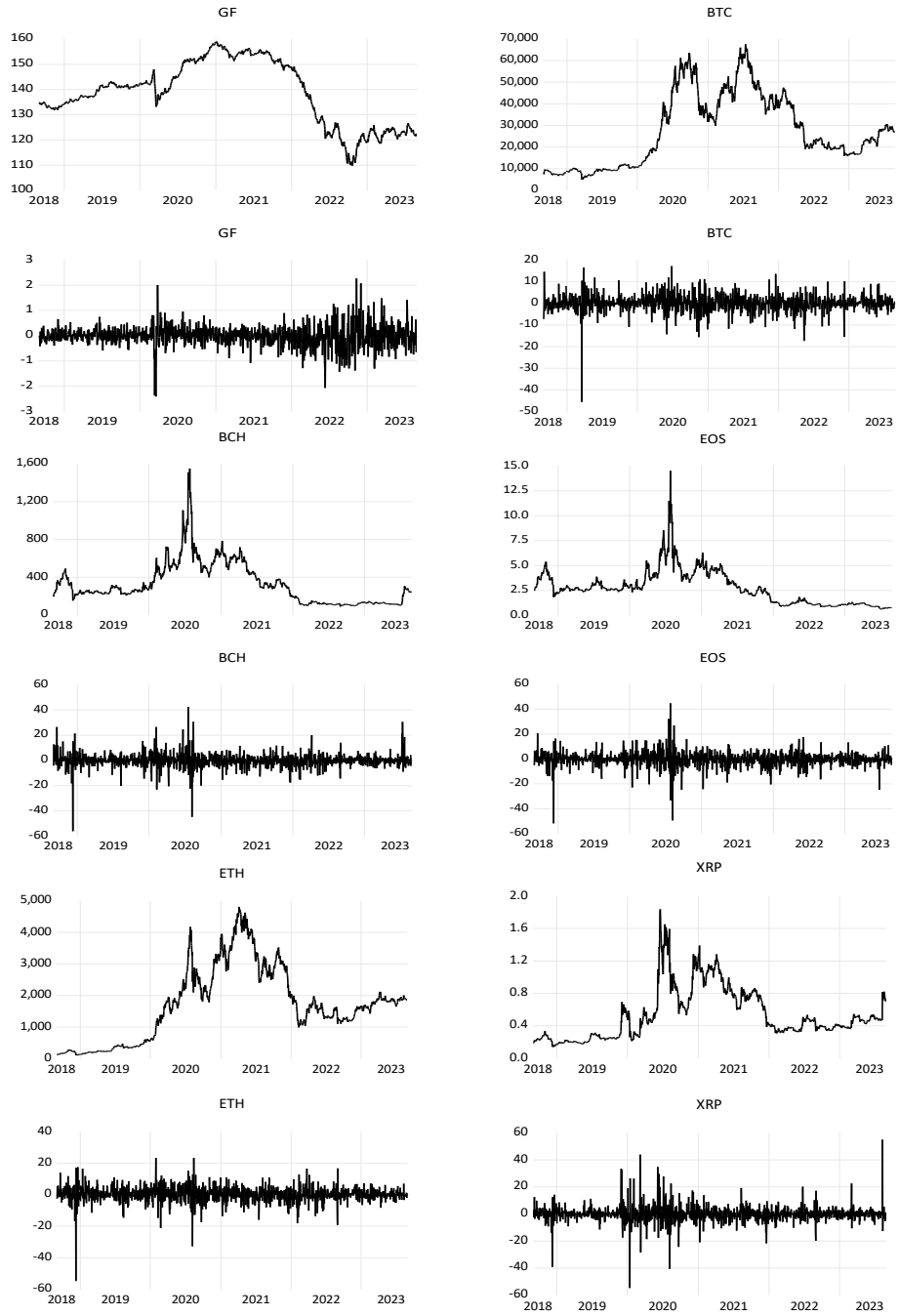



**Figure no. 1 – Daily prices and returns of GF, BTC, BCH, EOS, ETH and XPR market indices**

The descriptive statistics for the return series are represented in Table no. 1. The mean return for all selected cryptocurrencies is positive, while green finance has a negative value during the sample period. According to the standard deviation, BCH, ETH, EOS, and XRP are more volatile than the GF and Bitcoin markets. The coefficients of skewness and kurtosis indicate that all markets have a leptokurtic distribution. In this regard, the findings of the Jarque-Bera test uncover that the examined series do not have a normal distribution. In addition, the ADF unit root test suggests that GF and all cryptocurrency returns are stationary.

**Table no. 1 – Descriptive statistics of sample return data**

| | *GF* | *BTC* | *ETH* | *BCH* | *EOS* | *XRP* |
|---|---|---|---|---|---|---|
| ***Mean*** | -0.007422 | 0.092798 | 0.204377 | 0.012944 | 0.096108 | 0.100785 |
| ***Maximum*** | 2.271737 | 17.19993 | 23.23139 | 42.39830 | 44.72424 | 54.95832 |
| ***Minimum*** | -2.409932 | -45.55871 | -54.70192 | -56.12829 | -51.70109 | -54.74531 |
| ***Std. Dev*** | 0.408307 | 3.733022 | 4.862004 | 5.571933 | 5.873120 | 6.074729 |
| ***Skewness*** | -0.189252 | -1.386594 | -1.357431 | -0.533642 | -0.776129 | 0.425061 |
| ***Kurtosis*** | 7.794214 | 22.09335 | 18.62057 | 19.68429 | 16.70413 | 21.65015 |
| ***Jarque-Bera*** | 1254.681*** | 20194.38*** | 13636.96*** | 15163.12*** | 10319.03*** | 18908.89*** |
| ***ADF*** | -29.89807*** | -38.01121*** | -38.90268*** | -39.71634*** | -41.5688*** | -38.3468*** |

Notes: ADF is the computed statistics of the Augmented Dickey and Fuller unit root test. *** significant at 1%.

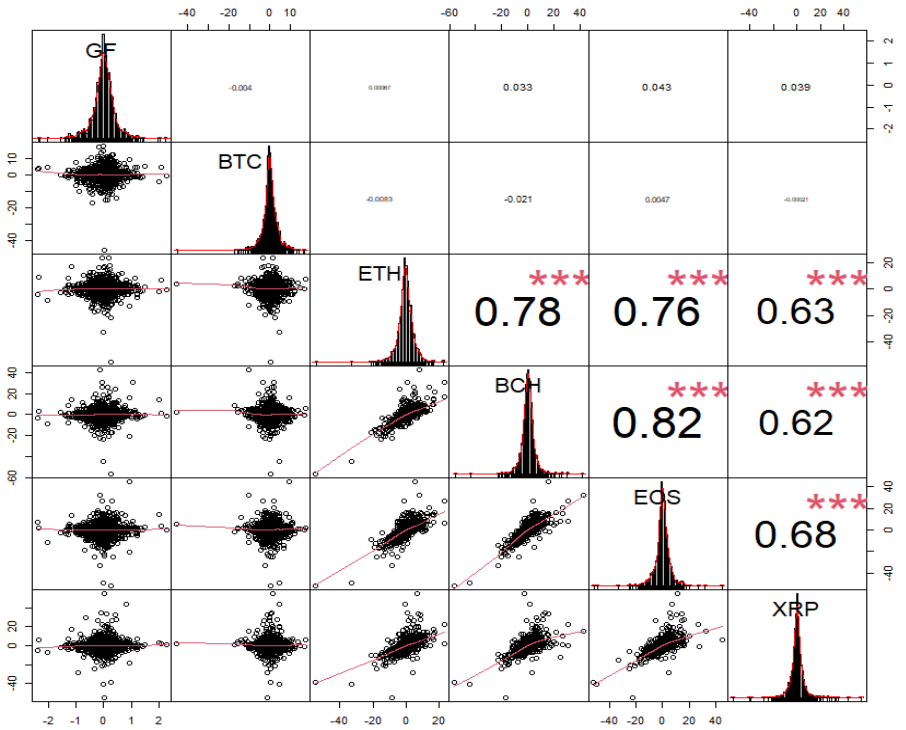



**Figure no. 2 – Correlation plot of the examined variables**

The unconditional correlations between GF and the cryptocurrency markets are reported in Figure no. 2. As shown in Figure no. 2, the linear correlations are significant and high between the cryptocurrency assets, revealing a strong association with others. Nevertheless, GF had no relationship with cryptocurrencies during the sample period. In general, we would demonstrate that no correlation might provide diversification benefits to portfolio holders in cryptocurrencies.

## 5. EMPIRICAL RESULTS

### 5.1 Wavelet Power Spectrum

Figure no. 3 illustrates the wavelet power spectrum of all-time series under consideration. The vertical axis shows frequency, while the horizontal axis denotes time. The color code goes from blue to red, with blue representing low power and red indicating high power. Figure no. 3 shows that these markets have various characteristics at different time frequencies. Specifically, during COVID-19, around 2020, power increased dramatically up to the medium run in the cryptocurrency markets, in particular, BTC and XPR indices. Among them, the first region is from 2019 to 2020, which is mainly affected by the first wave of the COVID-19 crisis. After an increase in power in the short run, there is a significant rise in power in the long run around 2020. This is true for green bond markets, revealing that major cryptocurrency markets are more volatile than GF. An increase in power around 2020 indicates an increase in variation because of the COVID-19 pandemic.

### 5.2 Wavelet coherence

Figure no. 4 shows the cross-wavelet transform (left side) and wavelet coherence (right side) between GF and the selected cryptocurrency markets. The color bar is depicted on the right side of each figure. Blue represents little power, while yellow, reddish yellow, and red represent high, higher, and maximum power, respectively. The power of the wavelet increases with the amount of color density.

Figure no. 4 depicts that with time covering our sample period on the horizontal axis and frequencies on the vertical axis. The areas with heavy shaded contours are significant at the 5% level. Warmer colors (red) indicate places with high significant dependence, whereas colder colors (blue) indicate regions where the two markets are significantly less dependent on one another. The lead-lag phase relationships between the GF and crypto markets are revealed by the phase arrows. Left arrows denote anti-phase, which indicates the opposite, while right arrows denote in-phase, which indicates the co-movement of two markets on a specific scale. The first market leads, as indicated by the right-down or left-up arrows, while the second market leads, as indicated by the right-up or left-down arrows.

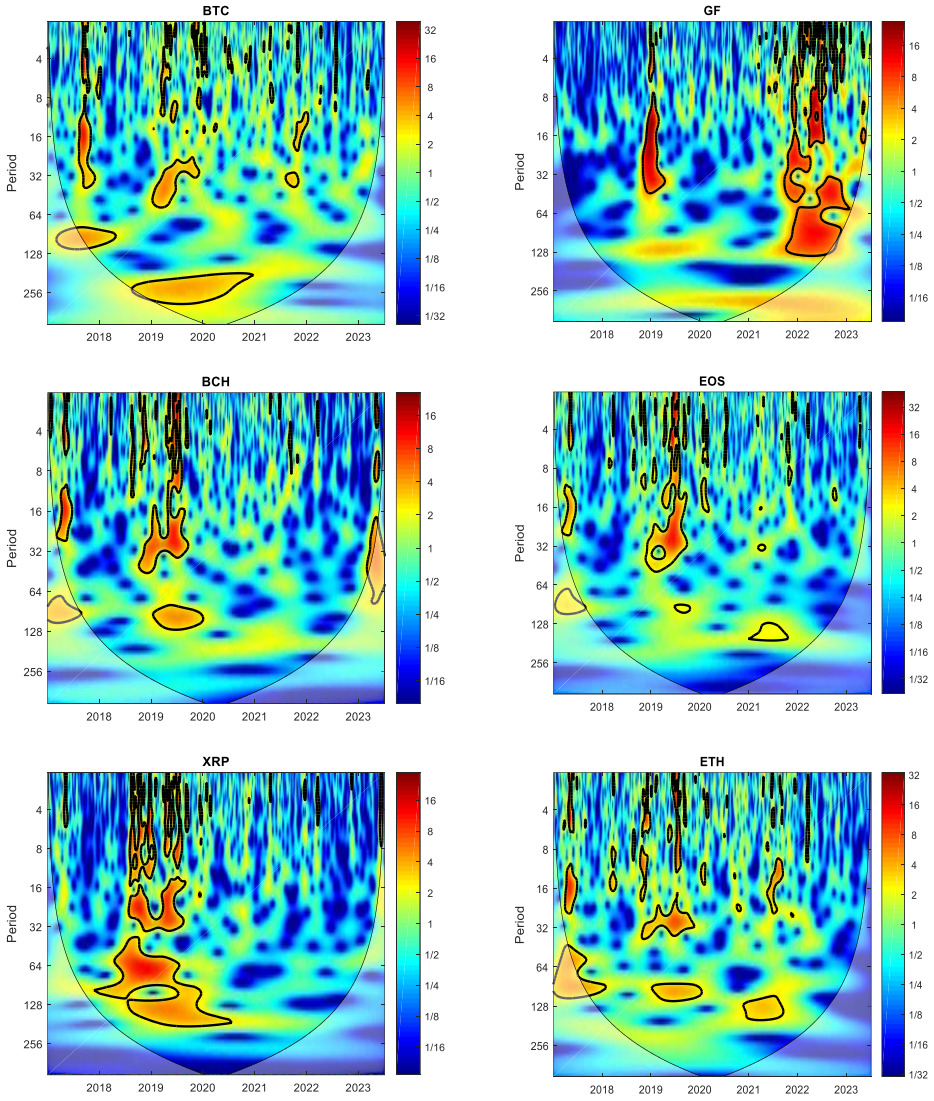
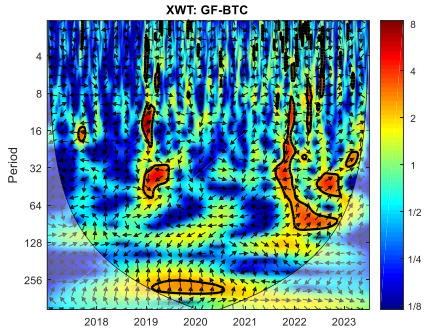



**Figure no. 3 – Wavelet Power Spectrum for the employed variables**


XWT: GF-BTC
Period
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128
256
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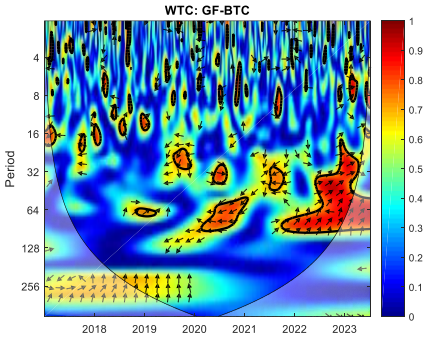
2
1
1/2
1/4
1/8


WTC: GF-BTC
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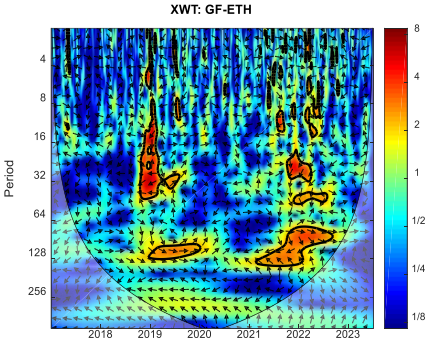
XWT: GF-ETH
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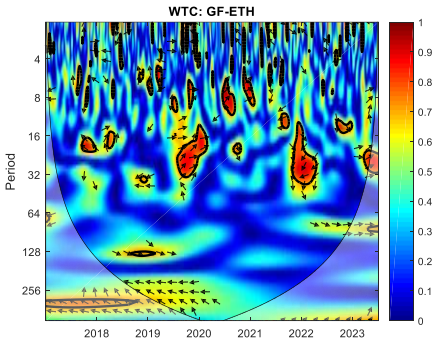
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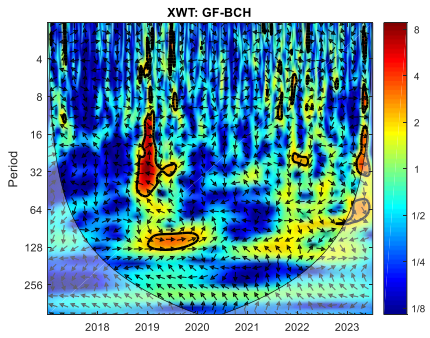
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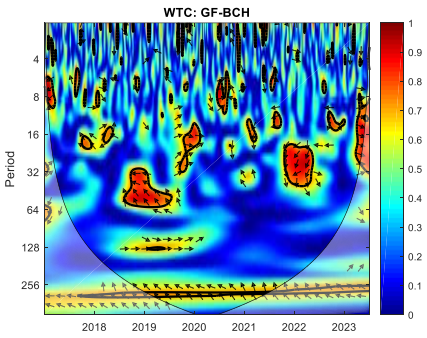
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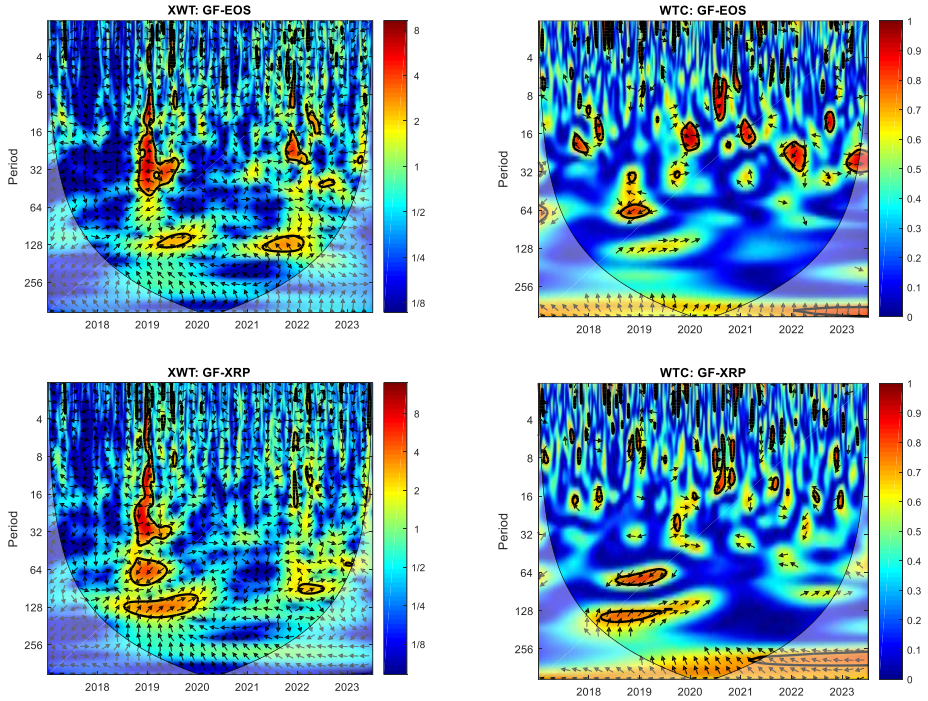



**Cross wavelet transform** **Wavelet coherence**

**Figure no. 4 – The wavelet coherence pairs of GF and cryptocurrencies**

It is worth noting that the direction of the arrows at different scales and across time in Figure no. 4 (cross wavelet transform) differs between the pairs of GF and crypto market returns. Throughout 2019–2020, the green bond and cryptocurrency returns pair exhibits a zone of significant coherency and co-movement at the lower frequency band. XWT systematically explains the popular power of two indicators without normalizing to the single wavelet power spectrum. This can occasionally produce similar outcomes because the jump created in the cross-spectrum, which is a multiplication of the continuous wavelet transformation of two series, cannot be attributed to the nexus between two series if one of the spectra is local and the other one exhibits a very high jump. As a result, we employ wavelet coherence analysis to capture the significant lead-lag interplay between GF and cryptocurrencies in the time-frequency spaces. The findings of wavelet coherence are presented on the right-hand side of Figure no. 4.

In terms of cross-mean effects, we see various narrow and small zones with a high degree of coherence that are spread across the whole analysis period. Most important local dependencies have a propensity to be short-lived, existing within various short-run time scales. Furthermore, the arrows in such places have either a rightward or a leftward trajectory, showing the existence of positive or negative contagion effects between the GF and crypto markets.

The following plot reports the coherency between GF and Bitcoin. Strong coherencies between these variables, where the GF is driven, are mostly localized at the medium and low frequencies, suggesting that there is a long-term association between BTC and GF during the COVID-19 and Russia-Ukraine crises. The arrows pointing right indicate an in-phase nexus

between these variables, revealing a positive relationship during the recent crises in low frequency. However, this relationship is negative from 2018 to 2020 in the short and medium frequencies. These results corroborate the studies of Huang *et al.* (2023) and Arfaoui *et al.* (2023).

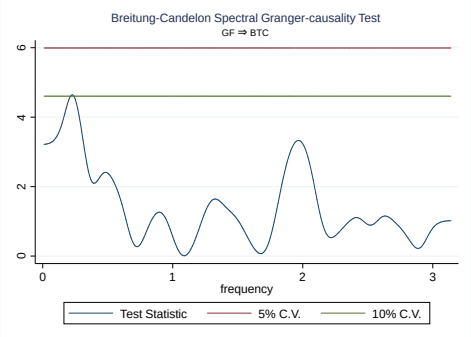
In the case of the GF-BCH pair, red zones are detected, suggesting the existence of a lead-lag nexus between green bond and BCH markets in the medium run. The direction of the arrows is left side down in the 8–16 cycle period in the periods 2018–2019 and 2021–2022, which reveals the negative relationship between the two series. Nevertheless, some in-phase cyclic effects are also visible in this association during 2019–2020 in the long run, a 2-4 cyclic period. Similarly, the wavelet coherence for GF-EOS represents the left side up in the 4–16 cycle period between 2019 and 2023. This indicates an anti-phase cyclic effect led by EOS. By contrast, the in-phase cyclic effect with arrows right side down will occur in 2019 and 2023 in the long run. Overall, it is clearly understood that BCH and EOS have leading effects on GF in the short and medium run during the sample period. BCH and EOS have solid green attributes; they are good hedges, and their prices are significantly impacted by the appreciation and depreciation of the green bond market (Ye *et al.*, 2023).

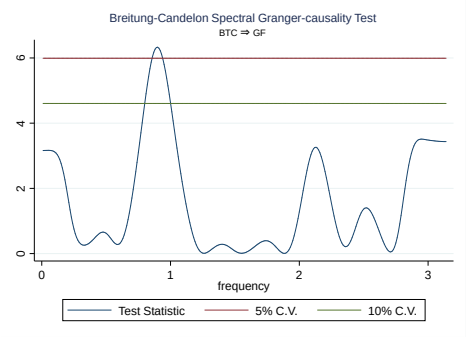
For the GF-ETH pair, we observe strong dependence during 2020–2023 for the frequency of 16–32 days, with arrows pointing to the lower left, which highlights they are anti-phase and ETH is leading. Conversely, significant areas between GF and ETH are also visible during 2019–2020 and 2023, where they are in phase and GF is leading. We note that there is both a negative and positive relationship between GF and ETH in the short, medium, and long run at different time periods. However, these movements are not very strong, in line with the literature (Lee *et al.*, 2023).

It is evident that the GF-XPR pair co-moves in a similar direction in the lower frequency scale, that is, 128–256-day cycles during 2019–2020 and 2021–2023. By contrast, the relationship changes in the opposite direction in the high and medium frequency scales, that is, 8- to 32-day cycles, over the sample period. Overall, we see weak coherence between XRP and GF during the period shown, which implies that XPR provides a chance for diversification. The findings are in agreement with those of Arfaoui *et al.* (2023) and Ye *et al.* (2023).

### 5.3 Robustness check

To validate our estimates, we propose the spectral Granger-causality test of Breitung and Candelon (2006). This approach works well for both stationary and non-stationary time series (Khalfaoui *et al.*, 2022). We chose the best lags for the various VAR models using the Akaike information criterion and the Schwarz Bayesian information criterion. As a result, the optimal lag is 4. In other words, this technique allows us to explore causality tests in the sense of Granger under the frequency domain to capture relationships between GF and cryptocurrency markets. At various frequencies (0-1, 1-2, and 2-3), the causal association between crypto and green bond markets uncovers long, medium, and short term, respectively. Our goals are to highlight the linkages between green bonds and cryptocurrency markets in time and frequency domains; wavelet analysis has yielded findings on these interactions in the short, medium, and long term. As a result, the spectral Granger causality test is used, which can also indicate bidirectional relationships between pairs of time series in different frequencies and time periods, so validating the results of wavelet analysis. The results of the test are depicted in Figure no. 5. The upper line (red) shows a level of significance of 5%, while the bottom line (blue) suggests a level of significance of 10%.


Breitung-Candelon Spectral Granger-causality Test
GF ⇒ BTC
frequency
Test Statistic
5% C.V.
10% C.V.


Breitung-Candelon Spectral Granger-causality Test
BTC ⇒ GF
frequency
Test Statistic
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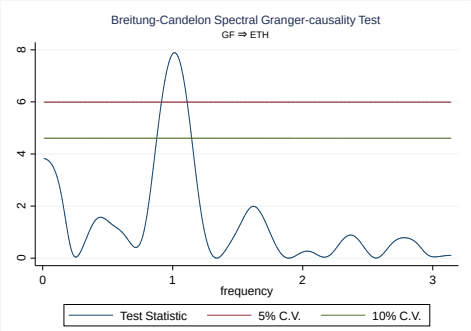
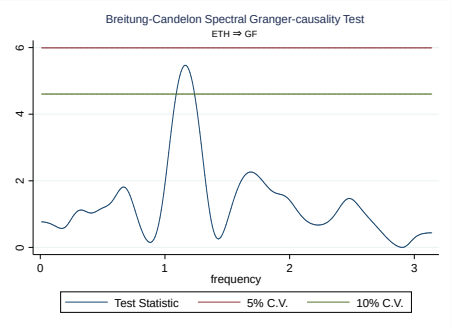
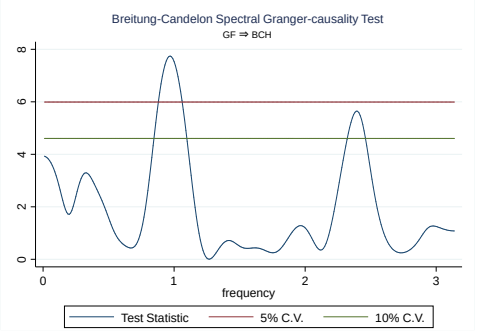
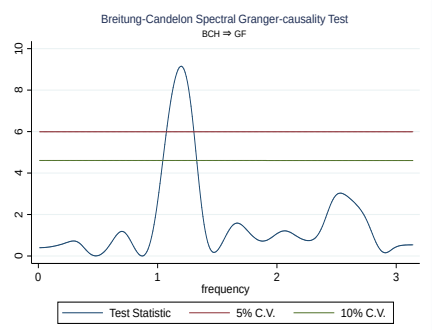
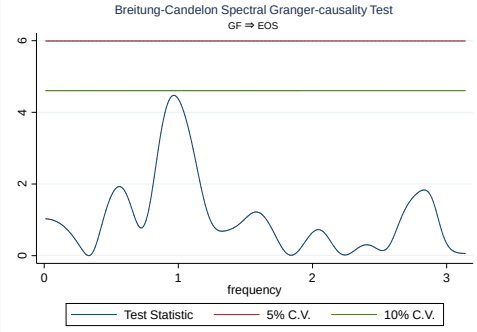

Breitung-Candelon Spectral Granger-causality Test
GF ⇒ ETH
frequency
Test Statistic
5% C.V.
10% C.V.


Breitung-Candelon Spectral Granger-causality Test
ETH ⇒ GF
frequency
Test Statistic
5% C.V.
10% C.V.


Breitung-Candelon Spectral Granger-causality Test
GF ⇒ BCH
frequency
Test Statistic
5% C.V.
10% C.V.


Breitung-Candelon Spectral Granger-causality Test
BCH ⇒ GF
frequency
Test Statistic
5% C.V.
10% C.V.


Breitung-Candelon Spectral Granger-causality Test
GF ⇒ EOS
frequency
Test Statistic
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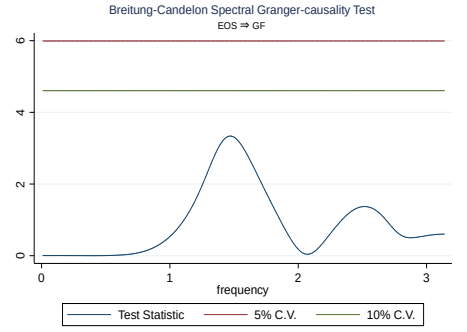
10% C.V.


Breitung-Candelon Spectral Granger-causality Test
EOS ⇒ GF
frequency
Test Statistic
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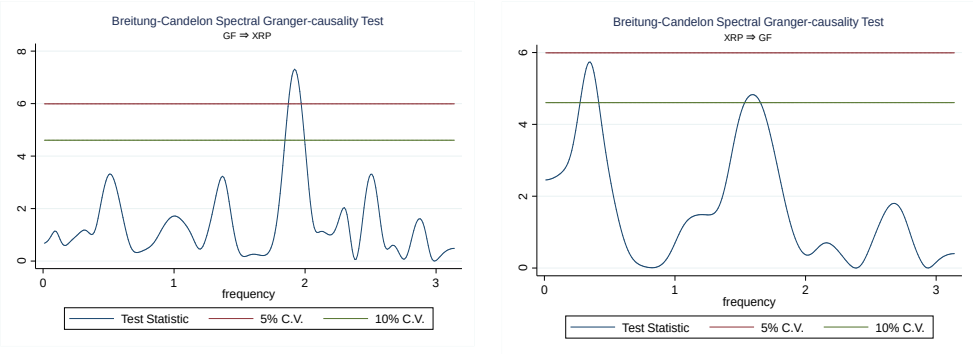


**Figure no. 5 – Breitung-Candelon spectral Granger causality test between GF and cryptocurrency markets**

As indicated in Figure no. 5, it is illustrated that the hypothesis that the crypto markets do not Granger-cause the green bond market can be rejected for high and medium frequencies at a 10% significance level. The outcomes demonstrate that there is a bidirectional causality between GF, BTC, BCH, XPR, and BCH in the short and medium run, except that the EOS does not cause a green bond market. In fact, it is in line with our wavelet analysis that there is a significant lead-lag relationship between GF and cryptocurrency markets in different time and frequency domains.

Overall, our findings indicate the presence of a causal association between variations in GF and changes in cryptocurrency prices using a wavelet technique, as do those of Yadav *et al.* (2023a) and Arfaoui *et al.* (2023), among others. The results of Ye *et al.* (2023), Yadav *et al.* (2023b) and Lee *et al.* (2023) are all in agreement with our findings that there is a bidirectional association between changes in the price of cryptocurrencies and green bond markets. Furthermore, our findings are consistent with existing articles that green markets offer hedging potential and effective diversification for cryptocurrency markets (Abakah *et al.*, 2023). In light of the existing literature (Lorente *et al.*, 2023; Udeagha and Muchapondwa, 2023), the importance of green assets as a hedge can be explained by two underlying factors, namely the process of green economic transformation and the dynamics of production costs. In the context of globally rising energy consumption and CO2 emissions, environmental challenges have pushed the financing of cleaner energy while simultaneously advocating for a green transition of the energy-intensive development mode, including cryptocurrency trading and mining. Despite the existence of active cryptocurrency trading aimed at generating financial gains, green investors would choose to stick with safer investments, resulting in an insignificant or even opposite relationship between the dynamics of the two types of assets (Ren and Lucey, 2022).

Important policy consequences result from understanding the heterogeneous relationship between the markets for green bonds and cryptocurrencies. Our work demonstrates a lead-lag association between price movements in green bonds and cryptocurrencies. Under different market conditions, how green or sustainable investments behave has little impact on how cryptocurrencies behave. We also discover that significant cryptocurrency changes have a negative influence on green bonds. To enhance environmental sustainability through legislation, governments and businesses should take into account the asymmetric nexus between cryptocurrency markets and changes in green bonds. Additionally, governments and businesses can reduce the environmental impact of cryptocurrency use by supporting the

creation of green bonds through regulations that encourage the consumption of clean energy in cryptocurrency mining and trading activities. What is more, green bonds have an asymmetric influence on cryptocurrency values, which governments, corporations, and investors should be aware of in order to consistently incentivize the development of green bonds and ensure environmental sustainability.

## 6. CONCLUSION

Green investments opened a new space in the financial world as a result of the widespread concern over climate change. Many investors are keeping an eye out for green instruments as a source for supporting and promoting sustainability as the SDGs receive greater attention. Previous research revealed that traditional cryptocurrencies might benefit from using green assets as a hedge or safe haven. This empirical study sheds light on the dynamic dependence structure between green financial instruments and major cryptocurrency markets for daily data from August 1, 2018, to August 30, 2023. We use the wavelet analysis and Granger causality frameworks as they highlight the strength, causality direction, and lead-lag nexus between the selected market returns.

Our analysis illustrates that the correlation between the returns of the green bond market and key cryptocurrencies is not stable over time. The intensity of coherence is significant across the time-scale domain, and it rises from the short to the long run. The short-term relationship between GF and crypto markets is weaker than the medium- and long-term effects. However, the co-movements between these assets tend to be different and, in some cases, strong, especially during recent financial crises. Furthermore, the Granger causality test demonstrates the existence of a bi-directional causality between the prices of these cryptocurrencies and green bonds.

Our empirical results provide several key policy implications for different stakeholders, crypto traders, and researchers in terms of hedging strategies and sustainability policy, especially during the recent global crises such as the COVID-19 outbreak and the Ukraine invasion. Based on these outcomes, by considering the diversification benefits of introducing green bond markets, investors and portfolio managers could construct cross-asset hedging strategies. Understanding the relationship between green bonds and cryptocurrencies can help regulators limit the negative consequences of contagion, particularly during extreme risk events. Portfolio managers can reduce downside risk by incorporating responsible investing assets into their portfolios. Our findings would encourage scholars to look into the interconnections of important asset types, which are currently understudied.

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# Tools in Marketing Research: Exploring Emotional Responses to Stimuli

**Ahmed H. Alsharif**[*], **Ahmad Khraiwish**[**]

**Abstract:** Electromyography (EMG), galvanic skin responses (GSR), and electrocardiogram (ECG) tools have been used to investigate emotional responses to marketing stimuli, encompassing advertisements, product packaging, and brand logos. However, despite the widespread application of EMG, GSR, and ECG tools in neuromarketing research, a comprehensive synthesis of their collective impact remains conspicuously absent. Addressing this gap is the primary goal of the present review paper, which systematically scrutinizes recent studies employing EMG, GSR, and ECG to assess emotional responses to marketing stimuli. Employing the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) protocol, relevant articles were meticulously extracted from the Scopus database, spanning the years 2009 to 2022, including twenty articles for detailed analysis. The outcomes of this review underscore the unique insights offered by these tools into emotional reactions, emphasizing that their collective utilization can afford a more comprehensive understanding of these intricate processes. This propels advancements in comprehending the pivotal role of emotions in consumer behavior and serves as a guidepost for future research directions in this burgeoning field. Ultimately, this paper aims to furnish a broad understanding and detailed insights into the current trends within neuromarketing research, specifically employing EMG, GSR, and ECG tools.

**Keywords:** emotional responses; neuromarketing; consumer behavior; EMG; GSR; ECG.

**JEL classification:** M30; M31; M39; O3.

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## 1. INTRODUCTION

While self-report methods have traditionally been used to understand consumer decision-making (Alvino *et al.*, 2020; Alsharif *et al.*, 2021c), recent neuroscience studies have revealed that decision-making primarily occurs in the brain's deep structures, such as the limbic and reptilian layers (Zaltman, 2000). This may explain why consumers often fail to predict their future choices and why their behavior may not align with their reported preferences (Alsharif *et al.*, 2021c). As a result, understanding the mechanisms of decision-making has become a crucial area of interest for researchers and marketers (Vecchiato *et al.*, 2013; Boksem and Smidts, 2015; Alsharif *et al.*, 2020a). To better understand consumer decision-making, marketers have turned to neurophysiological and physiological tools such as GSR, ECG, and EMG (Stanton *et al.*, 2017). This approach, known as "consumer neuroscience" or "neuromarketing," allows marketers to gain insights into consumers' emotional and cognitive responses to marketing stimuli (Pilelienė *et al.*, 2022; Alsharif and Pilelienė, 2023; Alsharif *et al.*, 2023f). While the usage of physiological tools has increased in recent years, there is still much to learn about how they can be applied to improve marketing strategies (Alsharif *et al.*, 2022e). For example, more research is needed to understand how these tools can accurately predict consumer behavior and preferences. Additionally, ethical considerations must be considered when using these tools, as they may involve collecting sensitive data about consumers (Stanton *et al.*, 2017; Alsharif *et al.*, 2022c; Alsharif *et al.*, 2023c).

The neuromarketing concept is connected to brain activities to understand consumers' subconscious and unconscious responses (Alsharif *et al.*, 2023a). Although "neuromarketing" emerged in 2002, some companies, such as Pepsi Co., used neurophysiological and physiological technology before 2002 to solve marketing issues (Cherubino *et al.*, 2019; Alsharif *et al.*, 2021b). Therefore, neuromarketing is defined as applying neurophysiological and physiological technology to better understand customers' behavior toward stimuli of the marketing environments (Plassmann *et al.*, 2015; Alsharif *et al.*, 2022d). For example, neurophysiological tools such as fMRI and EEG can measure the neural correlates of customers' behaviors, such as decision-making, emotions, attention, and memory, to the marketing environment (Alsharif *et al.*, 2022e). On the other side, physiological tools such as EMG, GSR, and ECG enable the measurement of customers' emotional responses toward brands, ads, or even packaging features of a brand (Cherubino *et al.*, 2019; Alsharif *et al.*, 2021d).

This scholarly paper aims to shed light on the pivotal role of EMG, GSR, and ECG tools in unraveling customers' emotional responses towards marketing stimuli. By leveraging the capabilities of EMG, researchers can capture both visible and invisible facial muscle movements, providing valuable insights into emotional expressions (Lang *et al.*, 1995; Bolls *et al.*, 2001; Larsen *et al.*, 2003). Similarly, GSR allows for measuring autonomic nervous system excitement in response to marketing stimuli, while ECG records heartbeat activations during exposure to such stimuli. Together, these tools enable the measurement of emotional responses, encompassing dimensions like pleasure/displeasure, excitement, and arousal, towards various marketing stimuli, including brands and advertisements (Missaglia *et al.*, 2017; Alsharif *et al.*, 2023b). Given the significance of measuring emotions and feelings in the marketing environment, this paper addresses the existing gap in the literature by focusing on GSR, EMG, and ECG and providing an up-to-date overview of these tools. It further delves into an extensive discussion of relevant articles that have employed these tools in

neuromarketing studies. Therefore, the primary contributions of this review paper can be summarized as follows:

(1) Investigating how the theoretical foundations of EMG, GSR, and ECG contribute to a more profound understanding of customer emotions in marketing research.

(2) Exploring the insights and findings derived from studies employing EMG, GSR, and ECG to measure emotional responses to various marketing stimuli, including brands, advertisements, and products.

(3) Gaining insights into effectively using EMG, GSR, and ECG through new references, assisting scholars in expanding knowledge and expertise in this domain.

Accordingly, three research questions were established to justify the structure and to gain the full view of the existing scientific research in the analyzed domain:

(1) How do EMG, GSR, and ECG theoretical foundations deepen the understanding of customer emotions in marketing research?

(2) What insights arise from studies using EMG, GSR, and ECG to measure emotional responses to marketing stimuli?

(3) How can scholars effectively use EMG, GSR, and ECG to expand expertise in investigating customer emotions in marketing?

The structure of this review paper is thoughtfully organized. Section 2 presents the literature reviews of the physiological tools: EMG, GSR, and ECG. Section 3 presents the methodology used to select and extract relevant articles. Section 4 discusses the contributions and findings of studies that have employed physiological tools in neuromarketing research. Finally, Section 5 presents the concluding remarks, summarizing the key insights gained from this review paper. Section 6 presents limitations and future agendas.

## 2. LITERATURE REVIEW

### 2.1 Electromyography

According to Ekman (2004), facial expressions are a powerful communication medium, enabling individuals to convey a wide range of emotional states, such as happiness, sadness, and more (Alsharif *et al.*, 2022a). Consequently, faces play a crucial role in deciphering unspoken emotions and serve as the primary indicator of one's emotional state (Salichs *et al.*, 2006). Facial expressions are significant in interpersonal communication and everyday interactions with the marketing environment (Missaglia *et al.*, 2017). Simply put, a smile generally signifies happiness, while a frown indicates sadness or anger (Missaglia *et al.*, 2017). Therefore, facial expressions serve as a reflection of consumers' emotional states.

In marketing contexts, analyzing facial expressions is of great importance for marketers and researchers seeking to understand customers' emotional responses to marketing stimuli. This analysis provides valuable insights into customers' emotional states (Cherubino *et al.*, 2019). Customers' facial expressions convey both the emotional tone and the level of arousal experienced (Ekman, 2004). For instance, movements of the mouth and eyebrows can indicate pleasure or displeasure, as well as ongoing communication (Mutlu *et al.*, 2009). Thus, facial expressions offer feedback regarding others' opinions and discussions (Cherubino *et al.*, 2019). EMG is a convenient tool for capturing emotional valence and arousal (Hadinejad *et al.*, 2019), focusing on both visible and hidden facial muscles, including the zygomatic and corrugator muscles (Lang *et al.*, 1995; Bolls *et al.*, 2001; Larsen *et al.*, 2003). Moreover, it

enables the measurement and identification of physiological properties of facial muscles, encompassing voluntary and involuntary responses (Ohme *et al.*, 2011). Activation of the zygomatic muscles is associated with positive stimuli and can influence purchasing decisions (Somervuori and Ravaja, 2013; Alsharif *et al.*, 2020b). Conversely, the corrugator muscles are linked to negative stimuli (Larsen *et al.*, 2003; Missaglia *et al.*, 2017). By employing EMG, researchers can gain deeper insights into consumers' emotional valence and arousal, enabling a better understanding of their responses to marketing stimuli. Therefore, this tool provides a nuanced understanding of the emotional aspects of consumer behavior, allowing marketers to tailor their strategies accordingly.

### 2.2 Galvanic skin response

GSR tool, also known as electrodermal activity (EDA), measures the autonomic nervous system (ANS), providing insights into consumers' internal emotional states (Cherubino *et al.*, 2019; Barquero-Pérez *et al.*, 2020; Lajante *et al.*, 2020; Alsharif *et al.*, 2021a). Furthermore, it is non-invasive and has become an essential component in the field of neuromarketing, offering a reliable method for measuring emotional arousal and cognitive engagement in response to marketing stimuli (Fortunato *et al.*, 2014; Barquero-Pérez *et al.*, 2020). (Dawson *et al.*, 2017) defined GSR as a temporary increase in the skin's electrical conductivity, indicating heightened activity of the sweat glands. Notably, the high concentration of sweat glands on the palms and soles of the feet makes GSR particularly suitable for studying consumer decision-making (Nourbakhsh *et al.*, 2017). These glands are mainly stimulated in response to emotional events such as stress, with a larger concentration in the face, palms of hands, soles of feet, and armpits, with the palms of hands being the preferred location for the GSR measurement (Durán-Acevedo *et al.*, 2021).GSR, along with other neuromarketing techniques such as eye tracking and EEG, has been employed to understand consumer behavior, emotional responses, and decision-making processes (Mañas-Viniegra *et al.*, 2020; Mengual-Recuerda *et al.*, 2020).

The use of GSR has been observed in various marketing contexts, including the evaluation of the effect of emotional fatigue on the purchase process (Andrii *et al.*, 2019), co-creation with consumers for packaging design validation (López-Mas *et al.*, 2022), and the influence of music on advertising effectiveness (Cuesta *et al.*, 2018). Additionally, GSR has been recognized as a valid tool for measuring consumer decision-making and emotional arousal (Alvino *et al.*, 2020; Alsharif *et al.*, 2023d). The integration of GSR with other physiological and neuroimaging tools has provided valuable insights into consumer behavior, emotional responses, and the effectiveness of marketing stimuli (Cuesta *et al.*, 2018; Giakoni *et al.*, 2022; Martinez-Levy *et al.*, 2022; Lei *et al.*, 2024). Therefore, GSR plays a crucial role in providing objective and real-time data to understand consumer responses, which is essential for guiding marketing strategies and improving consumer satisfaction in various industries, including tourism, hospitality, and product packaging (Vergura and Luceri, 2018; De-Frutos-Arranz and López, 2022). The widespread use of GSR in neuromarketing research underscores its significance as a tool for understanding consumer behavior and emotional responses, thereby contributing to the development of more efficient marketing campaigns and strategies.

### 2.3 Electrocardiogram

The electrocardiogram (ECG) is a valuable tool in neuromarketing research, often used in conjunction with other biometric tools to measure the heart's electrical activity (Sung *et al.*, 2020). Furthermore, the ECG is categorized as a physiological tool used in neuromarketing research, which is used to gauge the consumer's emotional responses and experiences toward marketing stimuli (Alvino *et al.*, 2020; Alsharif *et al.*, 2022b; Alsharif *et al.*, 2023a). For example, during exposure to marketing stimuli, ECG can record the activations of the heart rate (Baraybar-Fernández *et al.*, 2017; Barquero-Pérez *et al.*, 2020). Heart rate is commonly regarded as a reliable indicator of emotional valence. For example, the study by Baldo *et al.* (2022)demonstrated that heart rate and self-reported arousal are associated with ad recognition, supporting the relationship between heart rate and emotional valence. Additionally, Yarosh *et al.* (2021)revealed that customer choice is accompanied by a change in emotional valence, from negative emotions to positive ones, suggesting a correlation between emotional valence and heart rate in consumer decision-making.

Moreover, advancements in wearable ECG devices have expanded the opportunities for marketing researchers to gather real-time and ecologically valid data on consumer experiences, thereby enhancing the understanding of consumer behavior (Casado-Aranda and Sanchez-Fernandez, 2022). In addition, integrating ECG with other neuroscientific tools, such as EEG, has provided specific insights into consumer behavior, emotions, and decision-making processes (Harris *et al.*, 2018; Dursun and Goker, 2019). The application of ECG in neuromarketing has also been acknowledged in various industries, with a growing number of specialized neuromarketing research companies catering to an impressive list of brands across different product categories (Plassmann *et al.*, 2007). The ECG tool plays a crucial role in neuromarketing by providing valuable insights into consumer emotions, attention, and experiences, thereby contributing to a deeper understanding of consumer behavior and decision-making processes.

EMG, GSR, and ECG tools are convenient for measuring the customers' behaviors, such as emotional reactions toward marketing stimuli such as brands, logos, ads, packaging features, and color. Undoubtedly, EMG, GSR, and ECG tools have advantages (e.g., providing more valuable data) and disadvantages (e.g., subjectivity). Table no. 1 shows the summary of physiological tools, for example, what they measure, when they are used, advantages/disadvantages, and the cost of each tool.

**Table no. 1 – A summary of EMG, GSR, and ECG tools.**

| *Tool* | *Description* |
|---|---|
| ***EMG*** | ***What is it measured?*** To measure the facial expressions of customers toward marketing stimuli such as ads or brands.<br>***When is it used?*** This technique assesses brand recall, analyzes video materials, and examines consumers' reactions towards various marketing stimuli, including advertisements.<br>***Pros:*** This method demonstrates the capability to capture and analyze both visible and invisible movements of facial muscles, providing insights into emotional valence and arousal. Moreover, it exhibits high sensitivity and accuracy in detecting and interpreting various facial muscle movements.<br>***Cons:*** Subjectivity.<br>***Cost:*** Low-Moderate. |
| ***GSR*** | ***What is it measured?*** Emotional arousal, sweat glands.<br>***When is it used?*** This technique is used to predict market performance. |

| *Tool* | *Description* |
|---|---|
| | ***Pros:*** The capacity to quantify the level of emotional arousal and make more accurate predictions regarding market performance surpasses the reliability of self-reported measures and offers a cost-effective solution.<br>***Cons:*** There are limitations in using this approach to determine emotional valence, as it struggles to differentiate between emotions such as excitement and stress, which can appear similar. Furthermore, external environmental factors, such as temperature and humidity, can exert an influence on the obtained results. Additionally, the time required for obtaining results, typically ranging from 2 to 3 seconds, can introduce inconsistencies in the outcomes.<br>***Cost:*** Low-Moderate. |
| ***ECG*** | ***What is it measured?*** Emotions and emotional engagement during choice processes.<br>***When is it used?*** It is used to test movie trailers, website design, and ads.<br>***Pros:*** This non-invasive and portable tool offers a cost-effective means of acquiring valuable information about individuals' emotional responses to marketing stimuli.<br>***Cons:*** It presents a challenge to accurately ascertain real-time emotional states due to the inherent delay between physiological responses and brain activity, resulting in a lag of several seconds.<br>***Cost:*** Moderate. |

*Sources*: conducted by authors

## 3. METHODS

The research followed the PRISMA protocol to find relevant papers (Page *et al.*, 2021). This study aims to comprehensively identify relevant articles that delve into the utilization of GSR, ECG, and EMG in neuromarketing activities to fill the existing gap. Endeavoring to answer the research questions, the current study starts by extracting articles from the Scopus database on April 20, 2023. The procedure used in the study enabled the identification of 20 open-access articles that were published between 2009 and December 2022. The reason for selecting the open-access articles is that this paper is conducting a content analysis of the selected articles.

The authors directed their attention exclusively towards articles employing GSR, ECG, and EMG tools, a period chosen due to a notable surge in publications during this span. Furthermore, the inclusion criteria were limited to articles written in English, given its predominant usage in the field. The article selection process, delineated in Figure no. 1, outlines the meticulous steps taken in the curation of papers ultimately included in the study.

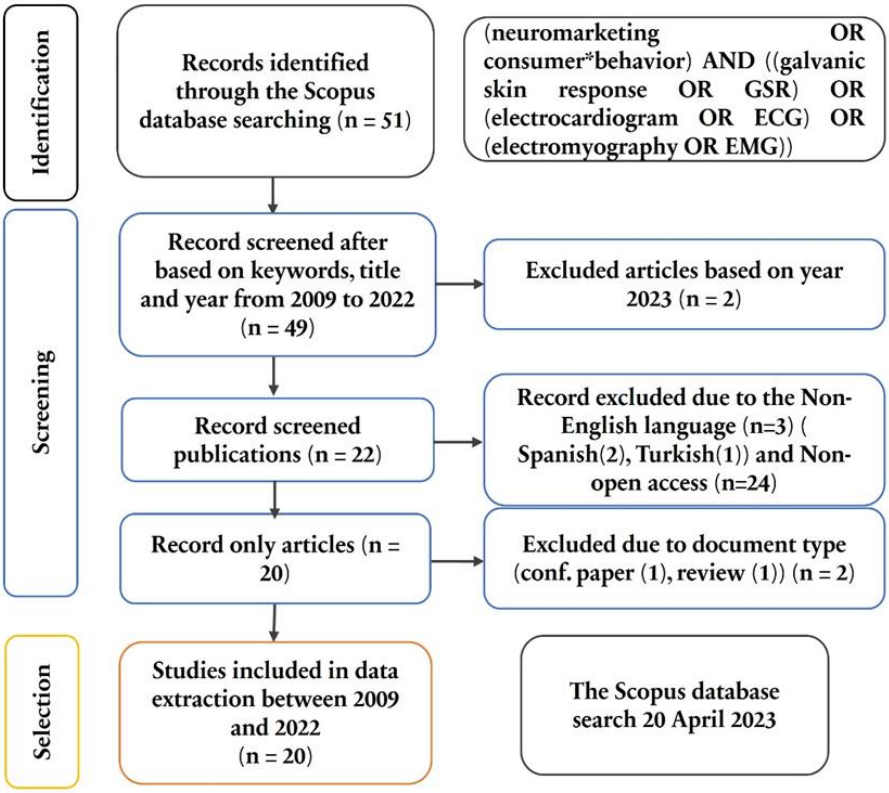


**Figure no. 1 – Extraction articles process from Scopus database**
*Sources*: conducted by authors

## 4. RESULTS AND DISCUSSION

### 4.1 The current trend in physiological monitoring technology (GSR, EMG, and ECG)

GSR is notably employed for assessing emotional reactions to advertisements, offering marketers insights into the emotional impact of their content (Vences *et al.*, 2020). Emotional information aids in crafting more emotionally resonant and effective advertising strategies. For example, Poels and Dewitte (2019); Alsharif (2023) emphasize the importance of emotions in advertising, highlighting that effective advertising messages touch the consumer's heart. Cui (2019) supported this by stating that emotional advertising that resonates with consumers influences their beliefs and desires better than logic-based advertising. Furthermore, Kemp *et al.* (2020) suggested that advertising is most effective when it stimulates logic by providing information and invokes emotions by connecting with the buyer. Additionally, Sanchez-Comas *et al.* (2021) found that advertisements with emotional content are more likely to be remembered than purely informative ones, as they actively engage viewers' emotions, contributing to better message assimilation. Additionally, GSR is utilized

to gauge consumer engagement during marketing interactions, providing real-time data on how individuals respond emotionally to products, services, or campaigns (Wei *et al.*, 2018; Cimtay *et al.*, 2020; Raheel *et al.*, 2020). This facilitates the creation of content that maximizes consumer engagement.

EMG plays a crucial role in evaluating the physical and emotional responses to product design and packaging. For example, EMG has been used in marketing studies to evaluate customer reactions to various stimuli, including different packaging designs, spatial orientation of attention, and emotional and cognitive impacts on the brain (Cherubino *et al.*, 2019; Alsharif *et al.*, 2022e; Alsharif *et al.*, 2023d). Furthermore, emotional responses to packaging information have been studied less frequently than intrinsic product properties (Gutjar *et al.*, 2015). In a study on emotional responses towards food packaging, self-report, and physiological measures were used to assess emotional responses to different food packaging elements, such as colors, images, and typefaces (Liao *et al.*, 2015). Additionally, research has shown that anxiety-inducing product packaging design influences food product interaction and eating behavior, with evidence suggesting that suppressing emotional regulation when exposed to such designs results in increased eating (Ilicic and Brennan, 2022). Understanding the impact of packaging design on consumer perceptions and purchase behavior is crucial for designers and marketers to satisfy consumer needs and potentially increase sales volume (Simmonds and Spence, 2017). Moreover, packaging design plays a significant role in consumer recycling behavior and can influence consumers' willingness to purchase products (Nemat *et al.*, 2019). Information provided on or in the food packaging can influence consumers' expectations and emotional responses (Gunaratne *et al.*, 2019). Furthermore, packaging design has been found to affect customer perception of a product, emphasizing the importance of effective packaging design in shaping consumer perceptions (Fatchurrohman *et al.*, 2022). Additionally, good packaging design for food products can attract consumers to buy the product, indicating the crucial role of packaging in consumer decision-making (Ahmad *et al.*, 2022). By analyzing facial muscle activity, marketers gain insights into the strength of positive or negative emotional associations with a particular brand or logo (Alsharif *et al.*, 2020b). EMG plays a crucial role in evaluating both the physical and emotional responses to product design and packaging. It provides valuable insights into consumer reactions to packaging stimuli, including emotional and cognitive impacts, and influences consumer perceptions and behaviors.

Electrocardiogram (ECG) monitoring in marketing is particularly focused on measuring stress levels during consumer decision-making processes. Understanding how stress influences purchasing behaviors allows marketers to design strategies that alleviate stress and enhance overall customer experiences. For instance, research has shown that shopping stress negatively affects consumers' purchase likelihood, making it essential for marketers to address stress factors in the shopping environment (Albrecht *et al.*, 2017). Additionally, the dark side of new-age technologies can contribute to customer technostress, which in turn influences purchasing behaviors, highlighting the need for marketers to consider the impact of technology on customer stress (Kumar *et al.*, 2022). Moreover, stress has been found to significantly impact customer satisfaction, particularly in the mall experience, emphasizing the importance of addressing stress to enhance overall customer satisfaction (Lucia-Palacios *et al.*, 2020). Furthermore, providing products and services that reduce customers' negative emotional attachments to work can contribute to promoting public health and well-being, indicating the potential for marketers to design strategies that alleviate work-related stress for

customers (Chen *et al.*, 2022). ECG is also applied to evaluate the physiological responses to various aspects of the customer journey, providing valuable data on the impact of interactions with a brand or product on consumer well-being. For instance, the capability of devices such as the Apple Watch to capture single-lead ECGs demonstrates the increasing integration of ECG technology in consumer-oriented products, further emphasizing its relevance in understanding consumer health and behavior (Wyatt *et al.*, 2020). Furthermore, consumers' decision-making process is influenced by various factors, including social media interactions, marketing strategies, and individual characteristics (Gupta, 2019; Zhang *et al.*, 2021), all of which can be measured and analyzed through neuroscientific and physiological techniques. This highlights the potential for ECG to provide valuable insights into the complex interplay of psychological, social, and individual factors that shape consumer decision-making processes (Kim *et al.*, 2016; Jamil *et al.*, 2022).

Across GSR, EMG, and ECG, the overarching trends include a move towards personalized marketing strategies, the integration of data analytics for insightful interpretation, and a heightened awareness of ethical considerations in the collection of physiological data for neuromarketing purposes.

### 4.2 Overview of selected articles

Neurophysiological and physiological methods have become essential tools for both researchers and practitioners, offering an in-depth exploration of consumer loyalty, perception, and brand preferences in comparison to their counterparts (McClure *et al.*, 2004; Plassmann *et al.*, 2007; Reimann *et al.*, 2012; Venkatraman *et al.*, 2015; Guo *et al.*, 2018; Alsharif *et al.*, 2021d; Alsharif *et al.*, 2023e). These approaches are extensively applied in marketing research to identify effective communication channels, including television, radio, Facebook, Twitter, and others, for successful advertising campaigns and to unveil implicit gestures (Fugate, 2007; Alsharif *et al.*, 2023a). For instance, GSR gauges autonomic nervous system (ANS) excitement in response to emotional stimuli such as advertisements (Alsharif *et al.*, 2023d). Another technique, EMG, assesses emotional valence and arousal evoked by advertising, products, and brands (Liaudanskaitė *et al.*, 2018; Lajante *et al.*, 2020; Ahmad *et al.*, 2022). EMG has been employed to evaluate the effectiveness of mass media platforms (e.g., TV, radio) or social media platforms (e.g., Facebook, Twitter, YouTube) in advertising campaigns, capturing subtle expressions (Fugate, 2007). Numerous studies e.g., Lewinski (2015); McDuff *et al.* (2015); Venkatraman *et al.* (2015); Missaglia *et al.* (2017); Liaudanskaitė *et al.* (2018); Lajante *et al.* (2020) have utilized physiological tools like EMG to measure consumers' emotional states (e.g., pleasure/displeasure, arousal) concerning ad effectiveness, comparing factors such as celebrity spokespersons versus regular individuals.

Furthermore, other studies e.g., Vecchiato *et al.* (2010); Reimann *et al.* (2012); Baraybar-Fernández *et al.* (2017); Cartocci *et al.* (2017); Guixeres *et al.* (2017); Leanza (2017); Halkin (2018); Andrii *et al.* (2019); Barquero-Pérez *et al.* (2020); Calvert *et al.* (2020); Herrador *et al.* (2020) have employed GSR and ECG to measure consumers' responses to marketing stimuli like advertisements and brands. These techniques offer valuable insights into the emotional aspects of consumer behavior and can potentially improve marketing strategies and campaign effectiveness. Table no. 2 shows the content analysis of the selected articles.

**Table no. 2 - Summary of the EMG, GSR, and ECG studies in marketing**

| References | Tools | Contributions | Findings |
|---|---|---|---|
| Martinez-Levy *et al.* (2022) | EEG, HR, GSR, ET | To improve nonprofit ad effectiveness by assessing cognitive and emotional responses to TV ad stimuli | Adjusting message framing in nonprofit ads boosts effectiveness by triggering stronger emotional and cognitive responses. |
| Awan *et al.* (2022) | EEG, ECG, GSR | To develop an ensemble learning method using physiological signals for emotion mapping. | The deep learning ensemble achieved a record 94.5% accuracy in emotion mapping, surpassing other state-of-the-art techniques in emotion detection. |
| Giakoni *et al.* (2022) | ECG, GSR, ET | To propose a new research methodology to assess the effectiveness of ads in esports. | The new metrics highlighted their usefulness in optimizing ad/brand placement during esports broadcasts. |
| Levrini and Jeffman dos Santos (2021) | EMG, ET | To offer fresh perspectives on the evaluation of consumers' perception regarding the brand of retail stores. | The significant impact of the conscious pricing factor on their inclination to make a purchase. |
| Lajante *et al.* (2020) | GSR, EMG | To examine pleasure or displeasure of the customers' behaviors towards ads. | Pleasure and displeasure positively impact customers' behaviors and attitudes towards commercial ads. |
| Barquero-Pérez *et al.* (2020) | ECG, GSR | To analyze six distinct ads and get indices that assess the functioning of the ANS. | Each ad produced different emotions, such as disgust, anger, surprise, rationality, and sadness. |
| Calvert *et al.* (2020) | Impulse Test | To examine emotional responses towards dynamic visual stimuli, such as movie clips or TV ads. | The Impulse Tests technique has ability to record a set of general emotions and specific feelings while watching visual stimuli. |
| Herrador *et al.* (2020) | EDA/ GSR | To evaluate attentional and emotional reactions for differential applications in marketing strategies. | Both male and female participants initially showed strong activation to stimuli, yet the male group exhibited decreased activation during the critical section of the video. |
| Andrii *et al.* (2019) | GSR | To investigate the emotional fatigue in the store and its impact on purchase decision-making. | The emotional fatigue is influenced by the store's atmosphere and consumers' emotional state. |
| Halkin (2018) | GSR, ECG | To estimate the consumers' emotional fatigue during the visit to the shop. | The act of waiting in the cashier queue led to an increase in the fatigue index in shops, while it led to a decrease in fatigue levels during the journey back home. |
| Liaudanskaitė *et al.* (2018) | EMG | To measure the intensity of the customer's emotions toward static advertising. | The valence and arousal significantly influence the effectiveness of advertisements. |

| References | Tools | Contributions | Findings |
|---|---|---|---|
| Baraybar-Fernández *et al.* (2017) | ECG, GSR | To explore the emotional messages on commercial attractiveness. | The ad containing sad messages among the participants emerged as the most captivating commercial. |
| Leanza (2017) | GSR | To compare the consumers' cognitive, emotive, and preference toward traditional and Virtual Reality (VR) TV commercials. | VR experiences significantly affect skin conductance signals, with a strong correlation to explicit consumer preference evaluations. |
| Cartocci *et al.* (2017) | GSR, ECG, EEG | To investigate the antismoking advertising campaigns and emotional perception. | Symbolic style strongly influences the approach-withdrawal index, while "fear-arousing appeal" images rank highest and narrative style scores lowest on the effort index. |
| Missaglia *et al.* (2017) | EMG | To identify the predictive percentage of participants toward violent and non-violent video social ads. | Around 30% favored non-violent social ads, with a tenfold higher likelihood of selecting them compared to those experiencing anger, reported by 64.3%. |
| Guixeres *et al.* (2017) | ECG, ET, EEG, Survey | To investigate the effectiveness of ads (e.g., liking ads) and the number of views on YouTube channels. | There is a strong relationship between neuroscience metrics, self-reported ad effectiveness (e.g., liking ads), and the number of views on YouTube. |
| Lewinski (2015) | EMG | To examine if the facial expressions toward YouTube videos can predict their popularity among users of social media. | The percentage of happiness or sadness and surprise expressions was 61%-86%, respectively. |
| McDuff *et al.* (2015) | EMG | To predict facial responses to evaluate ad effectiveness, including metrics such as ad liking and purchase intention. | The predictive percentage of ad liking accuracy was 85%, while purchase intention was 78%. |
| Reimann *et al.* (2012) | GSR | To measure the emotional arousal toward their beloved brands. | Increasing emotional arousal and increasing inclusions of close brans over time. |
| Vecchiato *et al.* (2010) | GSR, ECG, EEG | To investigate brain activity and emotional engagement toward TV ads. | TV ads elevated heart rate and theta band cerebral activity (left hemisphere), with no observable change in GSR values. |

Note: EDA; Electrodermal Activity, EEG; Electroencephalography, ET; Eye-tracking, HR; Heart rate

## 5. CONCLUSIONS

In recent years, there has been a significant upsurge in the interest among marketers and advertisers in better understanding customers' emotions. Utilizing EMG, GSR, and ECG in neuromarketing yields profound insights into customers' emotional responses towards various

marketing stimuli, including logos, brands, advertisements, and packaging features. EMG, measuring muscle activity, plays a pivotal role in assessing emotional responses through facial expressions, offering marketers a nuanced understanding of consumer engagement with advertisements, brands, and products. GSR, detecting changes in skin conductance, proves effective in pinpointing emotional arousal and evaluating the intensity of reactions, aiding marketers in identifying impactful campaign elements. ECG, measuring heart activity, contributes to comprehending consumer reactions' emotional and cognitive dimensions. Changes in heart rate serve as indicators of emotional engagement, allowing marketers to gauge stimuli impact on consumer perception. Collectively, these tools provide a comprehensive approach to neuromarketing, unveiling intricate connections between physiological responses and consumer preferences. By deciphering these connections, neuromarketers can tailor strategies for more impactful and resonant marketing campaigns. These tools' ongoing refinement and integration with neurophysiological methodologies (e.g., EEG, fNIRS, etc.) highlight their potential to significantly influence the future landscape of consumer research and marketing strategies.

Furthermore, ensuring the accurate application of electromyography (EMG), galvanic skin response (GSR), and electrocardiogram (ECG) in neuromarketing is crucial for obtaining reliable insights. Attention to detail, such as electrode placement, signal interpretation, and methodological consistency, is essential. Standardized procedures, clear guidelines, and addressing potential sources of variability contribute to the credibility of these physiological measures in providing meaningful and accurate insights into consumer behavior and emotional responses. In addition, these tools have proven reliable in capturing and analyzing customer emotions within the marketing environment, illuminating connections between customers and their surroundings and revealing underlying emotional states, whether positive or negative.

The theoretical foundations of EMG, GSR, and ECG significantly contribute to deepening the understanding of customer emotions in marketing research. By measuring muscle activity, EMG provides insights into the facial expressions associated with emotions, offering a non-intrusive window into consumers' emotional responses. GSR measures skin conductance, reflecting changes in arousal levels and providing valuable data on emotional intensity. ECG offers insights into physiological arousal and emotional valence. Together, these tools create a multidimensional understanding of customer emotions, allowing researchers to decipher both the cognitive and affective components of consumer responses to marketing stimuli.

Studies utilizing EMG, GSR, and ECG to measure emotional responses to marketing stimuli have yielded insightful findings. EMG studies reveal nuanced facial expressions associated with positive or negative emotions, aiding in understanding consumer preferences and engagement. GSR studies provide insights into emotional arousal levels, helping identify the intensity of emotional responses triggered by marketing content. ECG studies contribute to understanding the physiological aspects of emotional responses, offering valuable information on consumers' emotional valence and arousal. The integration of these physiological measures allows for a holistic interpretation of emotional experiences, providing marketers with a comprehensive understanding of how various stimuli impact consumers emotionally.

Scholars can effectively use EMG, GSR, and ECG to expand their expertise in investigating customer emotions in marketing through several strategies. First, by staying abreast of technological advancements in these tools, scholars can leverage the latest

developments for more precise and detailed measurements. Second, interdisciplinary collaborations with experts in psychology, neuroscience, and data analytics can enrich the interpretation of physiological data, enhancing the depth of emotional insights. Additionally, scholars can engage in empirical research projects that apply these tools in diverse marketing contexts, building a robust knowledge base and refining methodologies for future studies. Lastly, the integration of traditional survey-based methods with physiological measures allows for a comprehensive understanding of the interplay between conscious and subconscious emotional responses, offering a more holistic approach to investigating customer emotions in marketing research.

## 6. LIMITATIONS AND FUTURE AGENDAS

### 6.1 Limitations

The objective of the paper was to alleviate methodological constraints within the study; however, despite concerted efforts, some limitations persisted, prompting recommendations for future research endeavors. The study was exclusively centered on the neuromarketing field, deliberately excluding consumer neuroscience and English articles published in journals within the timeframe of 2009 to 2022, as indexed in the Scopus database. While designed to ensure precision, this deliberate approach inadvertently overlooked alternative document types such as conference papers, book chapters, and review papers, potentially introducing bias into the study's outcomes. Consequently, the paper presents a comprehensive examination of the utilization of EMG, GSR, and ECG tools in neuromarketing activities spanning from 2009 to 2022, drawing insights from the scrutiny of analyzed publications.

### 6.2 Future agendas

The future landscape of neurophysiological monitoring in marketing envisions groundbreaking applications of Galvanic Skin Response (GSR), Electromyography (EMG), and Electrocardiogram (ECG) technologies. GSR is anticipated to spearhead immersive marketing experiences, particularly in virtual and augmented reality, offering marketers detailed insights into consumer emotions. The envisaged future involves the dynamic optimization of content in real-time using GSR, ensuring continuous alignment with desired emotional impacts.

In the realm of EMG, the trajectory points toward revolutionizing e-commerce by integrating sensors into online platforms. This integration will give marketers real-time insights into facial expressions and muscle activity, shaping a more personalized and emotionally intelligent online shopping environment. Furthermore, EMG is anticipated to lead the way in interactive advertising, where technology embedded in displays allows consumers to engage with content in novel ways, providing marketers with enhanced data on consumer preferences and emotional responses.

Across these technologies, ethical and privacy considerations stand as pivotal themes. As neurophysiological monitoring advances, establishing robust ethical frameworks becomes imperative to ensure the responsible use of consumer physiological data. Interdisciplinary collaboration between marketers, neuroscientists, and technologists is foreseen as vital for

driving innovation, ensuring ethical practices, and navigating the dynamic landscape of neurophysiological monitoring in future marketing strategies.

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# Impact of Cost of Capital on European Economic Growth: The Role of IFRS Mandatory Adoption

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**Abstract:** Since 2005, the International Financial Reporting Standards (IFRS) mandatory adoption in the European Union has played a pivotal role to reduce financing costs which has influenced positively economic growth across member states. Thus, this study examines the effect of Cost of Capital on Economic Growth under IFRS mandatory adoption in 17 European countries between 1994 and 2021 using Pooled Mean Group Autoregressive Distributed Lag (PMG-ARDL) and System Generalized Method of Moments (GMM-system) methods. The findings reveal a positive correlation between the Cost of Capital and Economic Growth under IFRS adoption. Specifically, the model estimates indicate that the Cost of Capital contributes to a 0.58% increase in Economic Growth in the PMG-ARDL framework. Moreover, the GMM-system model underscores the significance of IFRS adoption in reducing the Cost of Capital, leading to a 0.52% increase in Economic Growth. These results provide insights into the benefits of adopting international accounting standards and highlight the importance of institutional and financial factors in shaping the economic impact of adopting accounting standards.

**Keywords:** Cost of Capital; Economic Growth; European Countries; PMG-ARDL; GMM-system.

**JEL classification:** C23; M40; O11; O52.

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## 1. INTRODUCTION

Economies, investors, and lenders depend on the free flow of capital and investment between countries. International Financial Reporting Standards (IFRS) have become a global language used by investors in more than 165 countries when evaluating cross-border investments (Prather-Kinsey *et al.*, 2022). In particular, the European Union (EU) has approved a regulation that, since 2005, listed companies in the European Union, including insurance companies and banks, can prepare their consolidated financial statements by IFRS. For this reason, the International Accounting Standards Board (IASB) introduced these Standards which represent an accounting code that aims to create a single financial reporting platform worldwide (Mohsin *et al.*, 2021).

As described in Van Greuning *et al.* (2011), this regulation heralded the biggest changes in financial reporting in Europe in the last 30 years, and these changes directly affected approximately 7000 companies and indirectly affected various types of consolidated subsidiaries. IFRS is governed by the IASB, an organization whose mission is to serve the public interest by promoting long-term economic growth, confidence, and financial stability in the global economy through reliable financial information. In general, IFRS replaces Generally Accepted Accounting Principles (GAAP). For example, members of the EU and the European Economic Union (EEA) have imposed a mandatory requirement to use IFRS for listed companies in member states and non-member countries since 2005 (Mager and Meyer-Fackler, 2017; Nguyen, 2018).

According to Zeff (2005), accounting standard setting reflects the growing importance of financial accounting standards in different sectors of the economy, which has led to increasing lobbying by special interests for accounting standards with characteristics consistent with desired outcomes. Financial accounting standards affect the economy in several ways, both overall and in the distribution of income, wealth, and risk. In addition, IFRS yields significant benefits for companies and adopting countries in terms of improved transparency, reduced capital costs, improved cross-border investment, improved comparability of financial reports, and increased scrutiny by foreign analysts (IASB, 2014; De George *et al.*, 2016).

The adoption of IFRS provides quality financial information, thereby encouraging FDI (Gordon *et al.*, 2012). The information provided when using IFRS is clear, which reduces business risk. In addition, the success of countries in integrating international trade developments has made free trade an important condition for promoting their growth and development. According to Cooke and Wallace (1990), the more open an economy is to the outside world, the more it will be exposed to international pressures. These pressures reflect complex business volumes but provide a skilled workforce and workers. In addition, they represent a comparative advantage in wage costs. These advantages are likely to attract investors and thus expand their economic activities. Thus, there are significant benefits to adopting accounting standards to facilitate international transactions (Kolsi and Zehri, 2013).

In the European case, Oppong and Aga (2019) examine the impact of IFRS adoption on economic growth using the GMM method for 28 European economies over a period from 2005 to 2014. The results of the model reveal that IFRS adoption has a positive and significant impact on economic growth. Furthermore, full adoption of IFRS is significantly associated with economic growth in both developed and developing countries, while partial adoption is only significant for economic growth in developing countries. Therefore, IFRS adoption is

not the only factor that may affect the rate of economic growth, but developing countries could benefit fully from IFRS adoption if they consider that geographical, macroeconomic, and political factors influence economic growth, as these factors appear to be important in explaining economic growth in the EU.

The effects of mandatory IFRS adoption in the European Union on economic growth is a very interesting and important topic for those interested in financial reporting. The voluntary adoption of IFRS in the European Union (EU) during the 1990s was a significant step toward harmonizing accounting practices across member countries which has been mandated since 2005 and their impact on the cost of equity of firms and economic growth has been significant (Bengtsson, 2022). Specifically, IFRS has played a crucial role in lowering the cost of capital and enhancing the financial ecosystem. As a result, cross-border investment has been facilitated, and the allocation of capital optimized, contributing to overall economic growth. This underscores the critical importance of IFRS as a key driver of financial stability and prosperity within the European Union.

Given the critical importance of financial reporting to economic growth, this study provides valuable insights into the potential benefits of adopting IFRS Standards. As highlighted by Ball (2006) and Barth *et al.* (2012) have extensively explored the positive effects of IFRS on financial reporting and capital markets which has positive effects on economic growth (Ben Othman and Kossentini, 2015; Oppong and Aga, 2019; Banker *et al.*, 2021; Owusu *et al.*, 2022). However, there remains a noticeable gap in understanding the nuanced relationship between the cost of capital and economic growth specifically within the EU context post-IFRS adoption.

While prior studies acknowledge the general benefits of IFRS, a focused examination of how variations in the cost of capital, influenced by IFRS, directly contribute to or hinder economic growth in the EU is notably underexplored. Addressing this gap is crucial for policymakers, investors, and businesses as it provides insights into the mechanisms through which financial reporting standards impact the broader economic landscape, offering valuable guidance for decision-making and policy formulation in the European Union.

Thus, the contribution of this study lies in its ability to provide concrete proof of the potential benefits of the mandatory adoption of IFRS and its considerable impact on the relationship between Cost of capital and economic growth for 17 European Countries adopted these Standards between 1994 and 2021 using two econometric methods which are Pooled Mean Group Auto-Regressive Distributed Lag (PMG-ARDL) and the System Generalized Methods of Moments (GMM-system). In this context, this research aims to answer the following research question: Does the cost of capital have a favorable effect on economic growth in EU countries under the mandatory adoption of International Financial Accounting Standards (IFRS)?

Additionally, many prior investigations have predominantly relied on singular methodologies, limiting the depth of their analyses. Thus, by incorporating both methodologies concurrently, this research seeks to provide a more comprehensive and robust assessment of the relationship between the cost of capital and economic growth. Moreover, unlike previous studies that may have employed broader or less relevant timeframes, this research takes a focused approach, analyzing the period between 1994 and 2021. This allows us to directly observe and analyze the dynamic interplay between changes in accounting standards and their real-world economic consequences, specifically on the cost of capital and growth.

The remainder of this paper is organized as follows. Section 2 provides a comprehensive overview of the theoretical and empirical framework underlying the research topic by

presenting the existing literature on the relationship between mandatory IFRS adoption and economic growth, exploring the main theories, concepts, and ideas that have been advanced by researchers and experts in the field, as well as presenting the hypothesis development. Section 3 describes the sample selection, data, and empirical specifications. Section 4 presents the empirical estimations of this study. Finally, Section 5 presents some conclusions of the findings and policy implications.

## 2. LITERATURE REVIEW

IFRS is the abbreviation for "International Financial Reporting Standards" which are accounting standards developed by the International Accounting Standards Board (IASB). They are used as a common financial reporting language by companies and organizations around the world to ensure transparency, comparability, and consistency of financial reporting. These standards guide various aspects of financial reporting, including financial statement presentation, recognition and measurement of assets, liabilities, and equity, and disclosure requirements. IFRS also guides in specialized areas such as revenue recognition, leases, and financial instruments and is intended to ensure that financial information is accurate, reliable, and relevant to the needs of investors, creditors, and other stakeholders.

Moreover, IFRS promotes transparency and consistency in financial reporting, making it easier for investors to compare financial information between countries. This can increase cross-border investment, and therefore economic growth. In addition, by providing standardized financial information, IFRS can increase the availability of capital for companies, particularly those in emerging markets, leading to increased investment, growth, and job creation. In addition, it encourages companies to present their financial information accurately and transparently, allowing investors and stakeholders to make informed decisions about resource allocation. This can lead to more efficient use of resources, better productivity, and increased economic growth.

### 2.1 Theoretical framework

The macroeconomic justification for the widespread adoption of IFRS is underpinned by two key theories: the economic theory of networks by Katz and Shapiro (1985) and the neo-institutional theory elucidated by DiMaggio and Powell (1991).

In the economic theory of networks, IFRS implementation creates a global financial reporting network, promoting seamless communication and collaboration among diverse economic entities. This interconnectedness enhances market efficiency, reduces information asymmetry, and attracts international investment, contributing to overall economic growth.

Conversely, isomorphism posits that countries adopting IFRS align themselves with global standards, gaining legitimacy and signaling a commitment to transparency and best practices. This alignment attracts foreign investment and harmonizes financial reporting practices, fostering economic stability and growth.

From the economic theory of networks perspective, countries are more likely to adopt IFRS if their trade partners or countries within their geographical region have already embraced IFRS. This theory views IFRS as a product, assessing its intrinsic value and the value derived from its network. If a country shares a close economic relationship with others

that have adopted IFRS, implementing IFRS reduces domestic bias for foreign investors and facilitates multinational operations (Ramanna and Sletten, 2009).

The "autarky value of IFRS" represents its intrinsic value, considering economic and political benefits. Economic net value refers to more efficient resource allocation, while the political value represents control over the standard-setting process. IFRS standards are considered valuable for a developing country if the autarky value and the synchronization value of IFRS surpass the value of local GAAP.

For the institutional theory, they explain the more and more homogeneous organizational behavior and structure by the concept of isomorphism. According to DiMaggio and Powell (1983); DiMaggio and Powell (1991), three types of isomorphism can be used to explain the adoption of IFRS in one country. The first type is Coercive isomorphism which involves institutions forcing economic actors to align with IFRS, such as the International Monetary Fund (IMF) requiring financial reforms in exchange for aid. The second type is mimetic isomorphism encompasses the imitation of nations perceived as more legitimate and successful, potentially influenced by professional accounting organizations. The third type is the normative isomorphism which is linked to a country's education level, with higher education attainment affecting accounting practices and the shift toward IFRS (Hassan, 2008).

### 2.2 Empirical framework

Several studies show that the adoption of IFRS can increase investment, improve access to capital markets, improve the quality of financial reporting, and promote economic growth. Several studies examined the effect of IFRS on economic growth. Larson (1993) used a similar approach and carried out a cross-sectional study with data from 35 African countries to assess the differences in growth patterns between countries that adopted IFRS to suit their local environment, countries that adopted the standards without any adaptation, and countries that did not adopt IRFS. The study reveals that compared to complete adopters and non-adopters, countries that adopt IFRS to suit their local environment experience substantially higher economic growth.

Larson and Kenny (1995) conducted an exploratory study that empirically examined the relationships between the adoption of International Accounting Standards (IAS), the development of stock markets, and economic growth in developing countries with stock markets for 27 developing countries between 1985 and 1989, using a transnational sociological research design and partial least squares. The results indicate that there is no major association between the development of stock markets in developing countries and economic growth due to the adoption of IAS standards.

Leuz and Verrecchia (2000) conducted a study on a sample of German companies that adopted either IAS or US-GAAP Accounting Standards in their consolidated financial statements. Their results showed that companies that are committed to increasing their disclosure levels receive economic benefits. Firstly, an international communication strategy is associated with a reduction in bid-ask spreads and an increase in stock turnover, while controlling for various firm characteristics such as performance, firm size, foreign listings, and selection bias. Secondly, regarding stock price volatility, the authors demonstrated a negative association or reduction around the switch to international accounting, and there are minor differences between companies that follow US-GAAP and those that follow IAS.

Zeghal and Mhedhbi (2006) conducted a study focused on the determinants of the adoption of IAS/IFRS standards by developing countries. Their study was based on a sample of 32 developing countries that have adopted IAS standards and 32 other countries that have not. They concluded that developing countries with developed capital markets, advanced education levels, and high economic growth are more likely to adopt IFRS standards.

In another study, Akisik (2013) examined the relationship between accounting regulation, financial development, and economic growth in 51 developed and emerging market economies over the period 1997-2009 using the Generalized Method of Moments estimation techniques. This study provides evidence that accounting regulation has a significant effect on economic growth, even after controlling for several macroeconomic and socio-economic variables.

Using a sample of 50 emerging economies over a period from 2001 to 2007, Ben Othman and Kossentini (2015) found a positive association between the degree of adoption of IFRS standards and the development of the stock market. Given that it has been proven that the development of the stock market promotes economic growth in developing economies (Adjasi and Biekpe, 2006; Cooray, 2010), the adoption of IFRS standards could enhance the economic growth of a country.

In a study spanning a decade from 2005 to 2015, Özcan (2016) investigates the impact of IFRS adoption on the economic growth of 41 countries that embraced IFRS and 29 countries that did not adopt IFRS standards. Through the application of a panel data model, the regression results demonstrate a significant increase in the economic growth of countries following the adoption of IFRS and while IFRS adoption emerges as a contributing factor, other elements such as education policies, human capital, geographical factors, and political structure also influence economic development rates.

Oppong and Aga (2019) studied the influence of IFRS adoption on economic growth across 28 European economies from 2005 to 2014, using the GMM method. This modeling reveals a positive impact of IFRS adoption on economic growth. The study also shows that full adoption of IFRS is associated with economic growth in both developed and developing countries, while partial adoption is only significant for economic growth in developing countries. This study suggests that IFRS adoption may not be the only factor impacting economic growth, as other factors such as geographic, macroeconomic, and political conditions may also play a key role in explaining economic growth in the EU. Therefore, developing countries could benefit from adopting IFRS by taking into account these factors that affect economic growth.

Akisik *et al.* (2020) examine the effect of IFRS adoption on economic growth in 41 African countries over the period 1997 and 2017 and found that the IFRS adoption and economic growth is statistically insignificant but its interaction with FDI has a significant and positive effect on economic growth, suggesting that the adoption of IFRS may not be beneficial for economic growth and IFRS appears to enhance the positive impact of FDI on economic growth.

In a recent study, Banker *et al.* (2021) examine whether productivity improves after mandatory IFRS adoption for 141 countries between 1996 and 2013 using mandatory IFRS as a shock to the accounting regime to examine changes in country-level productivity. The authors find that countries that adopt mandatory IFRS experience significant increases in Total Factor Productivity (TFP) and labor productivity and that post-adoption productivity improvements are larger for countries without convergence to IFRS. In addition, TFP

increases more for countries that experience a greater increase in industry comparability. In addition, the new IFRS accounting regime increases economic productivity by improving information environments and facilitating internal business decisions.

More recently, Owusu *et al.* (2022) examine whether the adoption of IFRS Standards affects economic growth in developing economies, and investigate the role of institutional quality at the country level in this relationship using panel data spanning three non-overlapping years between 1996 and 2013 for 78 developing countries, and employing the two-step Generalized Method of Moments (GMM) method. Their results showed that countries that adopt IFRS experience better economic growth than those that do not. Furthermore, good institutions can moderate the link between IFRS and economic growth.

### 2.3 Hypothesis development

The adoption of IFRS does not directly affect the cost of equity or economic growth. However, the adoption of IFRS can indirectly impact both of these factors. IFRS can affect the cost of equity by improving the transparency and comparability of financial statements, which can reduce the perceived risk of investing in a company. As a result, investors may require a lower return on their investment, reducing the cost of equity for the company. Moreover, IFRS can indirectly impact economic growth by improving the quality of financial reporting, which can enhance the ability of investors and creditors to make informed decisions about allocating capital. This, in turn, can increase the availability of capital for investment and stimulate economic growth. Indeed, this research can be further elaborated into this fundamental hypothesis (**H1**) which is that the cost of capital has a positive impact on economic growth in European countries under IFRS adoption.

## 3. RESEARCH DESIGN

### 3.1 Sample and data

The widespread adoption of the International Financial Reporting Standards (IFRS) has generated intense research interest within the last two decades. As Leuz and Wysocki (2008) point out, both firm-level and macroeconomic evidence are important in evaluating the economic consequences of accounting standards or reporting regulations. Thus, we provide some evidence on the macro front by investigating the link between IFRS adoption and the economic growth of countries.

This study assesses the effect of IFRS adoption on economic growth, through the variable cost of capital. Therefore, to estimate the effect of IFRS adaptation in equity on economic growth in European countries and concerning Oppong and Aga (2019), we will consider the following model:

$$GDPG_{it} = \beta_0 + \beta_1 Activity_{it} + \beta_2 GFCF_{it} + \beta_3 INFL_{it} + \beta_4 Trade_{it} + \beta_5 EXR_{it} + \beta_6 Mean\_Ke_{it} + \beta_7 IFRS_{it} + \varepsilon_{it} \quad (1)$$

where

- "*GDPG*" is the GDP growth rate in annual percentage, this indicator is expressed in annual percentage terms and represents an important economic indicator that measures the rate at which a country's economic output is expanding or contracting over a year. It represents

the vital instrument of the economic cycle and progression in countries (Acquah and Ibrahim, 2020; Song *et al.*, 2020).

- "*Activity*" is the ratio of the working population to the working age population (15 years and older), the activity rate serves as a valuable tool for analyzing the level of economic activity within a given population and plays a role in understanding the labor market dynamics on a national or global scale. Human capital is regarded as a measure of the ability and skills of a labor force and it is evaluated by the formal education or the job learning accumulated experience that plays a relevant role in enabling innovation and R&D activities.

- "*GFCF*" (% of GDP) is the ratio of gross fixed capital formation to GDP, this indicator measures the proportion of a country's total economic output used for investment in fixed capital assets and provides insights into the level of investment relative to the economic output. Investment is the heart of economic growth and plays a vital role in its economic progression. Psycharis *et al.* (2020) and Alfredsson and Malmaeus (2019) prove that public capital investment enhances industrial productivity, boosts GDP growth, and way forward to sustainability development.

- "*INFL*" is the Inflation rate in percentage of the consumer price index, this indicator reflects the rate at which the general price level of goods and services is rising, leading to a decrease in the purchasing power of a currency. In a neo-classical growth model, Haslag (1997) generalized the relationship between inflation and growth in the long run by introducing money and showed that there would be negatively related if money was a complement to capital, positively related if money was a substitute to capital, and independent if money was only a medium of exchange.

- "*Trade*" (% of GDP) is the ratio of the sum of exports and imports divided by GDP, this indicator measures the importance of international trade to the economic output of a country and reflects the degree to which a nation is engaged in global trade activities and the impact of international commerce on its economic performance. International trade is a necessary way for a country to cope with economic globalization, and it has long been debated whether the degree of trade openness is beneficial to the economic development of all countries in the world (Kirikkaleli and Oyebanji, 2022). Trade openness has a positive effect on economic growth (Manwa *et al.*, 2019; Ehigiamusoe and Babalola, 2021; Odebode and Oladipo, 2021; Rehman *et al.*, 2021). Carrasco and Tovar-García (2021) investigated the trade-economic growth relationship in developing countries, using a dynamic panel data model, and found that trade-induced growth in developing countries benefits from imports of high-tech and capital goods.

- "*EXR*" is the exchange rate of a currency against the domestic currency, in which has profound implications for the economy, influencing various aspects of international trade, investment, and overall economic health. There is a relatively large body of literature suggesting a correlation between the real exchange rate and GDP growth. As long as productivity is higher in the traded goods sector, countries have an incentive to maintain the relative price of traded goods high enough to make it attractive to shift resources into their production (Habib *et al.*, 2017).

- "*Mean_Ke*" is the aggregate cost of capital by country which represents the overall cost a company or entities within an economy incur to finance their operations and investments and reflects the return required by investors for providing funds to these entities. Mean_Ke plays a crucial role in economic growth by influencing investment decisions. A lower aggregate cost of capital may encourage businesses to invest in projects and expand

operations, fostering economic growth. In a recent study, Ghouma *et al.* (2023) found that IFRS adoption reduces in cost of equity capital which supports the argument that high-quality accounting standards enhance the quality of financial reporting and positively affect firms' cost of equity capital.

- "*IFRS*" is a dichotomous variable equal to 1 when the financial statements are prepared by IFRS and 0 otherwise, the year of adoption of IFRS in Europe thus begins with 1 between 2005 and 2021 and 0 between 1994 and 2004 (Gordon *et al.*, 2012; Ben Othman and Kossentini, 2015; Oppong and Aga, 2019; Owusu *et al.*, 2022).

All the variables were collected from World Development Indicators (WDI) and DataStream and our sample is presented by 17 European countries, which are: Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Luxembourg, Norway, Netherlands, Poland, Portugal, United Kingdom, Spain, Sweden, and Switzerland, between 1994 and 2021 (i.e. T=28). The parameters of the model measure the sensitivity of the variables to economic growth. We summarize all these variables in Table no. 1.

**Table no. 1 – Variables definitions**

| Variables | Definition | Source |
|---|---|---|
| GDPG | Gross Domestic Product (Annual %) | WDI |
| Activity | The ratio of the working population to the working-age population (15 years and older) | WDI |
| GFCF | Gross Fixed Capital Formation (% of GDP) | WDI |
| INFL | Inflation rate (% of Consumer Price Index) | WDI |
| Trade | The sum of exports and imports (% of GDP) | WDI |
| EXR | The exchange rate of a currency against the domestic currency | WDI |
| Mean_Ke | The aggregate cost of capital by country | DataStream |
| IFRS | The dichotomous variable is equal to 1 when the financial statements are prepared by IFRS and 0 otherwise | DataStream |

*Notes*: WDI refers to World Development Indicators DataBank.

### 3.2 Estimation techniques

We start by presenting the methodology of the Pooled Mean Group Autoregressive Distributed Lag (PMG-ARDL) method, this technique was proposed by Pesaran *et al.* (1999) and Pesaran *et al.* (2001) to overcome the limitations of the methods of Engle and Granger (1987) and Johansen (1991).

An advantage of the PMG-ARDL model is that the short-term dynamic specifications can vary across cross sections, while the long-term coefficients must be the same. Therefore, the PMG-ARDL model is used to study the cross-sectional heterogeneous dynamic problem and evaluate the short- and long-term relationship between the variables. In addition, the statistical advantages of this method are higher efficiency, low collinearity, and higher degree of freedom parameters (Lee, 1995). Furthermore, this estimator is made under the assumption of cointegration of all variables, which must be [I(0)], [I(1)], or a mixture of [I(0)] and [I(1)].

The reason for using PMG-ARDL is that it has a relatively small sample size and is therefore less sensitive to the presence of outliers (Pesaran *et al.*, 1999). In addition, the serial autocorrelation problem can be simultaneously corrected, and this rather lagged model has the advantage of reducing the endogeneity problem (Pesaran *et al.*, 1999), which has been a concern in the recent literature on economic growth and its application. Therefore, we obtain

unbiased estimates of the short-term model (Harris and Sollis, 2003). The equation of the ARDL model will be the following:

$$\begin{aligned} GDPG_{it} = {} & \delta_0 + \delta_1 GDPG_{it-1} + \delta_2 Activity_{it-1} + \delta_3 GFCF_{it-1} + \delta_4 INFL_{it-1} \\ & + \delta_5 Trade_{it-1} + \delta_6 EXR_{it-1} + \delta_7 Mean\_Ke_{it-1} \\ & + \sum_{j=1}^{p} \alpha_{1j} \Delta GDPG_{it-j} + \sum_{j=0}^{q} \alpha_{2j} \Delta Activity_{it-j} \sum_{j=0}^{q} \alpha_{3j} \Delta GFCF_{it-j} \\ & + \sum_{j=0}^{q} \alpha_{4j} \Delta INFL_{it-j} + \sum_{j=0}^{q} \alpha_{5j} \Delta Trade_{it-j} + \sum_{j=0}^{q} \alpha_{6j} \Delta EXR_{it-j} \\ & + \sum_{i=0}^{q} \alpha_{7j} \Delta Mean\_Ke_{it-j} + u_{it} \end{aligned} \quad (2)$$

Alternatively, a dynamic error correction model (ECM) can be drawn, whose error correction term $\rho_1$ must be negative and significant to indicate the speed of adjustment, i.e., the time required for the variables to return to long-term equilibrium. Thus, the ECM model can be represented by the following equation:

$$\begin{aligned} \Delta GDPG_{it} = {} & \rho_0 + \rho_1 \hat{\varepsilon}_{it-1} + \sum_{j=1}^{p} \alpha_{1j} \Delta GDPG_{it-j} + \sum_{j=0}^{q} \alpha_{2j} \Delta Activity_{it-j} \\ & + \sum_{j=0}^{q} \alpha_{3j} \Delta GFCF_{it-j} + \sum_{j=0}^{q} \alpha_{4j} \Delta INFL_{it-j} + \sum_{j=0}^{q} \alpha_{5j} \Delta Trade_{it-j} \\ & + \sum_{j=0}^{q} \alpha_{6j} \Delta EXR_{it-j} + \sum_{i=0}^{q} \alpha_{7j} \Delta Mean\_Ke_{it-j} + \mu_{it} \end{aligned} \quad (3)$$

where $\hat{\varepsilon}_{it-1}$ is the estimated residual error of the above Eq. 1.

To verify the results presented by ARDL, we proceed to use the System Generalized Method of Moments (GMM-system) method. This technique allows us to verify the robustness of results by checking if the estimated parameters are consistent across different models and also allows us to assess the sensitivity of their results to different assumptions. Arellano and Bover (1995) and Blundell and Bond (1998) develop a system of difference and level regressions. The instruments of difference regression are the lagged levels of the explanatory variables and the instruments of level regression are the lagged differences of the explanatory variables. These are considered appropriate instruments under the assumption that while there may be a correlation between the levels of the explanatory variables and the country-specific effect, there is no correlation between these variables in the differences and the country-specific effect.

Moreover, this technique is more efficient with an additional assumption that the first differences of instruments are uncorrelated with the fixed effects, which in turn allows the inclusion of more instruments (Roodman, 2009) and yields efficient estimates in cases where the series are close to being random walks (Blundell and Bond, 1998). The equation of the GMM-system can be written as follows:

$$\begin{aligned} GDPG_{it} = {} & \beta_0 + \beta_1 GDPG_{it-1} + \beta_2 Acticity_{it} + \beta_3 GFCF_{it} + \beta_4 INFL_{it} + \beta_5 Trade_{it} \\ & + \beta_6 EXR_{it} + \beta_7 Mean\_Ke_{it} + \beta_8 IFRS_{it} + \varepsilon_{it} \end{aligned} \quad (4)$$

In addition, to ensure the GMM-system estimation's consistency of Eq. 1, we employed two primary diagnostics. Firstly, we used the Arellano and Bond (1991) test to confirm that

the first differenced error term is without first- and second-order serial correlation. The null hypothesis of the p-value reported by AR(2) is that the first difference residuals have no serial correlation in the second-order. Secondly, we applied the Hansen (1982) test to identify constraints that report p-values for null assumptions and make sure that the error term should not be correlated with instruments.

## 4. RESULTS

### 4.1 Variables analysis

Before starting the analysis of the analysis of cross-section dependence, the stationarity of variables, the cointegration relationship between, and the analysis of the models, it is essential to start with the descriptive analysis taken into account for this estimation. Thus, we begin by analyzing statistically the key variables in this study.

According to Table no. 2, for the 476 observations, the variable "GDPG" is characterized by an overall mean of 2.236, a median of 2.261, and a standard deviation of 2.988. Furthermore, the minimum and maximum of this variable are equal to -10.823 and 25.176, respectively. Moreover, the distribution is completely skewed to the right (Skewness=0.299>0), and strongly platykurtic (Kurtosis=12.568> 0). Moreover, this distribution is non-normal for the whole sample and is no longer auto-correlated. Furthermore, the variable "Mean_Ke" is characterized by an overall mean of 0.014, a median of 0.008, and a standard deviation of 0.194. In addition, the minimum and maximum of this variable are equal to -3.148 and 1.317, respectively. Moreover, the distribution is completely skewed to the left (Skewness= -7.971>0), and strongly platykurtic (Kurtosis=162.014> 0).

**Table no. 2 – Descriptive statistics of variables**

| Variables | GDPG | Activity | GFCF | INFL | Trade | EXR | Mean_Ke | IFRS |
|---|---|---|---|---|---|---|---|---|
| Observations | 476 | 476 | 476 | 476 | 476 | 476 | 476 | 476 |
| Mean | 2.236 | 60.086 | 21.756 | 1.988 | 100.014 | 23.431 | 0.014 | 0.607 |
| Standard deviation | 2.988 | 5.862 | 3.439 | 2.517 | 61.861 | 168.806 | 0.194 | 0.489 |
| Minimum | -10.823 | 47.270 | 14.752 | -4.478 | 40.455 | 0.500 | -3.148 | 0 |
| Maximum | 25.176 | 74.110 | 53.591 | 32.991 | 388.848 | 1736.207 | 1.317 | 1 |
| Median | 2.261 | 60.175 | 21.599 | 1.812 | 79.441 | 0.903 | 0.008 | 1 |
| Skewness | 0.299 | 0.078 | 2.217 | 7.419 | 2.299 | 9.393 | -7.971 | -0.439 |
| Kurtosis | 12.568 | 2.826 | 19.311 | 80.073 | 8.803 | 90.727 | 162.014 | 1.193 |
| Jarque & Bera (JB) test | 1823 | 1.085 | 5667 | 1.2e+05 | 1087 | 1.6e+05 | - | - |
| Probability (JB) | 0.000 | 0.581 | 0.000 | 0.000 | 0.000 | 0.000 | - | - |
| Born & Breitung (BB) test | 3.04 | 14.43 | 7.33 | 13.79 | 11.53 | 2.02 | - | - |
| Probability BB | 0.218 | 0.001 | 0.026 | 0.001 | 0.003 | 0.365 | - | - |

*Notes:* JB refers to Jarque and Bera (1987) normality test. BB refers to Born and Breitung (2016) *serial correlation test.*

### 4.2 Cross-Sectional Dependence

The next step, after the statistical description of variables, is the application of the dependence test as this test represents an important step in the application of panel models. The dependence test is performed to test the hypothesis of cross-sectional independence and to determine the appropriate panel unit root test to adopt. De Hoyos and Sarafidis (2006) highlight the need and importance of testing for cross-sectional dependence in dynamic panel

data. Specifically, Sarafidis and Robertson (2006) indicate that the absence of cross-sectional independence in the data can lead to inconsistency in all estimation procedures.

In more detail, cross-sectional dependence should be considered when analyzing panel data, as it can impact the validity of statistical tests and lead to inaccurate findings. Pesaran (2007) underscores the importance of accounting for this dependence, especially in unit root tests and cointegration analysis. The assumption of observational independence may be violated by cross-sectional dependence, and maintaining this assumption is crucial for reliable statistical inference. Neglecting cross-sectional dependence may result in a misleading and inconsistent interpretation of the long-term relationships between variables. Thus, to ensure the accuracy and reliability of cointegration tests, it is imperative to account for cross-sectional dependence (Banerjee *et al.*, 2004).

Therefore, the Cross-sectional Dependence (CD) test developed by Pesaran (2004) is performed. In this vein, De Hoyos and Sarafidis (2006) argue that in dynamic panels, the validity of Pesaran (2021) tests remains proven under fixed/random effect estimation, and it is therefore considered the preferred choice for cross-sectional independence analysis. To this end, we will examine different tests of dependence such as the Friedman (1937), Frees (1995, 2004), and Pesaran (2004); Pesaran *et al.* (2008) tests. These tests examine the existence of a dependent relationship between individuals. According to Table no. 3, all the tests affirm the existence of a dependency between individuals because all the probabilities of these tests are lower than 1%.

**Table no. 3 – Cross-Section Dependence test results**

| Tests | Value | Probability | Decision |
|---|---|---|---|
| Friedman (1937) | 269.511 | 0.000 | Dependence |
| Frees (1995, 2004) | 5.307 | 0.000 | Dependence |
| Pesaran (2004) | 39.964 | 0.000 | Dependence |
| Pesaran *et al.* (2008) | 37.078 | 0.000 | Dependence |

### 4.3 Unit root tests

In the presence of cross-sectional dependence (CD), the use of first-generation unit root tests may lead to inaccurate results. Therefore, we have opted for unit root tests that can accurately identify the stationarity properties of the variables. For this reason, we have used second-generation stationarity tests for the determination of the stationarity attribute of the variables under study. Thus, both CADF and CIPS unit root tests of Pesaran (2003); Pesaran (2007) respectively were used to determine the order of integration of these variables (Akadiri *et al.*, 2020; Onifade *et al.*, 2023).

These tests, presented in Table no. 4, have been developed to asymptotically eliminate the problem of dependence between series and have the property of being robust. Thus, to control the order of integration, second-generation panel root tests have been performed. The results of these unit root tests show that the variables GDPG, INFL, EXR, and Mean_Ke are stationary in level while the variables Activity, GFCF, and Trade and stationary in first difference. We perform also another unit root test with a break to verify these results.

**Table no. 4 – Second-generation unit root test**

| Variables | GDPG | Activity | GFCF | INFL | Trade | EXR | Mean_Ke |
|---|---|---|---|---|---|---|---|
| **Pesaran (2003)** | | | | | | | |
| **Panel A: In level** | | | | | | | |
| With Constant | -2.780*** | -2.026 | -2.005 | -2.691*** | -1.862 | -3.880*** | -4.086*** |
| With Trend | -2.787*** | -2.390 | -2.952*** | -2.911*** | -2.105 | -3.822*** | -4.125*** |
| Decision | S | NS | NS | S | NS | S | S |
| **Panel B: In first difference** | | | | | | | |
| With Constant | -4.386*** | -3.274*** | -3.754*** | -4.319*** | -3.665*** | -4.838*** | -5.331*** |
| With Trend | -4.409*** | -3.407*** | -3.892*** | -4.589*** | -3.881*** | -5.200*** | -5.486*** |
| Decision | S | S | S | S | S | S | S |
| **Pesaran (2007)** | | | | | | | |
| **Panel A: In level** | | | | | | | |
| With Constant | -3.815*** | -2.094 | -2.077 | -3.227*** | -1.699 | -3.526*** | -4.832*** |
| With Trend | -3.850*** | -2.491 | -3.106*** | -3.312*** | -1.946 | -3.355*** | -4.736*** |
| Decision | S | NS | NS | S | NS | S | S |
| **Panel B: In first difference** | | | | | | | |
| With Constant | -5.945*** | -4.449*** | -4.100*** | -5.356*** | -4.362*** | -5.151*** | -6.005*** |
| With Trend | -6.004*** | -4.613*** | -4.561*** | -5.602*** | -4.279*** | -5.057*** | -6.150*** |
| Decision | S | S | S | S | S | S | S |

*Notes:* *, **, *** represent significance at 10%, 5%, 1%, respectively. NS: non-stationary. S: Stationary.

The results of Karavias and Tzavalis (2014) unit root test with break presented in Table no. 5 show that the series are stationary in level or first difference with the presence of some breaks in the years 1995, 1997, 1999, 2015, and 2020. As most of the variables are stationary in level or first difference, it is important to study the existence of a cointegration relation between them.

**Table no. 5 – Unit root test with a break**

| Variables | In level | In first difference |
|---|---|---|
| GDPG | -28.559***(1995) | -39.166***(1995) |
| Activity | -4.282***(1995) | -28.710***(1995) |
| GFCF | -11.425***(2015) | -42.923***(2020) |
| INFL | -14.765***(1997) | -30.674***(2020) |
| Trade | -15.338***(2020) | -30.793***(2020) |
| EXR | -1.9e+02***(1999) | -33.512***(1995) |
| Mean_Ke | -37.520*** (1995) | -45.890*** (2020) |

*Notes:* The value between brackets represents the break date. *** represents significance at 1%.

### 4.4 Cointegration tests

Since the variables are stationary in the first difference, it is necessary to find a long-term relationship (cointegration relationship) to justify the switch to the GMM approach. Therefore, we proceed to test for the existence of a long-term relationship between variables by using the panel Cointegration test. Therefore, we use the tests of Kao (1999); Pedroni (2004); Westerlund (2007) to determine the existence of a Cointegration relationship between variables.

**Table no. 6 – Cointegration tests**

| Tests | t-Statistics | Probability | Decision |
|---|---|---|---|
| Kao (1999) | -6.227 | 0.000 | Co-integration |
| Pedroni (2004) | -8.091 | 0.000 | Co-integration |
| Westerlund (2007) | -2.392 | 0.008 | Co-integration |

According to the results of Table no. 6 which presents the different cointegration tests, namely that of Kao (1999); Pedroni (2004); Westerlund (2007), all the tests have a probability lower than the 5% threshold, so we can say that there is at least one cointegration relationship for all the variables of our model. Thus, the null hypothesis is strongly rejected and consequently, the variables have a long-term relationship between variables. This confirmation not only enhances the reliability of our model but also offers insights into the speed of adjustment and short-term dynamics governing the long-term relationships among the variables.

### 4.5 PMG-ARDL results

After testing the Cointegration relationship between variables, we can proceed to estimate the model with the PMG-ARDL method by Pesaran *et al.* (2001) suggested to test the effect of IFRS adoption on economic growth in European countries. This estimator is performed with the assumption of the existence of cointegration between all variables which must be [I(0)], [I(1)], or a mixture of [I(1)] and [I(0)].

Moreover, the serial autocorrelation problem can be corrected simultaneously and the advantage of using panel ARDL with sufficient lags is a reduction in the endogeneity problem (Pesaran *et al.*, 1999) which has been a concern in the recent literature on economic growth. The results presented in Table no. 7 show that the most appropriate model is represented by an ARDL(1,0,0,0,0,0,0) with 1 lag and with a trend that has a maximum F-statistic (F-test = 12.971 with a significance level of 0.0003, higher than Pesaran *et al.* (2001) critical value of 3.79 at 5%).

The results of the short-term model reveal that the error correction term, $ECT_{it-1}$, is both statistically significant and negative. This proves the existence of a cointegrating relationship between the variables in the short-term model. Specifically, the estimated $ECT_{it-1}$ value is equal to -0.476, indicating that the rate at which the long-term equilibrium adjusts in response to the imbalances caused by the short-term shocks of the previous period is 47.6%. Briefly, this coefficient represents the strength of recall, meaning that 47.6% of the imbalance between real and desired economic growth is adjusted in response to economic shocks. Therefore, a shock to economic growth is fully absorbed after 2 years, 1 month, and 6 days.

In the short term, we observe that the cost of capital has a positive impact on the economic growth of EU countries. Therefore, the adoption of IFRS has an immediate effect on the important role of the cost of capital in increasing economic growth in European countries. The IFRS standards as soon as they are adopted give a positive sign in the short term for the European economies. In addition, the adoption of IFRS, in the short term, improves the level of transparency of financial information and reduces the information asymmetry in countries which leads to an improvement in FDI flows (Gordon *et al.*, 2012; Lungu *et al.*, 2017; Turki *et al.*, 2017a; Turki *et al.*, 2017b; Abad *et al.*, 2018; Yousefinejad *et al.*, 2018).

**Table no. 7 – Pooled Mean Group ARDL estimation**

| Variables | Coefficient | Standard-deviation | t-statistic | Probability |
|---|---|---|---|---|
| Short-term estimation of ARDL(1,0,0,0,0,0,0): dependent variable: $\Delta GDPG_{it}$ | | | | |
| $GDPG_{it-1}$ | -1.255 | 0.114 | -11.013 | 0.000 |
| $Activity_{it-1}$ | 0.423 | 0.205 | 2.065 | 0.034 |
| $GFCF_{it-1}$ | 0.193 | 0.065 | 2.950 | 0.003 |
| $Trade_{it-1}$ | 0.203 | 0.061 | 3.316 | 0.001 |
| $EXR_{it-1}$ | 0.457 | 1.380 | 0.331 | 0.740 |
| $INFL_{it-1}$ | -0.837 | 0.217 | -3.856 | 0.000 |
| $Mean\_Ke_{it-1}$ | 0.733 | 0.351 | 2.090 | 0.037 |
| $\Delta GDPG_{it-1}$ | 0.053 | 0.080 | 0.663 | 0.508 |
| $\Delta Activity_{it}$ | 0.569 | 0.351 | 1.625 | 0.104 |
| $\Delta GFCF_{it}$ | 0.611 | 0.197 | 3.102 | 0.002 |
| $\Delta Trade_{it}$ | 0.407 | 0.050 | 8.144 | 0.000 |
| $\Delta EXR_{it}$ | 0.825 | 1.902 | 0.434 | 0.665 |
| $\Delta INFL_{it}$ | -0.462 | 0.179 | -2.580 | 0.010 |
| $\Delta Mean\_Ke_{it}$ | 2.812 | 5.089 | 0.552 | 0.581 |
| Trend | -0.247 | 0.112 | -2.215 | 0.027 |
| $ECT_{it-1}$ | -0.476 | 0.081 | -5.894 | 0.000 |
| Constant | 15.320 | 24.694 | 0.062 | 0.535 |
| Long-term estimation of ARDL(1,0,0,0,0,0,0): dependent variable: $GDPG_{it}$ | | | | |
| Constant | 12.204 | 19.724 | 0.618 | 0.526 |
| $Activity_{it}$ | 0.337 | 0.162 | 2.071 | 0.038 |
| $GFCF_{it}$ | 0.153 | 0.051 | 2.986 | 0.002 |
| $Trade_{it}$ | 0.161 | 0.045 | 3.515 | 0.000 |
| $EXR_{it}$ | 0.364 | 1.102 | 0.330 | 0.741 |
| $INFL_{it}$ | -0.667 | 0.184 | -3.621 | 0.000 |
| $Mean\_Ke_{it}$ | 0.584 | 0.279 | 2.089 | 0.037 |

According to the long-term estimation of the PMG-ARDL model presented above, the results show that every 1% increase in the variable Activity increases growth by 0.34%. This factor is also considered to be a very important factor for an economy and it helps to provide a highly skilled and innovative workforce that can use limited resources efficiently, thus increasing per capita income. Effective human capital also attracts FDI, which stimulates economic growth (Intisar *et al.*, 2020). Moreover, any increase in gross fixed capital formation increases economic growth by 0.15%. The rate of capital formation can play a main role in promoting economic growth. In fact, for an open economy, the link between investment and economic growth is very important. In other words, a higher ratio of gross fixed capital formation has a positive impact on growth so growth opportunities also lead to further increases in domestic investment (De Long and Summers, 1991, 1992). Indeed, an increase in public investment increases output and therefore has long-term growth effects thus productive government activity and long-term economic growth allow for a better resulting welfare allocation. Furthermore, according to Barro (1990), government spending as a public good in the production function of individual firms increases the rate of return to private capital and therefore stimulates growth (Irmen and Kuehnel, 2009). Similarly, along with public investment spending, adequate private capital inflows accelerate economic growth in economies. Thus, private capital investment helps to stimulate economic growth (Choong *et al.*, 2010).

For the Trade variable, every 1% increase has a positive effect on economic growth of 0.16% and this result reveals that more liberalized trade regimes are accompanied by higher export and GDP growth rates. Trade openness is also considered likely to improve technology because a large international market can provide technological spillovers, economies of scale in research and development, and higher profits for innovators (Katz and Shapiro, 1985; Romer, 1990; Grossman and Helpman, 1991; Rivera-Batiz and Romer, 1991). The link between trade openness and growth can exist through investment and technology. For the first link, trade openness favors investment because the trade sector is more capital-intensive than the non-trade sector. For the second link, the production of investment goods uses imported intermediate goods to some extent, and competition in the international market for machinery and capital goods lowers the price of capital (Baldwin and Seghezza, 1996).

Concerning the inflation variable, any 1% increase in inflation reduces economic growth by 0.67%. Indeed, inflation is a harmful factor that affects output growth because it discourages exports, and savings and public spending become inefficient and increases taxes, which reduces purchasing power, increases uncertainty, discourages investment, and thus reduces productivity and economic growth. In other words, high inflation can lead to uncertainty about the future benefits of investment projects and thus reduce aggregate output (Azam and Khan, 2022).

The exchange rate exhibits a positive but statistically non-significant impact on economic growth, with a 1% increase in the exchange rate correlating to a 0.36% rise in economic growth. This positive association suggests that while exchange rate fluctuations contribute to economic expansion, other intricate factors concurrently wield significant influence. Effective policy measures, resilient fiscal strategies, and a stable global economic environment may be collaboratively acting to alleviate potential adverse effects of currency movements.

Moreover, it also seems that companies adapt to changes in exchange rates quite well, employing tactics that capitalize on the advantages while minimizing the drawbacks. This positive but not significant link highlights how complex the economic environment is, with various elements interacting to shape growth, and gives a picture of the situation that goes beyond significance.

According to the results, the cost of capital on economic growth has a positive and significant influence that a 1% increase in the cost of capital leads to a 0.58% increase in economic growth. Therefore, the adoption of IFRS in the EU has a positive influence on economic growth because it has created a higher level of confidence for investors and the transparency of financial reporting promotes increased foreign investment in host country companies. As a result, foreign investors are concerned about the costs and risks associated with investing in companies, and the adoption of IFRS helps to alleviate these concerns by creating greater confidence in financial reporting.

The adoption of IFRS has proven to be an effective strategy to improve the reliability of financial reporting, reduce information asymmetry among users of accounting information, and reduce the costs and risks associated with foreign direct investment (FDI) flows. By reducing the costs and risks of doing business in a foreign country, foreign investors gain greater confidence and assurance in investing outside their home country. In addition, improved corporate governance and reduced information asymmetry further enhance investor confidence.

Therefore, it can be concluded that IFRS adoption improves FDI, as evidenced by studies such as Gordon *et al.* (2012); Jinadu *et al.* (2016); Lungu *et al.* (2017). These studies suggest that IFRS adoption creates greater transparency and comparability in financial reporting, which leads to greater foreign investor confidence and encourages more foreign investment in host country firms. Foreign Direct Investment (FDI) plays a crucial role in stimulating economic growth and an increase in FDI flows leads to a significant improvement in economic growth (Borensztein *et al.*, 1998; Gudaro *et al.*, 2012; Pegkas, 2015; Bermejo Carbonell and Werner, 2018; Sokang, 2018; Song *et al.*, 2020). Given the economic growth benefits associated with increased FDI inflows, many countries, particularly developing nations, are actively seeking ways to increase FDI inflows. These efforts reflect a growing recognition of the important role that FDI can play in economic development and improved living standards.

**Table no. 8 – Diagnostic tests**

| Tests | Value (p-value) | Decision |
|---|---|---|
| ARCH test | 1.096 (0.295) | No heteroscedasticity |
| Serial autocorrelation LM-test | 0.227 (0.634) | No autocorrelation |
| Ramsey test | 0.320 (0.572) | No specification errors |

The diagnostic tests conducted on the ARDL model, as detailed in Table no. 8, reveal a robust validation of the model outcomes. The results affirm that the error terms within the short-term model exhibit freedom from heteroscedasticity, indicating consistent variability. Moreover, the absence of serial correlation and specification errors confirms the reliability of the model results and underscores the validity of the ARDL model and confidence in its capacity to provide accurate results.

### 4.6 GMM-system results

To verify the results obtained above, we need to apply the GMM-system method of Arellano and Bover (1995) and Blundell Blundell and Bond (1998), to check the long-term impact of variables on economic growth.

According to the GMM model results presented in Table no. 9, the results show that every 1% increase in Activity variable increases economic growth by 0.24%. Human capital is also considered a fundamental source of economic growth because it improves the level of total productivity and potential earnings of the labor force. Investment in human capital improves the quality of education and leads to self-sustaining growth. Moreover, investment in technological research results in new knowledge and technological development, and therefore investment in human capital is a key factor for sustainable economic growth (Lucas, 1988; Romer, 1990). In addition, human capital is also valued by skills, qualifications the ability to create new products, and experience of the workforce through specialization and division of labor, improving basic education, vocational training, encouraging self-employment, and creating business opportunities (Intisar *et al.*, 2020).

Moreover, any increase in gross fixed capital formation increases economic growth by 0.36 percent. This is because the investments will increase production capacity and have a positive impact on employment. These new jobs will generate wage income, which in turn will increase the stock of distributed income, which is used to provide goods and services, and thus to buy and serve. Therefore, firms make profits because they own more which

increases output in the domestic market and national income (Goldsmith, 2008; Leduc and Wilson, 2014; Scandizzo and Pierleoni, 2020).

**Table no. 9 – Two-step GMM-system estimation**

| Variables | Coefficient | Standard-deviation | t-statistic | Probability |
|---|---|---|---|---|
| $GDPG_{it-1}$ | -0.106 | 0.034 | -2.94 | 0.010 |
| $Activity_{it}$ | 0.238 | 0.057 | 4.16 | 0.001 |
| $GFCF_{it}$ | 0.358 | 0.090 | 3.99 | 0.001 |
| $INFL_{it}$ | 0.563 | 0.078 | 7.24 | 0.000 |
| $Trade_{it}$ | 0.024 | 0.004 | 5.75 | 0.000 |
| $EXR_{it}$ | -0.001 | 0.0002 | -3.05 | 0.008 |
| $Mean\_Ke_{it}$ | 0.520 | 0.227 | 2.29 | 0.022 |
| $IFRS_{it}$ | 1.907 | 0.312 | 6.11 | 0.000 |
| Constant | 4.891 | 2.925 | 1.67 | 0.114 |

Furthermore, investment is central to economic growth and plays a critical role in its economic progression. In other words, appropriate public financing and resource allocation policy accelerates economic activities. Moreover, public capital investment improves industrial productivity, stimulates GDP growth, and paves the way for sustainable development (Alfredsson and Malmaeus, 2019; Psycharis *et al.*, 2020).

For the inflation variable INFL, the results show that an increase of 1% in the inflation rate increases economic growth by 0.56%. Indeed, economic growth can benefit greatly from moderate inflation. In other words, modest inflation can stimulate economic growth by lowering real interest rates and promoting investment and spending. This idea supports the Keynesian viewpoint by highlighting the role that aggregate demand plays in promoting economic expansion. Additionally, moderate inflation can reduce debt loads, which in turn makes it simpler for governments and consumers to service loans and reallocate resources to more beneficial purposes.

Moreover, a 1% increase in the Trade variable exerts a positive influence, leading to a 0.024% improvement in economic growth. Indeed, trade openness and economic growth have a positive relationship with economic growth and there is a bidirectional causality between them. Our results are consistent with those (Yanikkaya, 2003; Wang *et al.*, 2004; Borrmann *et al.*, 2006; Armstrong *et al.*, 2008; Chang *et al.*, 2009; Oppong and Aga, 2019; Akisik *et al.*, 2020; Owusu *et al.*, 2022). Liberalization can provide useful insight into the gains from trade liberalization because it increases manufacturing output growth and can affect growth (Lee, 1995).

In addition, trade liberalization facilitates knowledge and technology transfer, which in many endogenous growth models improves productivity and growth (Grossman and Helpman, 1991) by increasing the size of the market and thus the demand for goods and services in the economy as a whole, which indirectly forces producers to generate a high level of output to meet unexpected demand. Concerning the relationship between the degree of trade openness and economic growth, the conventional view is that trade openness has growth-enhancing effects. Therefore, countries with outward-looking economies tend to grow faster than inward-looking economies. The explanation is that openness to trade generally expands a country's trade opportunities, increases the rate of technology transfer and diffusion, and improves the efficiency of resource allocation in an economy, which in turn improves productivity and growth (Wang *et al.*, 2004; Borrmann *et al.*, 2006; Abad *et al.*, 2018).

Additionally, the exchange rate has a low negative and significant on the economic growth of European countries. The changes in exchange rates have a negative effect on economic growth because they disrupt trade and investment and a volatile or depreciating currency can reduce a country's export competitiveness by raising the cost of its goods and services for foreign consumers which decreases exports has an impact on the country's overall economic output. Moreover, a volatile currency rate creates uncertainty, which discourages foreign direct investment and hinders enterprises' long-term planning.

Furthermore, capital inflows are hampered by investors' reluctance to participate in cross-border initiatives, which reduces the amount of money available for profitable projects and reduces the possibility of long-term economic growth. Thus, the adverse consequences of fluctuating exchange rates surpass their direct influence on commerce, infiltrating many aspects of the economy and generating an atmosphere less favorable for strong and consistent expansion.

Taking into account the impact of the cost of capital on economic growth, any 1% increase in the cost of capital increases economic growth by 0.52%. Our results are consistent with those (Choong *et al.*, 2010; Chen *et al.*, 2015; Francis *et al.*, 2016; Brown and Martinsson, 2019; Amel-Zadeh *et al.*, 2020; Golshan *et al.*, 2023).

It is revealed that the adoption of IFRS leads to a positive and significant increase in the GDP growth rate. This result is consistent with the institutional theory that IFRS adoption has a significant positive effect on economic growth, which is similar to Zehri and Abdelbaki (2013); Oppong and Aga (2019); Akisik *et al.* (2020), who found that IFRS adoption stimulates economic growth. The higher the level of harmonization with IFRS, the greater the development of adopting countries. The results also support the old institutional theory hypothesis that IFRS (in this case, mandatory adoption) is an institutional infrastructure that could stimulate growth and development (North, 1990).

The consistency of the estimated growth model parameters is based on the results of diagnostic tests of the estimated GMM-system dynamic model, presented in Table no. 10, which indicate the presence of first-order AR(1) autocorrelation and the absence of second-order AR(2) autocorrelation in the model residuals. In addition, the Hansen (1982) test is used to check the validity of the instruments to ensure that the model is not mis-specified.

**Table no. 10 – Arellano and Bond autocorrelation and over-identification tests**

| Tests | Value | Probability |
|---|---|---|
| AR(1) | -2.91 | 0.004 |
| AR(2) | -1.26 | 0.104 |
| Hansen | 15.910 | 0.460 |

Our results show that there is no serial correlation in the disturbances in the second-order AR(2), while the Hansen (1982) test demonstrates that the instruments used in the GMM specification are valid. This indicates that the estimated parameters are reliable and can be used to draw valid conclusions about the relationship between the variables in the growth regression model.

In other words, the absence of serial correlation within the perturbations of the second-order AR(2) model provides evidence of the temporal independence of the errors, which is crucial for ensuring the integrity of our model. These findings are consistent with the results of the Hansen (1982) test, which not only confirms the absence of serial correlation but also attests to the validity of the instruments incorporated in the System Generalized Method of

Moments (GMM-system) specification which is crucial as to resolve endogeneity problems in the growth regression model.

## 5. CONCLUSION AND POLICY IMPLICATIONS

This study examines the impact of the cost of capital on economic growth under the mandatory adoption of IFRS in 17 European countries between 1994 and 2021 using GMM-system and PMG-ARDL approaches. The results show that the cost of capital has a positive effect on economic growth under IFRS adoption. In other words, the model estimates show that the cost of capital increases economic growth by 0.58% in the PMG-ARDL. In the GMM-system model, the results show that IFRS adoption has important to lower the cost of capital, which increases the economic growth by 0.52%.

Before the adoption of IFRS, investors often faced greater uncertainty due to the absence of regulated reporting methods. In the 1990s period, the adoption of IFRS by corporations was voluntary, and as a result, financial reporting transparency improved significantly, boosting investor confidence and ultimately reducing the cost of capital. Since 2005, mandatory adoption has reinforced these positive trends by extending the benefits of lower capital costs to a wider range of enterprises. By facilitating access to capital for businesses, promoting strategic investments, and creating a more dynamic and effective business climate, these combined efforts have been crucial in boosting economic growth.

The positive effect of mandatory IFRS Standards on economic growth can be attributed to several factors. Firstly, IFRS improves the comparability and transparency of financial statements, enabling investors to make more informed decisions. Secondly, IFRS provides a more accurate picture of a company's financial situation, which helps to reduce the risk of financial anomalies and fraud. Finally, the adoption of IFRS encourages foreign investment by creating a level playing field for international investors.

IFRS reduces the knowledge gap between investors and companies by strengthening accountability and by providing both capital producers and capital holders with important information that holds both parties accountable. The implementation of these standards reduces investment risk, creating more investment opportunities for investors worldwide. Furthermore, IFRS provides high-quality accounting information that enables effective financial decision-making.

The adoption of IFRS can promote the harmonization of financial information across different countries and support the development of national accounting standards based on IFRS. This can reduce the cost and complexity of financial statement preparation for companies operating in multiple countries. Moreover, IFRS can improve financial stability by providing investors with better information about the financial situation of companies, which increases the comparability and reliability of financial statements, improves credit rating quality, and reduces the risk of financial crisis.

It should be noted that the majority of variables have positive and significant effects on economic growth, except inflation in the PMG-ARDL approach and the exchange rate in the GMM approach (negative sign).

Overall, our results using both approaches (PMG-ARDL & GMM) validate hypothesis H1 above, which assumes that the cost of capital has a positive impact on economic growth in European countries under IFRS adoption.

To foster further economic growth, the adoption of IFRS allows policymakers to invest in training programs that help companies better understand and apply IFRS. This can help address the complexity and interpretation issues associated with IFRS. In addition, policymakers can seek to harmonize accounting practices across European countries for more consistent implementation of IFRS and strengthen enforcement mechanisms to ensure that companies comply with IFRS by including more severe penalties for non-compliance and better monitoring and control of financial reporting. In addition, policymakers can help small businesses implement IFRS by including access to education and training programs as well as financial support to cover implementation costs.

As with any research, several research limitations should be acknowledged. Firstly, the complexity of economic systems and the multitude of factors influencing growth make it challenging to isolate and attribute causality solely to the cost of capital. Additionally, the heterogeneity in economic structures and regulatory environments across European nations may introduce variations in the observed effects, and the availability and quality of data, especially about the cost of capital calculations, could pose limitations on the accuracy and comparability of findings. Moreover, the dynamic nature of IFRS adoption and potential changes in regulatory frameworks over time may influence the long-term effects, requiring a nuanced interpretation of the results.

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# The Importance of Social Capital in Promoting Financial Inclusion: An International Perspective

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**Abstract:** This paper quantitatively explores the significance of social capital in enhancing international financial inclusion, with a specific focus on its usage dimension, represented by formal credit coverage. Through panel FGLS (Feasible Generalized Least Squares) and PCSE (Panel Corrected Standard Errors) analysis of a sample comprised of 24 countries for the period 2006 – 2021 and utilizing data obtained from diverse sources, it demonstrates that a country's credit coverage is influenced by both informal and formal social capital while controlling by factors such as access channels to financial products, measures to address asymmetric information and educational levels. The results underscore that, while financial inclusion is promoted through internationally accepted standards, its effectiveness is closely intertwined with the social context of implementation. Furthermore, formal institutions play a crucial role in shaping financial inclusion by fostering innovation, entrepreneurship, and technological advancement, while attitudes to risk and planning time horizons also significantly impact this dynamic. Notably, nations embracing a pragmatic outlook tend to have more viable access to bank loans, whereas risk aversion impedes economic actors´ propensity to engage in credit agreements, even when accessible.

**Keywords:** financial inclusion; social capital.

**JEL classification:** G18, G20, O43.

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## 1. INTRODUCTION

The importance of savings and the role of financial intermediation in channeling them to productive investment through credit have been studied for more than a century by authors such as Bagehot (1873), Hicks (1969), Goldsmith (1969), McKinnon (1973) and Shaw (1973), among others. However, it is not until the appearance of endogenous growth models (Sala-i-Martin, 2006) that financial development stands out in the economic literature, gradually discovering, thanks to advances in available quantitative methods, the endogenous and asymmetrical nature of its effects (Stiglitz and Weiss, 1981).

The Great Recession of 2007 limited the benefits imputed to the financial system, suggesting that its relationship with economic activity resembles a Gompertz's curve, with a great initial impact derived from the lower liquidity restrictions and its boost to investment and formality, to then decline and even subtract resources from other sectors. This *financial excess* could even generate over-indebtedness and eventually lead to a financial crisis, which Minsky (1982) considers an endogenous product of economic growth.

The diminishing returns attributed to financial intermediation, a product of the securitization and gradual financialization of the economy, suggest replacing the traditional indicators of deepening, such as those of monetary aggregates or credit as a percentage of gross domestic product (GDP), with others that contemplate the access and use of these services. The current conditions of global inequality, environmental deterioration, and the ambivalent role of technological progress in the working market feed the theoretical framework of sustainable growth, where combating these phenomena is no longer just an objective, but an input (Rodrik, 2018).

This concern for financial development is not recent (Mosley and Hulme, 1998), although the term financial inclusion did not appear until 2003, when Kofi Annan, former United Nations Secretary-General, used it in a speech on December 29th. Financial inclusion is currently considered a source of growth and social inclusion, promoting seven of the seventeen Sustainable Development Goals (SDGs) framed in the Millennium Goals. These emphasize their universal character and the importance of the means, such as the mobilization of financial resources, the development of capacities and technology, data, and the institutions to achieve them (UN, 2015). Financial inclusion implies the access, intensity, and regular use, by all segments of society, of a wide range of affordable, timely, and adequate financial services, in a context of competition, transparency, and financial education, to promote the well-being of its users and systemic stability, thus contributing to sustainable economic development that promotes economic and social inclusion (Pavón Cuéllar, 2021; Saha and Dutta, 2023).

Initiatives to achieve financial inclusion can hardly be separated from the institutional context in which they are implemented. How does the social capital of a country impact its financial inclusion? How much attention should the analyst pay to cultural traits and national economic institutions? Which cultural and institutional quality dimensions are most relevant to achieving greater financial product access and utilization?

This work aims to clarify these questions by analyzing the importance of a country's social capital in financial inclusion, both in its cultural and institutional dimensions, controlling the other factors that affect it, and building a model that allows for statistical verification of this relationship.

The hypothesis to test is:

***H₀**: National financial inclusion in its use dimension, represented by access to financing, depends on the determinants of consumption and savings, the channels of access to these services, the palliatives to the problems of asymmetric information necessary to provide financing at an accessible cost, but also on cultural traits and institutional quality, which affect the above elements and the attractiveness of using formal credit.*

Another dimension of financial inclusion is access through a bank account, which allows individuals and companies to better manage their income and expenses and provides a gateway to other sophisticated financial products and services. However, it was decided not to use this indicator in this work, since in some countries access to banking is mandatory, and in others, its use may be minimal and its effects as a palliative to the liquidity restrictions of its users are barely marginal. Financial inclusion acquires greater relevance in the economic sphere, when the different agents delve into the use of these products (contracting a loan or insurance, factoring or financial leasing, among others).

The work is structured as follows. In Section 1, financial inclusion, and its relevance in the framework of sustainable growth were presented, to continue in Section 2 with a synthesis of the literature on savings and credit, as well as social capital in its two dimensions, culture, and institutions. Then, Section 3 includes the construction of the model based on this theoretical review, as well as the research methodology used, to end with a brief description of the data and estimates. The results are analyzed and discussed in Section 4, to finally close with the conclusions in Section 5.

## 2. THEORETICAL FRAMEWORK

### 2.1 Consumption, Savings, Credit, and Financial Inclusion

In this section, a brief review of the theoretical framework on consumption, savings, and credit decisions is presented from a microeconomic perspective, to later delve into the macroeconomic sphere, financial depth and inclusion, and its determinants, particularly the institutional framework.

Before the twenties of the last century, saving was the key to economic dynamism, by providing funds for investment, although Keynes (1936) showed through his Paradox of Thrift that it could constitute, at least in the short term, an effective demand leak, as in the Great Depression. In the 1940s, facts claimed its growth-promoting role (Kuznets *et al.*, 1946) and, since then, the literature around savings and credit has had a higher relevance.

The studies of the Permanent Income Hypothesis (Friedman, 1957) and the Life Cycle (Modigliani and Brumberg, 1954) are the fundamental theoretical references to understanding savings and credit. These authors explain that consumption and savings depend mainly on disposable income, but also on permanent income and current and expected wealth, which smooth the path of consumption over time. Likewise, savings can be channeled into productive investment and stimulate economic activity through adequate financial intermediation (Kashyap *et al.*, 1993). However, these relationships are currently more unstable, reducing the explanatory power of traditional models and suggesting further investigation.

Gradually, the conventional indicators of financial depth are replaced by inclusion variables, which consider coverage rather than the importance of the sector, which is essential

for achieving sustainable and inclusive growth. Likewise, the literature broadens the range of its determinants based on recent facts:

There are inertial or persistent factors in the behavior of all savings and credit indicators at the national level (Roa *et al.*, 2014).

It is feasible that, in the ascending part of the economic cycle in environments with high interest rates, companies and families choose to acquire external sources of financing, such as bank credit, which is contrary to what would happen in times of price stability (Ozcan *et al.*, 2003).

Currently, not only actual and expected income but also its volatility is relevant. Getting into the use of financial products requires meeting requirements, providing guarantees, and acquiring medium- and long-term commitments, which are difficult for some potential users to fulfill. This situation is aggravated because credit bureaus, which seek to alleviate information problems to reduce the risk of adverse selection and moral hazard, do not include everyone. As a result, there are profound differences in the access and cost of financing. Financial exclusion is an inevitable consequence for some population segments (youth, women, inactive and rural) and productive agents (micro, small and young companies), which tends to be magnified as the sources of income become precarious and the labor market becomes flexible, preventing them from settling down and manage risks, long-term goals, and unforeseen events (Demirgüç-Kunt *et al.*, 2018).

Regarding human capital, its importance goes beyond formal education. Financial education, training, and technological readiness are positioned as essential elements for responsible access and use of unconventional financial products (Sarma, 2008).

The same financial inclusion policies give rise to distinct results depending on the country where they are applied (Pavón Cuéllar, 2021).

What is behind these stylized facts?

The relationships between coverage or financial deepening, and their determinants, are generally bidirectional, which explains their inertial behavior. Thus, for example, there is a multiplicative effect derived from the real interest rate, which grows as it increases, since it multiplies both savings and debts. Likewise, the infrastructure for access to financial services induces greater financial inclusion and at the same time promotes the creation of better access channels, although at a decreasing rate (Roa *et al.*, 2014). The bidirectional effect of human capital on financial inclusion or financial deepening is also evident (Holzmann, 2011).

A complementary explanation of great relevance, although it has been little explored, has to do with the barriers and inducers to the use of financial products linked to the environment. Within the financial system itself, its competition and regulation, user protection policies, the requirement of guarantees and documentation, as well as other intermediation costs, stand out. But there are also factors outside the financial sphere that determine inclusion, such as cultural traits, informality, and governance, among others. These institutional aspects are discussed in greater depth in the following section.

### 2.2 The Role of Institutions

The variables mentioned at the end of the previous section show the importance of social capital, made up of formal and informal institutions, always recognized in the theoretical field of economics, but little studied in the field of financial inclusion.

Classical jurists already highlighted its relevance and established that depending on the quality of the *social game*, its operation, participants, financing, and reward or punishment, certain individual and collective behaviors would be encouraged. Similarly, the Romans understood that the strength of people was found in the quality of their institutions and one of their main legacies to Western civilization was undoubtedly the law, understood as the formal institutional system. Smith (1776) also emphasized the importance of institutions in economic exchange.

Institutions, defined by North (1990) as the restrictions designed by human beings that shape the interaction between individuals, constitute mechanisms of social reproduction that operate through the internalization of the norms that guide specific behaviors (Enriquez, 1979). They are regulations that arise by consensus and that enjoy legitimacy even in an informal way, a regularized interaction pattern that is known, practiced, and accepted (even if it is not approved) by actors who expect to continue to interact under the sanctioned and sustained rules of that pattern (O'Donnell, 1997).

Institutions reflect the culture of a society and define the rules of the game: formal (institutions) and more informal conventions (cultural traits) that are translated into values and implicit codes of conduct, as well as the application characteristics of both. These are transmitted to individuals throughout their lives and change at a relatively slow rate (Becker, 1998; Hall and Jones, 1999). Each country has its own historical, religious, and cultural background, which affects and is affected by the environment. This feedback process is defined differently depending on whether it is an economic, political, or cultural approach. Economic theories hold that institutions are created and empowered when it is efficient to do so (Demsetz, 1967); political theories focus on redistribution rather than efficiency and sustain that those in power shape institutions to stay there (North, 1990; Olson, 1993); in cultural theories, societies hold beliefs that govern the creation and maintenance of formal institutions (Putnam, 1993; Landes, 1998).

In the next chapter, the two dimensions of social capital, cultural traits, and institutions, are analyzed in greater detail from a primarily economic perspective.

### *2.2.1 Cultural Traits*

National cultural traits can be defined as an interactive set of characteristics that are common to the population of a country (Hofstede *et al.*, 2010) that shape the cognitive schemes of an individual, programming behavioral patterns that are consistent with their cultural context. It is made up of people who share attitudes, values, and beliefs, in such a way that they simultaneously belong to national, ethnic, professional, and organizational cultures.

Although defining a national culture may be questionable since there may be more than one in a country, especially in the global context and with the advance in telecommunications, at the same time globalization induces a growing interaction that alters cultures and makes it difficult to isolate cultural subgroups within a country. Thus, each one acquires its own identity derived from its cultural fusion, so considering a national culture is acceptable or, at least, the most viable (Pavón Cuéllar, 2015).

At the same time, these cultural changes tend to occur over a relatively long time. As Becker (1998) states, individuals have less control over their culture than over other forms of social capital. They cannot alter their ethnicity or family history, and only with difficulty can they change their country or religion. Thus, attitudes, values, and beliefs, both individual and

group, change very slowly. This persistence justifies considering, in our study period, national cultural traits as constant and exogenous, as they are the product of their history.

Instead, as considered in this study, formal institutions vary and because social conventions persist or adapt slowly and inertially to transformations in formal institutions, discrepancies may arise between both components of the institutional structure. Therefore, even if the different societies imitate the institutions of others, the existing variations in the informal rules can explain to a large extent why the establishment of quality regulations affects each country differently (Van *et al.*, 2022). Both are included in this work.

### *2.2.2 The Institutions*

As already mentioned, institutions reflect the culture of a society and define the rules of the game. From an economic perspective, institutions are necessary for the proper functioning of the markets. On the one hand, scarcity forces us to specify them: in a world where needs exceed available resources, if there were no contractual and property rights, the exchange would take place through violence and the law of the strongest.

Additionally, market failures such as externalities, public goods, or information problems (uncertainty and asymmetric information), can lead to incomplete or non-existent markets, with an economically inefficient result. Institutions try to remedy these failures by reducing problems and information costs, as well as providing decision rules for different situations. "Economic agents, confronted with the limitations of individual rational behavior, create institutions that, by generating new incentives or imposing new restrictions, allow them to transcend those limitations" (Bates, 1995).

Finally, we need to remember that markets, even when they are efficient, do not necessarily produce a fair distribution of income. A market economy generates an unacceptably high level of inequality since income depends on accidental factors such as inheritance, luck, or natural abilities, among others, and because the production of goods follows monetary votes and not the greatest needs, institutions also intervene in this area (Samuelson and Nordhaus, 2010).

Endogenous growth models have driven the literature on social capital and its impact on economic activity since the mid-1990s. Authors such as Borner *et al.* (1995) or Keefer and Knack (1998), incorporate the factors listed by Barro (1996) as conditions for convergence between countries, linked to the institutional framework (protection of property rights, rule of law, bureaucracy, honest government, and delimitation of executive power).

This New Institutional Economics (NIE) also emphasizes the bidirectional nature of the relationship between institutional quality and economic variables, noting that not only social infrastructure affects economic activity, but it is also clear that rich economies can afford and choose better institutions (Hodgson, 2006). The success of different national economic initiatives then appears to be a result, not only of the capacity of their individuals but also of their capacity for collective action.

Now, measuring this institutional quality is not an easy task, since it is a broad concept that encompasses the law, individual rights, regulation, and government services. The concept of institutional quality arises from the English word *governance* which, according to the Cambridge Dictionary, means how organizations or countries are administered at a higher level. It represents better design, implementation, effectiveness, supervision, and continuous improvement of the policies and *rules of the game* that govern a country.

Rodrik (2007) distinguishes five types of institutions necessary for long-term sustainable economic development: the *market makers*, which protect property rights and guarantee that contracts are fulfilled; the regulatory ones; who seek macroeconomic stability; those that promote social security; and conflict managers. All of them allow, if they are appropriate, markets to function efficiently and with the degree of equity desired by the different governments, by mitigating market failures (imperfect competition, externalities, public goods, or information problems), while guaranteeing certain fundamental economic principles, being predictable and having adequate incentives.

What defines the quality of an institution? The World Bank points out that a quality institution fulfills two basic economic functions: reducing transaction costs by granting certainty and predictability to social interaction; and facilitating coordination between economic agents (World Bank, 2023). To achieve this, it must have some attributes (Alonso and Garcimartín, 2013), the main ones being static efficiency (being compatible with incentives that promote behaviors with lower social costs); legitimacy (being able to define credible contracts intertemporally); security (reducing transaction costs derived from the uncertainty associated with human interaction) and, finally, dynamic efficiency (adaptability and anticipation of social changes or, at least, the existence of incentives that facilitate the adjustment of agents to these changes).

These institutions affect all types of economic activity and constitute an important palliative to market failures and the achievement of a more equitable, environmentally friendly, and stable economy. Its role is particularly relevant in the financial field due to the systemic impact and the asymmetries in the information that characterize this sector. The next step is to determine which elements of the institutional framework have the greatest weight in financial inclusion, through an econometric analysis that statistically validates their influence.

## 3. RESEARCH METHOD

### 3.1 The Model

After analyzing the theoretical framework, this section builds the model that tests the importance of the elements mentioned for financial inclusion and the nature of their interrelationship.

The first step is to define the dependent variable. The indicators most used in the literature are, for financial access, the number of savings accounts, and for the use of financial products, the commercial bank borrowers, both for a certain number of inhabitants. These indicators capture, although not fully, the financial inclusion that a depth indicator such as monetary aggregates or credit over GDP cannot, since financial resources tend to be concentrated in a few recipients.

The use of these variables is also justified by the lack of availability of more assertive international financial access indicators, due to the importance of commercial banking in the delivery of basic financial services and because these tend to be, at least for now, a prerequisite for access to more sophisticated products (Sarma, 2008). As already mentioned, opening a bank account is the entry route to the financial system, but access to credit is an indicator of a more comprehensive financial inclusion, which is why it is the indicator chosen in this study to represent financial inclusion.

It should be noted that, in recent years, although traditional banking services such as loans and deposits continue to be the majority, digital banking, and non-bank financial products have gained special relevance. This trend has become more evident since the pandemic, particularly for those services contracted and used through mobile phones, so today the latter is considered an important channel of financial access (World Bank, 2022; IMF, 2023).

Bank account ownership among the adult population continued to grow across all income groups. For example, the share of depositors increased from 44% to 50% in middle-income countries between 2019 and 2021, and that of borrowers also increased in middle-income countries, although it remained stable in low- and high-income countries. Overall, the use of deposit and loan services did not vary between 2020 and 2021, picking up in 2020 due to government income and transfer support policies adopted in response to the pandemic (OECD, 2021), before falling in 2021 because of the reversal of these policies.

Today, more than 70% of adults in the world have a financial account, but this figure hides severe inequalities: coverage is almost universal in terms of banking and more than a third in access to credit in Central Asia and Europe, while in Sub-Saharan Africa these figures do not even reach 25% and 5%, respectively (World Bank, 2023). In emerging countries, a large population and productive segment tend to finance their activities through their own or informal funds, either because they lack access to the formal system or because they have it but prefer not to use it. According to the latest aggregate figures available from the World Bank (World Bank, 2023), 47% of adults on the planet reported having requested a formal or informal loan in the last 12 months, 64% in high-income countries, and 44% in emerging countries.

The use of informal sources of financing derives from job insecurity and the fact that access to formal credit is difficult for some segments of the population (youth, women, inactive and rural) and the productive sector (small and youth businesses).

More recent figures from the Financial Access Survey (FAS) already show a clear trend toward financial digitization: the number of mobile money agents per 100,000 adults has almost doubled globally between 2019 and 2021, mainly in Africa and Asia. On the other hand, the number of commercial bank branches and ATMs per certain number of inhabitants, the two indicators of the 17 United Nations Sustainable Development Goals (SDGs), have decreased in recent years, partly due to banks' cost reduction efforts. In high-income countries, such as Europe, this decline reflects the rapid adoption of digital payments, while in low- and middle-income countries, the emergence of other retail alternatives such as branchless agent banking is growing rapidly, particularly in Latin America (IMF, 2023).

These figures highlight the importance of testing various infrastructure indicators for access to financial services in the model, in addition to the traditional coverage of bank branches that are falling into disuse. The empirical literature suggests that this is evaluated by the number of automated teller machines (ATMs) or, according to the most current trends, by subscriptions to mobile phones (cellphones) since ATMs lose relevance as financial digitization increases (IMF, 2023).

In addition to the access channels, the rest of the control variables must be included in the model, indicated in the literature as inducers or inhibitors of financial inclusion.

Use barriers derived from incomplete and asymmetric information, such as required documentation, guarantees or collateral, credit bureaus, interest rates, and spreads.

Quality and/or dynamism of the sources of income, such as those linked to the business environment, income, activity and inactivity, employment and unemployment, or job insecurity.

Human capital: education at different levels, training, financial education, and technological training

Once the main determinants of savings and access to financing have been identified according to the literature, the explanatory variable of interest is incorporated: social capital, which includes both national cultural traits and its institutions.

Regarding cultural traits, anthropology, sociology, history, and psychology can provide valuable elements to assess their impact on financial inclusion, since cultural differences could explain, for example, why what works for one country does not work for another (Hofstede *et al.*, 2010; Jaén *et al.*, 2013). This suggests an interdependence between culture and financial inclusion, so the next step is to obtain indicators of these common national traits internationally in a format that facilitates their quantitative processing.

According to the catalog of instruments to measure culture by Taras *et al.* (2010), more than 150 indicators were available in 2010. Among the intercultural papers, Hsu *et al.* (2013) highlight the research of Hofstede *et al.* (2010), Inglehart and Baker (2000), Steenkamp (2001), Schwartz (2012), and the Globe project (House *et al.*, 2004). Hofstede's model specifies and identifies more cultural dimensions, is validated by multiple international studies, follows the current theoretical framework, and includes a representative sample of countries. It is then chosen in this research.

Hofstede *et al.* (2010) define, through a factorial analysis, six main cultural dimensions, understood as traits measured in relative terms and being stable over time. Why? Because if something alters them, the event is usually global or at least continental, therefore, since it affects all countries, it maintains its relative positions intra and internationally unchanged, except in extreme cases, such as a war or a large-scale natural disaster.

These six dimensions can be summarized as follows:

*1. Power distance:* assesses the degree to which the weakest members of a society accept or expect the existence of differences in levels of power. A high score suggests a more hierarchical and generally more violent social structure; *2. Individualism:* measures the degree to which people integrate into groups and have a sense of belonging and loyalty to them. High individualism reflects weak social ties and self-sufficiency; *3. Masculinity:* calibrates the distribution of traditional gender emotional roles, with masculine societies being more assertive and competitive, with a greater gap between roles and a more marked search for material success. In more empathetic female cultures, there is a greater preference for consensus, equity, cooperation, and quality of life; *4. Uncertainty avoidance:* the social tendency to avoid risk and ambiguity. Risk-averse societies are more emotional and anxious, they reinforce their security through strict laws and absolute truths, so they are less tolerant and reflective; *5. Long-term orientation or pragmatism:* social valuation of long-term commitments, perseverance, and the ability to postpone satisfaction, in exchange for later gratification; and *6, Indulgence:* a degree of social complacency that, in contrast to the restriction, symbolizes freedom, the permissibility to satisfy the basic and natural human impulses, especially those related to the enjoyment of life and leisure.

Regarding formal social capital, the definition of institutional quality, its characteristics, and requirements already mentioned in the previous section have inspired analytical exploration and empirical work in search of its determinants, and form the theoretical support of various indicators of institutional quality, among which the Worldwide Governance Indicators (WGI) stand out, published by the World Bank (World Bank, 2023), a reliable

source of information, that collects opinions through various surveys, both in emerging and industrialized countries.

The World Governance indicators use more than 30 databases from a wide range of polling firms, expert groups, non-governmental organizations, international organizations, and private companies, reported for more than 200 countries for the period 1996 - 2021 (World Bank, 2023). They cover six dimensions of global governance and are published individually and in aggregate.

These dimensions evaluate the perceptions of those surveyed in the following fields: voice and responsibility (political representation and freedom of expression); political stability and absence of violence and/or terrorism; Government effectiveness (quality, credibility, and independence of public services and policy formulation and implementation); regulatory quality (formulation and implementation of sound regulations and policies that promote the development of the private sector); rule of law (confidence in the regulatory framework and its compliance) and the last, the control of corruption (to what extent public power is exercised for private benefit, includes minor and major forms of corruption, as well as institutional capture).

### 3.2 Empirical Data, Analysis, and Discussion of the Results

This section analyzes the impact of institutional quality on financial inclusion, controlling for other factors that the theoretical framework suggests as determinants and confirming whether they maintain a statistically significant relationship for the sample and period of analysis.

For choosing the variables, an exploration of the different available databases was necessary, grouping the indicators into categories and through a correlation and factorial analysis, excluding those that seemed to capture the same information.

The model is annual, for the period 2006-2021, corresponds to commercial banks and the sample includes 24 countries (Albania, Argentina, Bangladesh, Brazil, Cape Verde, Colombia, Croatia, Dominican Republic, Egypt, Arab Republic, Estonia, Ghana, Italy, Latvia, Malaysia, Namibia, Nigeria, Pakistan, Peru, Saudi Arabia, Singapore, Thailand, Turkey, Uruguay, and Zambia). Information sources are Hofstede (2001); Hofstede *et al.* (2010) (2001; 2010), World Bank (2023), The International Labor Organization (ILO, 2023), World Economic Forum (2020), The International Monetary Fund (IMF, 2023), and EIU (2022). Database integration forces multiple years and countries to be removed and to estimate some isolated missing data through a linear extrapolation (Scott Armstrong and Collopy, 1993).

The estimated model attempts to consider the following categories of variables:

$$Financial\ inclusion\ (use) = f(Infraest, Control, Culture, Inst) \quad (1)$$

where:

Financial inclusion (use): Commercial bank borrowers/thousand adults

Infraest: Bank branches; ATMs or mobile cellular phones subscriptions for a certain number of inhabitants or kilometers

Control: Other control variables that have being suggested in the literature as determinants of the explained variable (income or job quality; credit bureaus and the cost of financial products, among others).

Culture: Dimensions of Hofstede's cultural traits (power distance, masculinity, individualism, intolerance of uncertainty, pragmatism, and indulgence).

Inst.: Representative variables of institutional quality. The Global Governance Index and each of its dimensions are tested (voice and accountability; political stability and absence of violence/terrorism; government effectiveness; regulatory quality; rule of law and last, control of corruption).

The final estimated model is:

$$FinancialInclus_{it} = \alpha + \beta\ MobileCel_{it} + \gamma\ Bureau_{it} + \delta\ HumanCap_{it} + \eta\ RegQual_{it} + \theta\ Pragmatism_{it} + \lambda\ UncertAvoid_{it} + \epsilon_{it} \quad (2)$$

where:

FinancInclus: Borrowers from commercial banks are the reported number of resident customers that are nonfinancial corporations (public and private) and households that obtained loans from commercial banks and other banks functioning as commercial banks.

MobileCel: Mobile cellular phones subscriptions (per 100 people).

Bureau: The Depth of Credit Information Index measures rules affecting the scope, accessibility, and quality of credit information available through public or private credit registries. The index ranges from 0 to 80, with higher values indicating the availability of more credit information, from either a public registry or a private bureau, to facilitate lending decisions.

HumanCap: Labor force with basic education (percentage of total working-age population with basic education).

RegQual: The regulatory quality captures perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development. Worldwide Governance Indicators give the country's score in units of standard normal distribution, i.e., ranging from approximately -250 to 250.

Pragmatism: Long-term orientation country refers to the time horizon people in a society display. National scores range from 1 for the lowest to 100 for the highest.

UncertAvoid: Uncertainty avoidance reflects the degree to which a culture avoids risks and the uncertainty of the future. National scores range from 1 for the lowest to 100 for the highest.

$FinancInclus$ is the dependent variable and *MobileCel*, *Bureau*, *HumanCapm*, *RegQual*, *Pragmatism* and *UncertAvoid* are explanatory variables, i = 1…m is, in this case, the number of countries; t = 1…T is the number of years, α, β, γ, $\delta$, η, θ, and λ are parameters and $\epsilon_{it}$ is a disturbance term, that can be correlated along time (t) or across countries (i).

## 4. RESULTS OF THE EMPIRICAL ANALYSIS AND DISCUSSION

The model was estimated using a panel FGLS (Feasible Generalized Least Squares) and PCSE (Panel Corrected Standard Errors) analysis, where first-order autocorrelation and heteroscedasticity were detected, due to the endogenous nature of some of the variables. The presentation of both models in Table no. 1 is done to verify the robustness of the results although, for the reasons detailed below, the second is the most appropriate.

**Table no. 1 – Results of Panel Analysis**

| Variables | FGLS | | PCSE | |
|---|---|---|---|---|
| | Coefficients | Standard Errors | Coefficients | Standard Errors |
| Dependent | | | | |
| $FinancInclus_{it}$ | | | | |
| Explanatory | | | | |
| $MobileCel_{it}$ | 0.489707 *** | 0.093810 | 0.716295 *** | 0.203620 |
| $Bureau_{it}$ | 0.626276 *** | 0.141080 | 0.820684 ** | 0.392536 |
| $HumanCap_{it}$ | 1.138002 *** | 0.275105 | 1.513683 ** | 0.610250 |
| $RegQual_{it}$ | 0.663386 *** | 0.076852 | 0.778361 *** | 0.153732 |
| $Pragmatism_i$ | 2.943305 *** | 0.383050 | 5.516504 *** | 0.748155 |
| $UncerAvoid_i$ | -2.173959 *** | 0.257096 | -3.009215 *** | 0.786912 |
| Coefficient of determination ($R^2$) | | | 0.6637 | |
| Wald Test | | | | |
| $Chi^2$ | 708.48 | | 229.77 | |
| Prob>$Chibar^2$ | 0.0000 | | 0.0000 | |
| Breusch and Pagan LaGrange Multiplier Test | | | | |
| $Chibar^2$ | 1864.49 | | | |
| Prob>$Chibar^2$ | 0.0000 | | | |
| Hausman Test | | | | |
| $Chibar^2$ | 8.63 | | | |
| Prob>$Chibar^2$ | 0.0710 | | | |
| Observations | 281 | | 282 | |
| Groups | 24 | | 23 | |

Note*:* Statistically significant at *10%, **5%, and ***1% levels.

*Source:* Own estimation with data from Hofstede (2001); Hofstede *et al.* (2010); IMF (2023); World Bank (2023).

FGLS fits linear models of panel data by using feasible generalized least squares. It allows estimation in the presence of AR (1) autocorrelation within the panels and cross-sectional correlation and heteroscedasticity between them. An Ordinary Least Squares (OLS) estimation is also carried out with Panel Corrected Standard Error (PCSE) using the Prais-Winsten equation since the disturbances are not independent and identically distributed, but heteroskedastic and correlated between countries (Roodman, 2009; Stata, 2019).

Thus, the endogeneity of the model variables is identified and corrected, but it cannot be studied, since the persistence of cultural traits prevents the use of dynamic models.

The two estimates presented in Table no. 1 pass the test for the non-existence of omitted and redundant variables, as well as for non-overidentification (LM, Wald's F, and Hansen's J tests, respectively). These tests were carried out due to the positive relationship between pragmatism, or long-term vision, and institutional quality, to rule out that any of them did not provide additional explanatory power to the model, controlling in turn for any multicollinearity that the temporal component of the database would not have corrected (Gujarati, 2003). It should be noted that there is also a weak negative relationship between this institutional quality and uncertainty avoidance.

The explanatory power of the model is also evaluated using the Wald test and, in the case of the PCSE estimation, by the coefficient of determination ($R^2$). Both indicate that the estimate is correct and that the indicators together explain the dependent variable. Likewise, the high

significance of each of the independent variables allows validation of the model in both estimations. The Akaike, Schwarz, and Hannan-Quinn information criteria tests yield the values of 10.63062, 10.72102, and 10.66687 for the model estimated using FGLS, and 10.66242, 10.75283 and 10.69868, respectively, in the PCSE estimation, that is, with a slightly better explanatory power in the case of the estimation by FGLS. However, the specialized literature suggests that if the number of years is not equal to or greater than the number of countries, as in this case, optimistic estimates of standard errors (SE) can be obtained if estimated using this method (Labra and Torrecillas, 2018). Thus, this research favors the PCSE methodology. However, presenting the results using both methods allows for verifying the robustness of the model, ensuring that the sign and significance of its independent variables are maintained, along with the explanatory power of the model in both cases.

When the effect of access infrastructure on credit coverage among the population is analyzed, the importance of bank branches and even ATMs decreases as that of mobile phones increases. As the recent literature on this topic points out (Lannquist and Tan, 2023), digital financial services – including those using mobile phones – are already operational in more than 80 countries, and in some cases have reached a considerable scale. As a result, millions of low-income clients, previously excluded, are gradually beginning to access formal financial services. In China, Kenya, India, and Thailand, more than 80% of the population is banked, thanks to various reforms, innovations, and efforts to promote the opening of low-cost accounts, including mobile and digital payments (World Bank, 2022).

Regarding barriers attributable to the financial sector, the variable that turned out to be highly significant was the one that represents the palliatives to asymmetric information: credit bureaus, consistent with what has been indicated in the literature (Beck *et al.*, 2007; Yang and Masron, 2024). This variable incorporates aspects related to the cost of credit, both in terms of the interest rate and the intermediation margin, moral hazard, and adverse selection, so that, as expected, the depth of information represented by these companies, has a positive and significant impact on access to credit and its use. Such inclusion, in turn, feeds them, further reducing information asymmetries (Hoffmann, 2001).

In the explanatory variables referring to human capital, including education and the labor market, it should be noted that employment, wages, and labor vulnerability were not significant in this case, perhaps because, in recent years, the sources of income and their quality seem to have an ambiguous effect on the use of financing, in an environment of more volatile interest rates. In times of economic boom, economic agents generally enjoy a better financial situation, have more attractive projects, and can commit to credit, but access to it does not guarantee its use, particularly when its cost is unpredictable. On the other hand, it is in the downward phase of the economic cycle, when agents require funds to offset liquidity restrictions, that access to credit is restricted (Wu and Wan, 2023). The paradox is then fulfilled: credit is usually available to those who need it least, and vice versa.

Education, in contrast, is a relevant component of human capital to achieve greater use of financial products (OECD, 2023), but only at a basic level, since additional years of study do not lead to their more meaningful utilization, at least as far as it refers to credit. Specific variables of financial education and technological readiness do not yet have enough cross-sectional and temporary observations to allow their evaluation.

Finally, initiatives to achieve greater financial inclusion cannot be separated from the social context in which they are implemented. Institutional quality, as well as the cultural traits that prevail in a nation, have a significant impact on its success or failure.

Institutional quality is highly significant in the model, demonstrating that it provides a virtuous circle, since it promotes innovation, entrepreneurship, and technological catch-up, through confidence not only in the future but also that the fruit of the effort can be harvested and that it will be done safely. This, in turn, allows higher quality institutions: access to funds and their effective allocation make it possible to build infrastructure that leads to improvements in productivity and that ends up creating better financial prospects (Levine and Zervos, 1998). Van *et al.* (2022) highlight the importance of the legal framework and the efficiency of contract execution, Saifurrahman and Kassim (2022) consider regulations regarding the disclosure of information essential, and Rajan and Zingales (2003) show that, in autocratic countries, the interests of the elite, public and/or private, are preserved, to the detriment of efficiency and financial development. The more power these groups have, the more obstacles there are to financial inclusion, because of lobbying and institutional capture, among other rent-seeking activities. This suggests that institutional reforms aimed at limiting the influence of lobbying, expanding suffrage in the political system, promoting compliance with the law and civil rights and liberties, eliminating bureaucratic processes, and improving institutional efficiency, are beneficial for financial inclusion (Girma and Shortland, 2008)

Regarding the more persistent informal social capital, the estimation made in this research highlights the importance of two national cultural traits linked to their attitude towards risk and the time horizon of their planning, which influence financial inclusion. Similar results have been found by authors such as Pavón Cuéllar (2019); Anyangwe *et al.* (2022); Zeqiraj *et al.* (2022); Bialowolski *et al.* (2023), among others.

The model shows that, in countries with a long-term or, in other words, pragmatic vision, contracting a bank loan is more feasible, as expected. Pragmatism, a characteristic of countries in the Far East, entails strategic thinking and dynamism that facilitate entrepreneurship and innovation (Yeganeh, 2013), which, together with the importance of honor in this culture, promote respect in social exchanges and business and, together with persistence, contribute to the achievement of objectives and the fulfillment of the acquired commitments, including financial ones (Hofstede *et al.*, 2010).

On the other hand, risk aversion reduces the willingness of economic agents to contract credit, even if they have access to it since it constitutes a bet on the future and entails risks. These countries are less prone to innovation and entrepreneurship, which inhibits competitiveness, and they feel more comfortable with control, which is reflected in a long-term scenario by a more voluminous, inefficient, and lower-quality legal framework, which prevents the free flow of new ideas and their implementation (Pavón Cuéllar, 2015). This is verified in this study and explains why even if quality institutions are established, these informal codes of conduct affect their interactions and their effect on financial inclusion.

## 5. CONCLUSIONS

This research demonstrates quantitatively the importance of the institutional environment in financial inclusion, both in its informal dimension: culture, and in its formal dimension, represented by regulatory quality, controlled by other factors.

Regarding the control variables, it is verified that financial inclusion, in its dimension of use, depends on the access channels to these products, the most relevant being the mobile phone, since bank branches and even ATMs have been losing relevance as digital banking gains. Also, as expected, credit bureaus are essential for accessing credit, since they make it

easier and less expensive by alleviating the problems of uncertainty and asymmetric information. Likewise, the educational level of the population is relevant, although it seems that this is limited to the basic level, perhaps because, as the literature points out, technological literacy and financial education are the specific dimensions of human capital that have the greatest impact on the inclusion, and not so much formal middle or higher studies. It should be noted that this appreciation has not been validated with the data used in this research, but rather only constitutes a possible interpretation based on the theoretical framework.

Concerning the variable of interest, social capital, evidence of its importance in achieving greater financial coverage is found, both in its informal and formal dimensions.

The significance of two cultural traits in the model, pragmatism, and risk aversion, coincides with the specialized financial literature and emphasizes that, although there are internationally accepted elements to promote financial inclusion that have been validated by the specialized literature, their effectiveness cannot be detached from the cultural environment where these measures are implemented. Uncertainty avoidance inhibits the willingness to contract a loan, while pragmatism induces it.

Likewise, the high explanatory power of formal social capital as a facilitator of financial inclusion, represented by institutions, shows that quality regulations are required for economic agents to take the step towards more intensive use of financial products. The ability of an independent and transparent government to formulate and implement quality regulations that promote efficiency, the rule of law, and social peace are sine qua non conditions for promoting social inclusion in general, and financial inclusion in all countries in the world. This result also shows that, in any financial inclusion strategy, a joint effort of all economic agents is necessary, beyond the financial sphere, with a common and long-term project.

Several obstacles prevent financial coverage, particularly in emerging countries, leaving a broad population and productive segment vulnerable to the liquidity restrictions imposed by being financially excluded, while in other segments a saturation of products of this type is detected. In addition to the ethical issues in terms of equity that this situation raises, unexploited business opportunities are also evident, since these unattended segments constitute a possible solution to the slowdown in financial dynamism and its decreasing effect on economic activity, by representing a market that could be profitable if the right conditions are established to avoid systemic risks, and with high diversification potential.

To move towards more comprehensive financial coverage, and considering the results obtained in the present research regarding institutional quality, access channels, education and palliatives to asymmetric information, concrete measures are necessary. From a supply perspective, the opening of low-cost accounts for basic services should be promoted, while at the same time simplifying and standardizing the documentation necessary for their opening through electronic platforms, supported by financial education and technological readiness programs. The subsidiarity role of development banks is also relevant for the granting of guarantees, for preferential credit support, and for providing specialized advice and financial services. In this area, supranational organizations must promote financial inclusion by channeling resources for this purpose, but with greater monitoring of the destination and use of the funds.

On the demand side, it is necessary to explore what the transition from informality to formality represents in practice in each country, its organizational culture, and whether financial services match the needs and educational level of their potential users. This requires, as has been demonstrated in the present study, an exhaustive analysis of the national culture and the regulatory framework that determines the existing incentives in the country.

As pointed out by Jungo *et al.* (2022), the effectiveness of any financial inclusion initiative depends on these factors, regardless of whether it is focused on technological innovation, user protection, financial education or technological literacy, disclosure of relevant information, or regulatory proportionality to the risks of innovative products.

It should also be noted that this research is not exempt from limitations, among which are the use of a narrow indicator of human capital and not inquiring into the endogenous nature of several variables in the model, which is only detected. However, the analysis period of just over a decade validates the unidirectional character established between social capital, human capital, and financial inclusion, given the persistence of the cultural traits of a society, its institutional quality, and its educational level. It only seeks to establish whether there is a significant effect of these characteristics on financial inclusion and its sign, and not an exact quantitative relationship for statistical inference purposes.

In this sense, we must also remember the weaknesses attributed to the panel models, which assume that the economies share the same function and that this is relatively stable over time, although in their defense it should be noted that they allow us to focus on priority issues of analysis and, by considering homogeneous and reliable sources of information, facilitate international comparison and the drawing of general conclusions, opening the possibility of developing subsequent studies that allow understanding national and even local specificities.

Thus, the most promising lines of research derived from this document are those that seek to detail the analysis by the level of national development, distinguishing individuals from companies, people by gender and age, or firms by size and sector. Some of this information already exists, although it will take some time to have the time and cross-sectional series that enable its statistical treatment.

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# Positions and Delimitations Regarding the Financial Performance - Sustainability Relationship in the Context of Organizational Resilience

**Mihaela Neacșu*, Iuliana Eugenia Georgescu****

**Abstract:** Sustainability can guide the decision-making process of managers in obtaining competitive advantages. Incorporating sustainability criteria into the main managerial strategies of organizations generates long-term profitability. Using Structured Literature Review (SLR) as a research methodology we synthesize the characteristics and differences between financial performance and sustainability in the context of organizational resilience. Therefore, this paper offers a comprehensive structured literature review based on the relationship between the concepts of financial performance, sustainability, and organizational resilience, using research studies from four main databases: Web of Science, Scopus, ScienceDirect, and Springer. In carrying out this study, we identified the current trends in the specialized literature regarding the relationship between financial performance and sustainability in the context of organizational resilience as they were debated in the analysed literature, until the end of September 2023, in 116 papers.

**Keywords:** organizational sustainability; financial performance; organizational resilience; social responsibility; risk.

**JEL classification:** G01; L25; M14.

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## 1. INTRODUCTION

As the old people used to say, it's wiser to prepare when it's not raining than to dig a well when you're thirsty. Currently, the global economic environment is experiencing important changes at a rapid pace, and organizations face both risks and opportunities (Zhu *et al.*, 2022). Human society is increasingly demanding sustainable development, and emerging economies are striving to realize their sustainable production potential (Jinru *et al.*, 2022). Organizations are pressured to take the initiative in resisting risks to survival, to take advantage of development opportunities in critical situations, and to have a positive response to the demands of sustainable development (Cyert and March, 1963).

In recent years, various threats have been reported, such as cyber security attacks (Gisladottir *et al.*, 2017), terrorist attacks (Tingbani *et al.*, 2019), natural disasters (Mal *et al.*, 2018), economic crises (Tooze, 2018), unexpected tragedies (Amankwah-Amoah *et al.*, 2021). Most companies only occasionally adopt sustainable development (Yu and Zhu, 2022), and when financial goals conflict with environmental or social responsibilities, financial goals are prioritized, leading to accelerated environmental deterioration and increased social inequality.

We observe that an organization becomes efficient not only if it manages to achieve its financial objectives, but must adapt as much as possible to the social and environmental context in which it operates, to develop the capacity to recover from various changes. Against the backdrop of globalization, the principles that govern the business environment have changed. Increasing profitability rates is still considered the cornerstone of any successful organization, but meeting market demands is not enough. Since the launch of the Brundtland Report (WCED, 1987), managers have understood that, to be competitive, they must analyse not only economic but also social and environmental issues. These circumstances facilitated the creation of a new type of entity, called a sustainable organization, designed to be profitable and to develop the socio-ecological system in which it operates. Later, a new type of organization appeared, based on knowledge (Drucker, 1988). In this economic organization, knowledge is the key to obtaining competitive advantages. At the beginning of the 21st century, a sustainable organization based on knowledge that adapts promptly to the dynamic and uncertain nature of the economic environment was proposed (Leon, 2013).

This paper aims to synthesize the common features and differences between financial performance and sustainability in the context of organizational resilience in papers published until September 2023, using four databases: Web of Science, Scopus, ScienceDirect, and Springer.

In this context, the study was organized into 4 sections. Section 2 defines the research method, aiming to identify and organize a set of relevant papers for the literature review. Section 3 examines the selected studies to establish the state of knowledge in the researched area, attempting to answer the following research questions:

*1. How and when did the concepts of financial performance and sustainability develop in the context of organizational resilience?*

*2. What was the impact and contribution of the publications in the researched literature?*

*3. How is the interest in researching the relationship between financial performance and sustainability in the context of organizational resilience spread in the world?*

*4. Are financial performance and sustainability included in organizations' development and resilience strategies?*

*5. What are the main areas of research regarding the relationship between financial performance and sustainability in the context of organizational resilience?*

Section 4 presents the conclusions of the study.

## 2. METHODOLOGY

To analyse and clarify the current trends in the specialized literature regarding the relationship between financial performance and sustainability in the context of organizational resilience, we used a Structured literature review (SLR) as a research methodology. Kitchenham (2004) argues that SLR is a means of evaluating and interpreting all available research relevant to a particular research question, topic area, or phenomenon of interest. According to Hossain *et al.* (2022), this is a comprehensive and unbiased research method that evaluates and interprets the available research so that by reviewing the literature, the state of research in an area of interest can be strengthened.

Using a rigorous and reliable methodology (SLR), we aimed to present a fair assessment of the relationship between financial performance and sustainability in the context of organizational resilience. Using the literature analysis protocol proposed by the researcher Cooper (1988), we identified six characteristics regarding the literature analysis: focus, purpose, organization, perspective, target group, mode of evaluation, and synthesis of studies. In Table no. 1, I adapted Cooper (1988) taxonomy in the process of reviewing the literature on the relationship between financial performance and sustainability in the context of organizational resilience.

**Table no. 1 – Research taxonomy**

| Characteristics | Cooper's taxonomy (1988) | Author taxonomy |
|---|---|---|
| ***Focus*** | Type of studies used (methodological, theoretical, practical, applied) | All types of studies |
| ***Scope*** | - synthesizing: generalizing, resolving conflicts, building linguistic connections;<br>- criticism;<br>- to identify the central problems | - to identify the central problems |
| ***Organization*** | Chronological<br>Conceptual<br>Methodological | Chronological, conceptual, and methodological |
| ***Perspective*** | Neutral presentation<br>Embracing point of view | Neutral presentation |
| ***Target group*** | Specialized Researchers<br>Researchers from all fields<br>Practitioners<br>The general public | Specialized Researchers |
| ***The mode of searching and synthesizing the studies*** | Exhaustive<br>Exhaustive with selective citation<br>Representative<br>Fundamental and Crucial | Representative |

*Source:* adapted from Cooper (1988)

The purpose of this study is to synthesize the literature and identify current trends in the specialized literature regarding the financial performance-sustainability relationship in the

context of organizational resilience, investigating the emergence of these concepts, their development, similarities, and differences, but also their overlaps. This literature review was analysed first chronologically and then conceptually and methodologically, presenting an objective view, the study mainly focusing on specialist researchers. In identifying how to search and synthesize the studies, we opted for a reasonably representative coverage.

As part of the literature search process, we selected databases and keywords and performed an ongoing evaluation of sources. Thus, we applied the following steps in the search strategy: choice of a database source, choice of keywords and search criteria, and evaluation of the appropriateness of the literature subset (Vom Brocke *et al.*, 2009).

For a more comprehensive investigation, we chose four main scientific online databases as data sources: Web of Science (WOS), Scopus, ScienceDirect, and Springer. The keywords used in the research were financial performance, sustainability, and organizational resilience. This research includes papers published until the end of September 2023. Applying the selection criteria, 957 papers were initially identified, from which, following the assessment of the adequacy of the literature set, we selected 116 papers relevant to the study, which were processed with the help of RStudio software (Table no. 2).

**Table no. 2 – The research process in the literature review**

| Steps | Query criteria | Results | | | |
|---|---|---|---|---|---|
| | | **SCOPUS** | **WOS** | **ScienceDirect** | **Springer** |
| **I** | TITLE-ABS-KEY / All Fields (financial AND performance) AND (sustainability) | 5.560 | 15.471 | 16.660 | 102.911 |
| **II** | TITLE-ABS-KEY / All Fields (organizational AND resilience) | 247 | 46 | 113 | 551 |
| **III** | Studies included in the research | 64 | 11 | 27 | 14 |

*Source:* Made by the authors

The investigation of the 116 papers was carried out by applying the criteria of the research of Cocchia (2014), and Dumay *et al.* (2016):

a. temporal analysis, which explores the evolution of research on the relationship between financial performance and sustainability in the context of organizational resilience over the last ten years. The studies were organized according to the year of publication, the result is a graph regarding the trend of papers in the researched field during the period 2013 - September 2023;

b. the analysis of the typology of the researchers, which reveals their contribution and affiliation to the researched field, they being from the academic environment, the business environment, and research institutions;

c. the analysis from the perspective of the geographical area explores the world map to identify both the most studied regions and the representative countries that have published the most research papers on the relationship between financial performance and sustainability in the context of organizational resilience;

d. the analysis from the perspective of the research methodology analyses two research initiatives in the field regarding the relationship between financial performance and sustainability in the context of organizational resilience: the first initiative refers to the studies that adhered to specific development strategies (top-down approach), and the second involves solving specific and independent economic-financial problems (bottom-up approach). Thus,

the studies were ranked according to the year of publication and research method (empirical study or theoretical study);

e. research theme analysis explores the themes identified in the papers studied. The main research themes were identified by calculating the co-occurrence of keywords from the article abstract in RStudio software.

Although the literature review process never ends (Ricciardi, 2010), the purpose of this study is not only to clarify the similarities and differences between financial performance and sustainability or to identify a comprehensive definition of the two concepts but also to outline a new research process regarding the deepening of the characteristics of these constructs. This new research process aims to collect as many empirical studies as possible to analyse and validate strategies for the development and adaptation of organizations to adverse situations and changes.

## 3. ANALYSIS OF THE RELATIONSHIP FINANCIAL PERFORMANCE – ORGANIZATIONAL SUSTAINABILITY IN THE CONTEXT OF ORGANIZATIONAL RESILIENCE

This section describes and explains the results obtained from the analysis using RStudio software and answers the research questions stated in the introduction.

### 3.1 Temporal analysis

Through temporal analysis, we identify both the temporal trend and the distribution of research on the relationship between financial performance and sustainability in the context of organizational resilience, to understand what are the main determining factors of this temporal trend. Relevant paper to this research have been identified since 2013. Thus, analysing the abstracts in RStudio, the 116 papers included in the study were organized in chronological order and classified into three periods (2013-2019, 2020-2021, 2022-2023).

Figure no. 1 presents the number of papers identified on the relationship between financial performance and sustainability in the context of organizational resilience in the last 10 years. As the trend line highlights, the first study in the research field was identified in 2013. We observe that since that time, the number of publications has gradually increased, reaching a total of 36 papers in 2022.

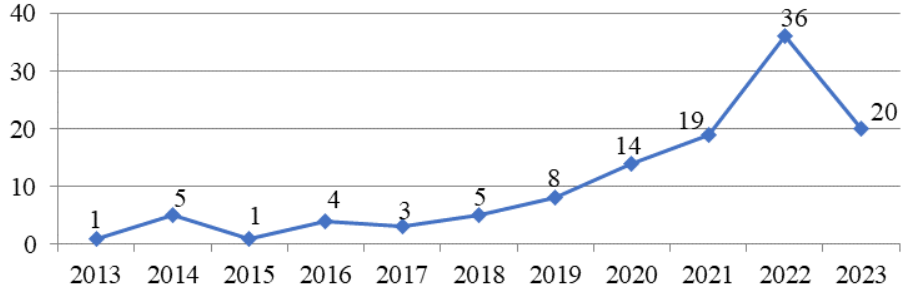


**Figure no. 1 – Number of papers identified in the research field**

*Source:* Made by the authors

Examining the abstracts of these studies with the help of the RStudio software (Figure no. 2) we identify three important periods in which the topic of the relationship between financial performance and sustainability in the context of organizational resilience was more intensively discussed. This period is divided according to the evolution of research on the concepts of sustainability and resilience. These periods are: 2013-2019, a period that analyses corporate sustainability, 2020-2021, a period that brings to the fore the concept of organizational sustainability, and the period 2022-2023, which introduces the concept of organizational resilience.

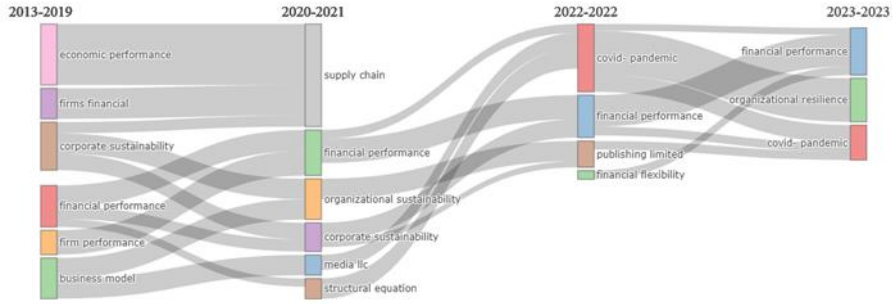


**Figure no. 2 – Thematic evolution of the researched area**
*Source:* Processing with RStudio

The first period (2013-2019) began with the work of researchers Linnenluecke and Griffiths (2013), in which a bibliometric analysis of the field of corporate sustainability from 1953 to 2011 can be found. The researchers claim that during the analysed period, this field developed through four theories conceptual: corporate social performance theory, investor theory, corporate social performance versus financial performance, and environmental management. The study concludes that during the analysed period there is more emphasis on the conceptualization of the issue of sustainability, to the detriment of empirical approaches.

A representative work from this period is that of researchers Ortiz-de-Mandojana and Bansal (2016), which suggests that social and environmental practices, associated with business sustainability practices, have a significant contribution to increasing organizational resilience. Researchers demonstrate that organizations that develop and apply responsible social and environmental practices have lower financial volatility, increase sales, and increase their chances of survival over 15 years. Instead, in the short term, they failed to identify the beneficial effects of these practices in increasing profits.

In the period 2020-2021, we identified an intense concern for the concepts of sustainable tourism, business models, distribution chain, organizational sustainability, organizational resilience, and financial performance. A sustainable business model is provided by researchers (Khan *et al.*, 2021). They believe that blockchain technology and circular economy practices boost the sustainable and financial performance of organizations.

In the last period (2022-2023), the concepts already studied in the other periods (financial performance, organizational resilience, organizational resilience) are also analysed in the context of the COVID-19 pandemic. The COVID-19 pandemic triggered an economic crisis with a worldwide impact, affecting organizations in many fields of activity, especially

those in the production, transport, tourism, and technological services sectors (Donthu and Gustafsson, 2020). Most countries have responded to this pandemic with travel bans, restrictions, and a series of health regulations aimed at managing the pandemic situation (Jones and Nguyen, 2021).

Analysing the research trend during the 10 years included in the study, we observe that the financial performance of organizations is studied in the beginning in close connection with corporate sustainability, continuing with organizational sustainability, and, more recently, with organizational resilience.

### 3.2 Analysis of researchers' typology

The analysis from the perspective of the typology of researchers was inspired by the work of the authors Dumay *et al.* (2016). With the help of the RStudio program, we analysed the contribution and affiliation of the authors who developed papers in the field of the relationship between financial performance and sustainability in the context of organizational resilience. 309 researchers from 136 institutions were included in the study. The majority of researchers come from academia (87%), the most representative universities being Bosowa University (5 papers), University of Craiova (4 papers), King Faisal University (3 papers), Indian Institute of Management Kozhikode (2 papers), School of Management (2 papers), Tamkang University (2 papers), The University of Queensland (2 papers), Universidade de Celaya (2 papers), Universidade de Vigo (2 papers). Using the RStudio software tool, we obtained a list of the authors with the most papers in the targeted field, shown in Figure no. 3.

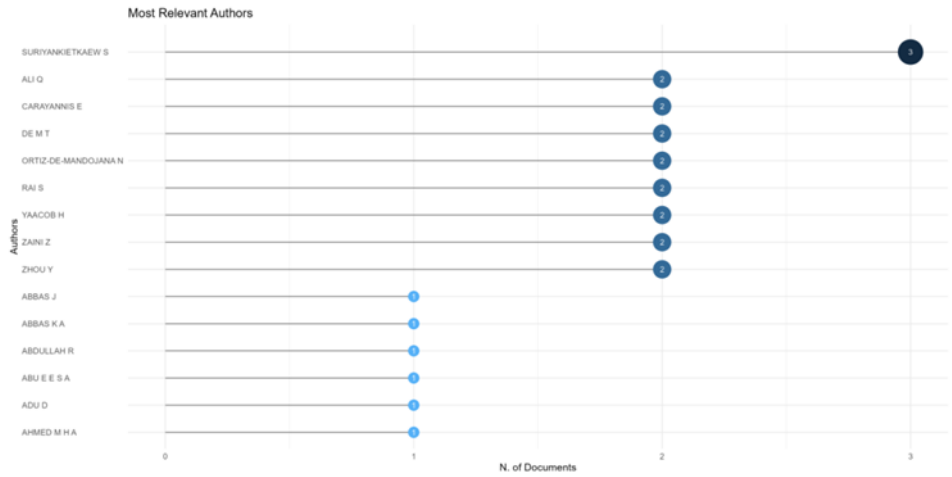


**Figure no. 3 – Distribution of researchers according to the number of papers included in the study**
*Source:* Processing with RStudio

To ensure the relevance of the analysed papers, in Table no. 3 we proposed to present a situation of the authors with the most citations in the analysed papers, among which Ortiz-de-Mandojana and Bansal (2016) - 351 stand out; Ivanov (2022) – 330; Linnenluecke and Griffiths (2013) – 124; Khan *et al.* (2021) – 124.

**Table no. 3 – Distribution of researchers by citations obtained**

| Researchers | Citations |
|---|---|
| Ortiz-de-Mandojana and Bansal (2016) | **351** |
| Ivanov (2022) | **330** |
| Linnenluecke and Griffiths (2013) | **124** |
| Khan *et al.* (2021) | **124** |
| Govindan *et al.* (2020) | **84** |
| Gupta and Gupta (2020) | **64** |
| Tang *et al.* (2022) | **46** |
| Rodríguez-Espíndola *et al.* (2022) | **41** |

*Source:* made by the authors

The 116 papers included in the research were published in 62 journals (as illustrated in Table no. 4), so an analysis from this point of view allowed us to observe that the most popular in the researched field were the journals Sustainability with 17 published papers, Business Strategy and the Environment and the International Journal of Production Economics with six papers each, followed by the Journal of Cleaner Production with four papers.

**Table no. 4 – Identified journals and related papers**

| Scientific Journals | No. of papers |
|---|---|
| Sustainability | **24** |
| Business Strategy and the Environment | **6** |
| International Journal of Production Economics | **6** |
| Journal of Cleaner Production | **4** |
| International Business Review | **2** |
| International Journal of Disaster Risk Reduction | **2** |
| International Journal of Hospitality Management | **2** |
| Journal of Business Research | **2** |
| Journal of The Knowledge Economy | **2** |

*Source:* made by the authors

### 3.3 Analysis from the perspective of the geographical area

The purpose of the geographic analysis is to identify where around the world the financial performance-sustainability relationship in the context of organizational resilience has been addressed in studies, highlighting authors from these geographic areas who have been more interested in this topic.

Geographical analysis from Figure no. 4 highlights that:

- Asia is the continent where the largest number of studies were carried out in the researched field (39% of the analysed papers), followed by Europe, where there is a relevant number of revised studies (24%);
- America is the third continent in terms of the researched field, with 9% of the reviewed papers;
- Africa and Australia are the continents with the fewest research studies, with 2% of each of the papers reviewed.

For papers looking at multiple countries, multiple regions, or are not looking at a specific region, has been added the term General. At the general level, 24% of the reviewed papers were identified.

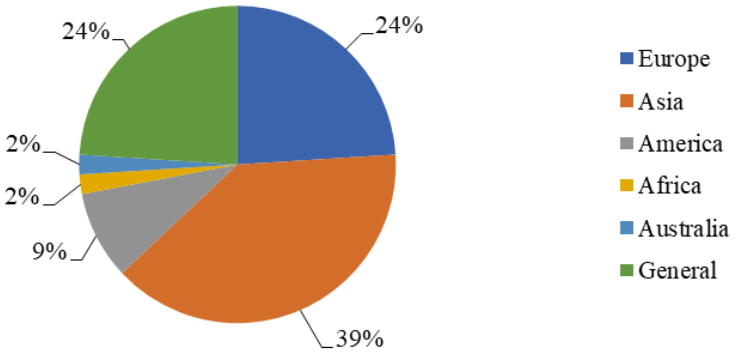


**Figure no. 4 – Analysis of papers according to the region under study**
*Source:* made by the authors

Analysing all the publications in the sample, 33 countries were identified in which analyses were carried out regarding the relationship between financial performance and sustainability in the context of organizational resilience. Among these countries, China ranks first (14 papers), followed by Italy (7 papers), Spain and the USA (each with 5 papers) (Figure no. 5).

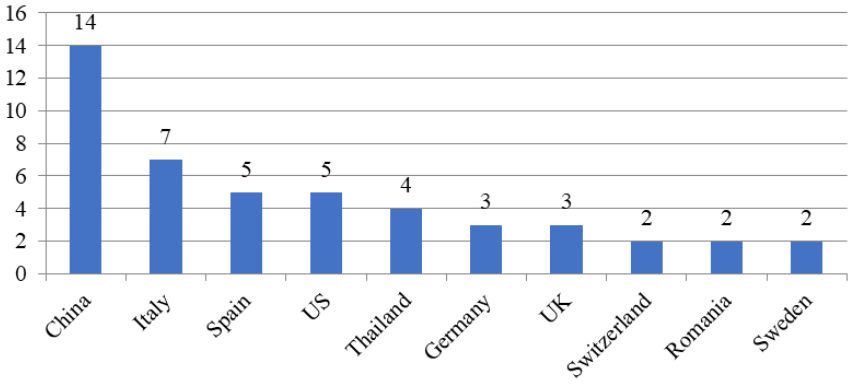


**Figure 5 – Analysis of the papers according to the country under study**
*Source:* Made by the authors

It can be concluded that Africa and Australia are the regions where the interest in this topic is the least, with only two countries analysed each. In addition, following the analysis of citations per article and the analysis of the countries studied, it is observed that publications that compare different countries or regions are more frequently cited, as opposed to those that focus on a specific country or region.

### 3.4 Analysis from the perspective of research methodology

The purpose of this review is to separate theoretical studies from empirical work. The reason for this type of examination is to understand if the field of research on the financial performance-sustainability relationship in the context of organizational resilience is built more on a theoretical basis or if the results of practical studies are the ones that support and highlight the relationship between financial performance and sustainability.

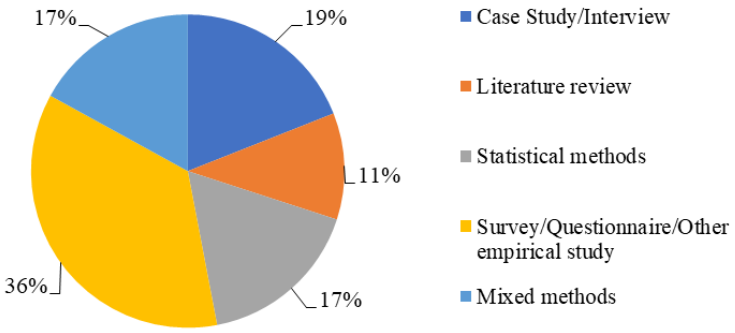


**Figure 6 – Analysis of papers according to the studied method**
*Source:* Made by the authors

The research methodology used in papers is illustrated in Figure no. 6, and highlights that most of the articles studied use empirical studies (36% of papers reviewed), followed by case/interview studies (19% of papers reviewed) and mixed and statistical methods (17% each of papers reviewed). Figure no. 6 demonstrates that empirical studies are more numerous than theoretical ones and, therefore, the process of spreading the literature on the financial performance-sustainability relationship in the context of organizational resilience was achieved through a predominantly inductive scientific approach, i.e. from the bottom up.

The label of performing organization is chosen according to the organization's ability to survive in a changing environment, with the redesign of structures and the replanning of financial performance, with long-term effect. We can conclude that the development of the relationship between financial performance and sustainability in the context of organizational resilience is largely based on innovative and sustainable management.

### 3.5 Analysis of the research theme

With the help of the RStudio software, we processed and synthesized the research themes from the papers included in the study, carrying out qualitative research. By analysing the correlation between the keywords identified in the abstract (Figure no. 7) and the map of terms and concepts associated with the relationship between financial performance - and sustainability in the context of organizational resilience (Figure no. 8), we identified six research themes that were the subject of the papers in the sample selected, namely:

1. Innovative policies to support sustainability;
2. Risk management in crises;

3. Sustainable financial performance;
4. Management of corporate responsibility strategies;
5. Sustainable business strategies;
6. Sustainable leadership practices.


**Figure no. 7 – Analysis of Keywords in the Abstract**
*Source:* Processing with RStudio

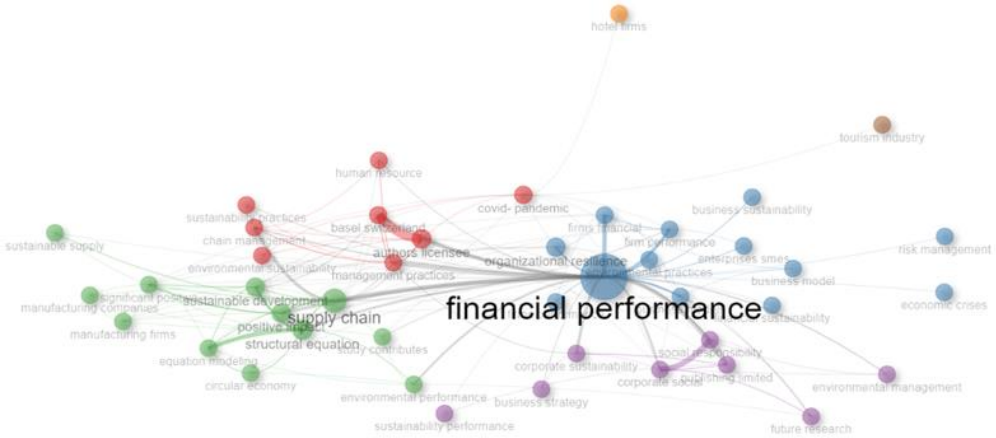


**Figure no. 8 – Map of terms and concepts associated with the financial performance - sustainability relationship in the context of organizational resilience**
*Source:* processing with RStudio

The first research theme, innovative policies to support sustainability, was a research topic for 18 of the papers in the analysed sample. Ecological innovation (Gambelli *et al.*, 2021; Tian and Hong, 2022), circular economy practices (Dura *et al.*, 2022; Rodríguez-Espíndola *et al.*, 2022; Tang *et al.*, 2022; Borms *et al.*, 2023), smart manufacturing techniques, blockchain technology (Khan *et al.*, 2021; Bresciani *et al.*, 2022; Hossain *et al.*, 2022), big data analysis strategy (Zhu and Yang, 2021), internal and external management practices

ecological supply chain (Ali *et al.*, 2020; Ivanov, 2022; Ullah *et al.*, 2022), inventiveness in cash flow and investment management (Pal *et al.*, 2014), business model innovation (Carayannis *et al.*, 2014; Kilintzis *et al.*, 2020; Zupancic, 2023) are important factors in the growth and sustainable improvement of financial performance.

For strong economic sustainability, organizations must integrate sustainable approaches with resilience. Organizational resilience has a mediating role in the process of promoting innovative performance in organizations, and the ability of organizations to be active in the modern digital environment can determine sustainable strategies, sustainable innovation, process and product innovation, business model innovation, and even economic and financial performance. Sreenivasan and Suresh (2023) argue that to increase financial resilience, companies need to pay attention to digital financial innovation, liquidity planning, financial strategy promoted by CFOs, and cyber threats.

Risk management in crises is the second research theme identified, being addressed in 27 of the papers analysed. Organizations' competitive advantages erode due to the emergence of uncertain, unstable conditions, and a focus on resilience can strengthen the organization to face adversity (Carmeli *et al.*, 2020). Political risks, risks generated by supply, demand, and internal processes (Syed *et al.*, 2019; Zheng *et al.*, 2022) negatively influence the financial performance of organizations. Conversely, sustainability strategies correlated with resilience capabilities positively influence the financial performance of organizations (Syed *et al.*, 2019; Balugani *et al.*, 2020; Mao *et al.*, 2023).

Risk is a consequence of the business environment, of the market (Santos *et al.*, 2022), it is part of economic activity, and its knowledge and awareness (Andersson *et al.*, 2019), the anticipation of changes, minimization of vulnerabilities (Yuan *et al.*, 2022) can create organizational sustainability and longevity. Liu *et al.* (2018) demonstrated that risk management improves the performance of organizations during various crises. Risk management considers three aspects of organizational resilience: crisis anticipation, organizational robustness, and recoverability (Rai *et al.*, 2021; Li *et al.*, 2022). A resilient business model determines organizational resilience (De Vries and Hamilton, 2021; Radic *et al.*, 2022; Zhang *et al.*, 2022a), the advantages of resilience being observed when the organization faces various crises (Lampel *et al.*, 2014; Pashapour *et al.*, 2019; Sobaih *et al.*, 2021).

Gleißner (2023) argues that to develop a business strategy designed to ensure adequate resilience to face crises, uncertainty must be taken into account. A resilient company must exhibit three characteristics: high financial sustainability, a robust business strategy, and a high level of competence in risk management. To respond to the COVID-19 pandemic, Klöckner *et al.* (2023) identify five types of company behavior: operational, digitization, financial, support, and organizational. Some researchers (Mishrif and Khan, 2023; Santos *et al.*, 2023) believe that the development of digital technologies reinvented entrepreneurial resilience during the COVID-19 pandemic, while others (Chou *et al.*, 2024) demonstrated that exploitation strategies lead to increased resilience, and Kotsios (2023) argues that reliability, integrity, and work ethics are vital to increasing the resilience of a business in crises.

Climate risk affects the financial performance of organizations (Bergmann *et al.*, 2016). The recovery of the initial financial performance is slow (Chen, 2021) and depends on factors such as the size of the organization, the size of equity, and profit. By capitalizing on limited resources and cultivating an entrepreneurial attitude, these entities can build resilience in the business environment (Conz *et al.*, 2023). Researchers Huang *et al.* (2018) argue that

organizations operating in countries frequently exposed to climate risks develop increased resilience, and have little short-term debt, while long-term debt is higher.

The next research theme identified in the selected sample is sustainable financial performance, a topic that was discussed in 20 studies. For increased adaptability to an uncertain business environment, affected by the COVID-19 pandemic, conflicts, trade frictions, and economic recession, researchers (Bergmann, 2016; Schwab *et al.*, 2019; Govindan *et al.*, 2020; Atz *et al.*, 2022; Xie *et al.*, 2022; Zhang and Liu, 2022; Zhang *et al.*, 2022b) believe that organizations must increase their financial flexibility by adopting strategies that incorporate environmental, social and economic performance.

Ma *et al.* (2023a) argue that the strategy based on the mix of resources, skills, and environment provides intellectual support for sustainable development and increases the sustainability of organizations. Ye and Gong (2021) demonstrate that organizations with high asset value, diversified revenues, high administration costs, and located in wealthier areas are more likely to achieve financial sustainability and increase their resilience to unexpected economic shocks.

Analysing the impact of the COVID-19 pandemic on the performance of organizations, Biswas *et al.* (2022) argue that profitable organizations before the pandemic suffered more than less profitable organizations. But, in the long term, these organizations show financial stability and development. Organizational resilience contributes to increasing the long-term performance of organizations (Markman and Venzin, 2014; Tracey and French, 2017; Melián-Alzola *et al.*, 2020; Ilseven and Puranam, 2021; Sánchez-García *et al.*, 2023). Instead, Yu and Zhu (2022) demonstrate that to achieve solid sustainable performance, the entity must combine the instrumental factors of economic activity (sustainable human resource management practices, sustainable spending, technological development, and investor pressure) with the ethical factors of activity (the ethical leadership of the entrepreneur), insisting on balancing financial, environmental and social interests. Some researchers (Brand *et al.*, 2022; Nirino *et al.*, 2022; Kao, 2023; Kim and Kim, 2023; Ma *et al.*, 2023b; Nguyen *et al.*, 2023; Vinod *et al.*, 2023) believe that high-quality sustainability reports have a positive influence on the economic activity of the organization, credibility, readability, and relatively high informational value.

Lu and Khan (2023) argue that during the 2020–2021 COVID-19 crisis, the impact of sustainability on financial performance is more pronounced in developed economies than in emerging economies, and Rahi *et al.* (2024) argue the influence of sustainability on financial performance is elusive in capitalist countries.

The fourth research topic is the management of corporate responsibility strategies, a topic that was treated in 20 of the analysed studies. Various researchers (Brand *et al.*, 2022; Nirino *et al.*, 2022; Kim and Kim, 2023; Ma *et al.*, 2023a; Vinod *et al.*, 2023) suggest that corporate responsibility management can increase organizational resilience and maintain the financial performance of organizations in difficult times.

Responsible social and environmental practices associated with business sustainability lead to lower financial volatility, higher sales growth, and organizational resilience. In times of crisis, these CSR initiatives positively influence financial performance, creating resilient organizations capable of recovering from various shocks.

Sustainable business strategies is another research topic discussed in 18 studies in the selected sample. The COVID-19 pandemic has had a devastating economic impact, and to

achieve financial performance, organizations have had to rethink their economic policies and practices (Mehta and Sharma, 2021).

The integration of sustainability in the business strategy leads to an increase in the organization's financial performance during global crises (Cavaleri and Shabana, 2018; Mann and Kaur, 2020; Avery, 2021; Jum'a *et al.*, 2021; Long *et al.*, 2021; Mehta and Sharma, 2021; Adu, 2022; Cui *et al.*, 2022; Lopes *et al.*, 2022; Mattera *et al.*, 2022; Menne *et al.*, 2022).

Fontanet-Pérez *et al.* (2022) conducted a study on the impact of the COVID-19 pandemic on US airlines. The results of the study claim that the business model, implicitly the financial and operational, made the difference in terms of the extent of the impact of the pandemic. Thus, models based on low costs and tariffs, when demand drops drastically, are considered profitable strategies, leading to financial performance. Herghiligiu *et al.* (2022) consider that addressing the issue of sustainability of production units can be considered as a fine balance between environment, human resources, and net benefits. The researchers identified a sustainability profile of production units using multiple correspondence analyses on a final sample of 30 large companies (listed on the Bucharest Stock Exchange) in Romania.

Zhu *et al.* (2022) argue and demonstrate that the strategy of strengthening organizational resilience through awareness and assessment of organizational weaknesses is effective for adapting organizations to uncertain environments. Thus, organizations abandon passive defense in favor of active defense when faced with the effects of the crisis.

Parast (2020) argues that investments in research and development are becoming important means of improving the resilience and financial performance of the organization.

Thi Mai Nguyen *et al.* (2023) argue that low leverage mitigates the negative impact of the pandemic on tourism organizations, and capital structure policies must be an essential part of resilience-building and crisis management strategy.

The last research theme identified relates to sustainable leadership practices and is addressed in 13 studies. Responsible leadership practices (societal orientation, business ethics, investor involvement, segregation of powers, environmental orientation, innovative team practices, strong vision, trust in the management team, capitalization of human resources, long-term orientation, focus on quality and innovation) significantly influence the financial performance, resilience and sustainability of organizations (Suriyankietkaew and Avery, 2016; Manab *et al.*, 2017; Danovi *et al.*, 2018; Majerova *et al.*, 2021; Prayag and Dassanayake, 2022; Seraj *et al.*, 2022; Castañeda García *et al.*, 2023; Suriyankietkaew, 2023).

Leaders' decisions regarding the integration and use of organizational resilience can lead to achieving sustainable performance and reducing organizational losses during crises. In contrast, Suriyankietkaew (2019) suggests that leadership and management practices, such as trust in the management team, harnessing human resources, long-term orientation, and focus on quality and innovation, lead to increased financial and sustainable performance of organizations. During crises, leaders' decisions become important for ensuring the resilience and sustainability of organizations (Fainshmidt *et al.*, 2017; Bashir *et al.*, 2022).

Hillmann (2021) criticizes the concept of resilience, considering it ambiguous and lacking clarity in terms of its definition and measurement. The researcher identifies five disciplinary perspectives that have influenced the understanding of resilience: ecology, safety and reliability, engineering, positive psychology, and organizational development and strategic perspective. It argues that different disciplines influence the understanding of resilience in business and management. Hu *et al.* (2022) demonstrate that the identification and organization of organizational resilience capabilities according to the size of the

organization leads to the achievement of sustainable performance. The study suggests that leaders' decisions during crises regarding the adoption and application of organizational resilience capabilities can lead to sustainable performance and diminishing financial losses of organizations.

## 4. CONCLUSIONS

The concepts of resilience and sustainability appear multidimensional and contextually correlated. Sustainability practices can lead to both increased organizational resilience and growth. So the financial performance of the organization can increase thanks to sustainable strategies. Sustainability has become a managerial behavior that plays an important role in contemporary organizational strategy. Poor management of sustainability can harm the image and reputation of the organization, which in turn negatively affects the value of the shares and the organization in the market. The current study addresses a developing and scientifically grounded field but is fraught with dissension created by controversial views on the concept of performance or the subjectivity of professional judgment. Although the concepts of organizational sustainability and resilience have been analysed and debated from the perspective of several economic fields, however, from the financial-accounting perspective, these concepts are insufficiently analysed.

The paper aims to summarize the characteristics and differences between financial performance and sustainability in the context of organizational resilience. The specialized literature reveals that all these clarified concepts (financial performance, sustainability, organizational resilience) are not in contradiction, but present an interconnected relationship. For this reason, it was decided that these concepts should be investigated and analysed together, in the specialized literature.

This structured literature review (SLR) traces the development of the relationship between financial performance and sustainability in the context of organizational resilience over time, starting a decade ago (since 2013) and intensifying in recent years (since 2018). The financial performance-sustainability relationship in the context of organizational resilience has been studied in 33 countries, of which China recorded the most studies in the field. Six research themes were identified in the selected sample (innovative policies to support sustainability, risk management in crises, sustainable financial performance, management of corporate responsibility strategies, strategies of sustainable business, and sustainable leadership practices), providing a structured framework for understanding the relationship between financial performance and organizational sustainability in the context of organizational resilience.

Despite the approach of a rigorous literature review, a limitation of this study we argue is the lack of inclusion in this study of books, book chapters, or reports. The contribution of this work consists in the fact that, through the structured literature review developed, we clarify important subjects debated in the literature regarding sustainable business strategies, sustainable leadership practices, management of corporate responsibility strategies, and sustainable financial performance. These subjects need to be further investigated to meet the requirements of business companies interested in increasing their values according to financial, social, and environmental criteria.

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# The Effect of Personality Characteristics on the Development of Interpersonal Communication Skills Through One-Time Training

**Alon Efrat*, Adriana Zait****

**Abstract:** The importance of interpersonal communication skills in the business environment will only increase as the world undergoes trends of globalization and digitization, as well as various crises. The factors that affect interpersonal skills, such as life experience, situational factors, and individual characteristics, are difficult to isolate. Among the prominent antecedents of interpersonal communication effectiveness are personality characteristics. The current study used one-time training to examine how personality traits and interpersonal skills relate among 127 managers from a wide variety of professions in Israel. The current study confirmed the effect of personality characteristics on interpersonal communication skills, albeit weakly. A significant improvement was found in the Emotional stability following the training. Participating in the training changed the way people associate personality traits with Interaction management. An in-depth study of an intervening variable found that those with low extraversion and high conscientiousness improved assertiveness, empathy, supportiveness, openness to experience, and self-disclosure, in contrast to those with less solid personality characteristics who showed a smaller improvement or even decreased in these skills. Our findings have important implications for increasing the effectiveness of interpersonal skills training.

**Keywords:** interpersonal communication skills; interpersonal communication skills training; personality traits; Big-Five; marketing.

**JEL classification:** M16; M31; M53.

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## 1. INTRODUCTION

Communication skills are some of the most important aspects of everyday life, yet they are among the most difficult to define and assess. In light of this expanding focus and the increasing value expected from communication skills, it is worthwhile to gain a deeper understanding of such precious soft skills. A variety of activities that we encounter daily require interpersonal communication skills: problem solving, resource distribution, creating collaborations, dispute resolution, and promoting important issues in an interpersonal environment at home and in the workplace. A skilled communicator can select key pieces of a complex idea to convey through words, sounds, and images to build shared understanding (Levy and Murnane, 2004). Through social perception, persuasion, negotiation, instructing, and service orientation, skilled communicators negotiate positive outcomes with customers, partners, subordinates, and superiors (Mumford *et al.*, 1999).

Communication skills are vital to the business environment and will become even more important during the transition to the future job market. Timm (2005), cited in Mitchell (2008) observed that in the new global marketplace, employees are expected to interact with others more personally than ever before; therefore, traditional technical skills will not suffice. Soft skills are critically important in the workplace (Robles, 2012). According to this research, hard skills only contribute 15% to success, whereas soft skills account for 85%. In order to demonstrate these skills, one must be able to communicate and interact with others. As these skills have become increasingly important, significant funding is spent on interpersonal communication skills training programs to improve these skills. Educational success in general, as well as the effectiveness of various trainings depend a lot on individual characteristics, especially personality traits (Matthews *et al.*, 2005; Knapp and Daly, 2011; Fowles *et al.*, 2023; Deng and Turner, 2024; Grosz *et al.*, 2024). However, there are very few studies addressing the relationship between models of personality and the affect for education (Matthews *et al.*, 2005), and little research with the Big five personality taxonomy published in communications journals (Knapp and Daly, 2011). The need for the present research thus evolved from a double perspective – a gap in the literature addressing the relationship between the successful training of interpersonal communication skills and personality traits of the trainees, and the practical need of the consulting industry to design appropriate, effective trainings in the field, adapted to personality differences of the trained groups. The novelty of the approach is given by the methodology used – an action research type of approach, quasi-experimental, with real interpersonal communication training offered to real business people.

## 2. LITERATURE REVIEW: PERSONALITY TRAITS AND INTERPERSONAL COMMUNICATION SKILLS

Interpersonal communication skills tend to be situation-specific behaviors, so finding strong or even significant predictors may be difficult. Because interpersonal skills are influenced by various factors, such as life experience, situational factors, and individual characteristics, it is difficult to isolate them from other influences. Hayes (2002) cited in Klein (2009), identifying strong and consistent demographic or personality predictors may be a difficult task. According to an extensive meta-analysis published by Klein (2009), Several possible antecedents of Interpersonal communication skills have been identified in the literature. Among those most frequently investigated include gender and personality traits.

Based on their findings, Klein *et al.* (2006) concluded that skilled social performance expertise requires competence in a number of different areas, including interpersonal communication skills. A practical framework was provided by these authors to explain how antecedent variables, such as life experience, individual differences, and personality characteristics, as well as situational characteristics, such as goals, tasks, or norms, may contribute to the perception and cognitive activity that occurs during interpersonal skills training. Consequently, the study found that personality characteristics and gender influence interpersonal communication effectiveness (Klein, 2009). Among the personality variables, extraversion showed the strongest associations with interpersonal communication skills. The results indicate a clear, positive impact of Interpersonal communication training programs.

### 2.1 Interpersonal communication competence scale (ICCS)

Communication competence is defined by Jablin and Sias (2001), cited in Payne (2005) as the set of skills at a communicator's disposal. As a strategic, goal-oriented approach to competence, this definition emphasizes both knowledge and ability. Rather than focusing solely on communication, the definition emphasizes two essential aspects: understanding of communication and context, as well as the ability to accomplish goals (skill). According to Spitzberg and Cupach (1984), It is an individual's competence to choose appropriate behaviors to achieve interpersonal communication goals in a particular situation. The complexity of the communication process creates a challenge in every measurement issue. The definitions of communication competence are becoming more specific as the issue of context is considered more closely (Payne, 2005). The difference between skills and traits is that skills can be improved and change with instruction. In contrast, traits are relatively stable qualities that cannot be taught (Rubin and Martin, 1994). Competence conceptualizations among researchers is commonly based on the original criteria proposed by Spitzberg and Cupach (1984): appropriateness and effectiveness. Interpersonal communication competence (ICC) refers to a judge's perception of an individual's abilities to communicate effectively in social situations (Rubin and Martin, 1994). There has been a strong association between ICC and the ability to adapt to new situations. This brief, self-report questionnaire measures ten ICC skills and is useful for self-assessment. After examining the leading assessment tool (Spitzberg and Cupach, 1984) for several years, this tool obtained ten variables that constitute a valid measure of interpersonal skills. Compared with previous measures, the ICCS has greater content validity, since it taps into the multiple facets of ICC found in the literature of interpersonal relationships. Several studies (Hullman *et al.*, 2010; Wilkins *et al.*, 2015; Pichler *et al.*, 2018; Xu *et al.*, 2018), have found that it is extremely useful for interpersonal communication training.

The extant literature already mentioned recognizes ten dimensions of competence:

- *Self-disclosure* - Openness, the ability to reveal personality traits through communication. It is the basis for establishing interpersonal relationship. It must be appropriate to the person and the situation.
- *Empathy* - the ability to understand another person's perspective through emotional response to their internal state.
- *Social relaxation* - the ability to feel comfortable in social situations without anxiety, apprehension, or stress. the ability to deal with others' criticism or negative reactions without getting overwhelmed by it.

- *Assertiveness* - Standing up for one's own rights without denying any other person's rights.
- *Interaction management* - the ability to handle rituals in everyday conversation. It involves skills such as negotiating topics for discussion, taking turns, starting, and ending conversations, and developing conversation topics.
- *Alter centrism* - the ability to Understand what others say and how they talk and recognizing spoken and unspoken messages.
- *Expressiveness* - the ability to express feelings through nonverbal behaviors, such as facial expressions, gestures, and vocal modulations. Recent theory proposes that expressiveness is also based on communicating thoughts and feelings through speech (Rubin and Martin, 1994).
- *Supportiveness* - the ability to confirm the other in a descriptive (not evaluative), provisional (not certain), spontaneous (not strategic) way. orientation towards solving a problem (not controlling), empathic (not remote), and egalitarian (not superior) communication style (Bochner and Kelly (1974), cited in Rubin and Martin (1994)).
- *Immediacy* - the ability to be seen as approachable and available for communication. "Immediacy is often communicated through nonverbal behaviors such as facing the other directly, adopting an open stance, having a pleasant facial expression, using direct eye contact, and leaning forward, as well as nonverbal behaviors that convey a feeling of interpersonal warmth, closeness, and affiliation" (Spitzberg and Hurt, 1987).
- *Environmental control* - the ability to meet predetermined goals and satisfy needs, to handle conflict situations and solve problems in a cooperative environment, and to gain compliance from others.

### 2.2 Big-Five personality inventory

The Big-Five Inventory (BFI) was developed in the late 1980s (John *et al.*, 1991) as an extremely short measure of personality traits based on the characteristics Extraversion, Agreeableness, Conscientiousness, Emotional Stability, and Intellect or Openness to Experience. Introverted individuals are less talkative, assertive, outgoing, and shy than their extraverted counterparts. Often termed neuroticism, it is characterized by poor emotional adjustment resulting in stress, anxiety, and depression. Being agreeable involves attributes such as being courteous, cooperative, and trustworthy. Finally, conscientious individuals are described as being meticulous, thorough, organized, and well-planned (Rowold, 2007).

The Big-five factor model appears to capture some of the most important and enduring personality traits, despite new traits being identified regularly (Maccroskey and Daly, 2011). These five factors tap dimensions of personality found in many other instruments. The Big-Five conceptual framework has played a significant role in theory development and still does (Rowold, 2007; De Raad and Mlačić, 2015). Several studies have used the Big-Five as a variable in the study of interpersonal skills, with mixed results (Dean *et al.*, 2006; Kuntze *et al.*, 2016; Sims, 2016). Due to limited assessment time, a demand for super-short measures increased, and even researchers using the BFI requested a shorter version. Several samples indicate that, given its brevity, the BFI-10 has acceptable psychometric properties (Rammstedt and John, 2007). An extremely short version of the variable was successfully validated by Gosling *et al.* (2003).

Several studies have examined ways to measure and assess the effectiveness of different forms of training to improve interpersonal skills (Bedwell *et al.*, 2014). With a one-time training program, the present study examined how personality characteristics affect interpersonal communication skills.

## 3. RESEARCH HYPOTHESIS

Human personality variations can be explained by the Big-Five across many cultures and languages. Furthermore, the Big-Five's biological basis has been demonstrated within different fields of study, including neuropsychology, developmental psychology, and evolutionary psychology (Sims, 2016). Social relationships are influenced by traits of the Big-Five, according to a growing body of research (McCrae and Sutin (2009); Malouff *et al.* (2010); Hahn *et al.* (2012); DeYoung (2015), cited in Sims (2016)). In addition, the Big-Five have been linked to a variety of interpersonal behaviors during first interactions (Berry and Hansen (2000); Cuperman and Ickes (2009) cited in Sims (2016)). Numerous researchers have empirically explored the relationship between the Big-Five personality traits and interpersonal performance (Klein, 2009). In her study, Sims (2016), using the Big-Five model, explain differences in communication ability between individuals. An understanding of manifested IPS may require knowledge of personality traits. This suggestion is currently being empirically examined by researchers (Klein *et al.*, 2006). As an example, Ferris *et al.* (2001) found that the five-factor traits explained about 20% of the variance in social skills.

There is generally agreement that the Big-Five personality traits are the gold standard criteria for all personality tests. Based on the theory discussed above, the following hypothesis is proposed:

Hypothesis 1: Personality traits are positively correlated with interpersonal communication improvement

***H1**: Big-5 personality traits will be positively related with improvement of interpersonal communication skills*

- ***H1.a**: Agreeableness will be positively related with improvement of interpersonal communication skills*
- ***H1.b**: Conscientiousness will be positively related with improvement of interpersonal communication skills*
- ***H1.c**: Emotional stability will be positively related with improvement of interpersonal communication skills*
- ***H1.d**: Extraversion will be positively related with improvement of interpersonal communication skills*
- ***H1.e**: Openness to experience will be positively related with improvement of interpersonal communication skills*

## 4. METHODOLOGY

In the current study, the goal was to examine the relationships between personality traits and the ability to improve interpersonal skills through one time training. Quantitative research was used. The design is a combination of action research and quasi-experimental “before and after” research. Careful content design of the training was assured, based on the consulting

experience of one of the article authors, who delivered the workshop; the whole setting was established after a thorough analysis of previous research in the field, most of the studies being from the medical sector (Leung and Bond, 2001; Karsenty, 2011; Zait, 2016; M. *et al.*, 2018; Alhassan, 2019; Efrat and Zait, 2022; Fowles *et al.*, 2023; Lombardo *et al.*, 2023; Mercan *et al.*, 2023; Deng and Turner, 2024; Grosz *et al.*, 2024; Verojporn and Luna, 2024). In line with the study hypothesis, well-established and validated reflective scales from the literature were used to measure the constructs (BFI-5 items, ICCS-10 items) (Rubin and Martin, 1994; Rammstedt and John, 2007). An online questionnaire was applied to collect the data, before and after the training, as detailed below. BFI was used as independent variables and ICCS as dependent.

### 4.1 Research tools

The methodology was action oriented. A training focused on the ten interpersonal competence skills enumerated in Rubin's work (Rubin and Martin, 1994). Training involved didactic teaching separated by demonstrations of specific communication skills and their consequences, discussion of difficulties in changing behavior, sharing experiences, identifying good and less effective communication skills from scenarios, and rehearsing effective communication skills in everyday scenarios. The participants completed a four-hour training session. The participants in the training completed the questionnaires twice: before and after the training. Assessment of interpersonal skills was based on self-reporting.

### 4.2 Measuring scales

ICC's: The research questionnaire used the Likert scale (1-5). The variable and dimensions were calculated by averaging the scores in the items of each dimension, creating a new scale of the quasi-interval type whose range is between 1-10.

BFI: The research questionnaire used the Likert scale (1-5). The variable and dimensions were calculated by averaging the scores in the items of each dimension, creating a new scale of the quasi-interval type whose range is between 1-5.

### 4.3 Research population and data collection

In this study, managers from diverse professional fields, managing level and experience backgrounds within business organizations of different sizes in Israel who manage interpersonal interactions, including internal and external factors, as part of their responsibilities were selected. Several training sessions were held on several dates during July 2022, November 2022, December 2022, January 2023, and February 2023 for the participants to voluntarily participate. Each training had between 18-25 participants due to its effectiveness limit. A total of 160 people attended the training. A total of 127 respondents completed the survey twice: 71 women and 56 men.

## 5. FINDINGS

Hypothesis 1: Personality traits are positively correlated with interpersonal communication improvement

To examine the effect of personality traits on interpersonal communication skills, Pearson's correlation coefficient was used and compared between before and after the training.

**Table no. 1 – Pearson's correlation coefficient between Personality traits and Interpersonal communication skills**

| | **Personality traits** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Extraversion** | | **Agreeableness** | | **Conscientious Ness** | | **Emotional stability** | | **Openness to Experiences** | |
| **Interpersonal communication skills** | **Before** | **After** | **Before** | **After** | **Before** | **After** | **Before** | **After** | **Before** | **After** |
| Self-disclosure | .350** | .217* | .066 | .086 | .002 | .092 | .062 | -.026 | .126 | -.020 |
| Empathy | -.068 | .177* | .252** | .265** | -.122 | .164 | .192* | .289** | .235** | .250** |
| Social relaxation | .249** | .262** | .182* | .208* | .150 | .228** | .296** | .335** | .387** | .246** |
| Assertiveness | .085 | .034 | -.133 | -.027 | .121 | .038 | .107 | .094 | .141 | .076 |
| Alter centrism | .200* | .131 | .039 | -.005 | -.050 | -.137 | -.064 | -.011 | .126 | .093 |
| Interaction management | .139 | .140 | .052 | .143 | .132 | .197* | .173 | .181* | .202* | .266** |
| Expressiveness | .226* | .210* | .131 | .154 | -.017 | .185* | .111 | .124 | .278** | .162 |
| Supportiveness | .034 | .153 | .425** | .434** | .172 | .097 | .265** | .165 | .172 | .192* |
| Immediacy | .192* | .111 | .377** | .401** | .134 | .210* | .301** | .258** | .281** | .253** |
| Environmental control | .160 | .099 | .068 | .201* | .064 | .105 | .268** | .291** | .265** | .302** |

*Sources*: conducted by authors; (**) p<0.01; (*) p<0.05

A first objective of the study was to determine if there was a correlation between the numerous factors and the two variables, as well as to determine if there were differences in the correlations, their strength and direction following training. According to the table, there is some significant correlation between Personality traits and Interpersonal communication skills, as follows:

***Personality traits – Extraversion:***

The higher the level of **Extraversion** before participating in the training, the higher the level of **Self-disclosure**, while after participating in the training the correlation between these two variables is low and not significant. Also, the higher the level of **Extraversion**, both before and after participating in the training, the higher the level of **Expressiveness**. The higher the level of **Agreeableness**, the higher the probability of an elevated level of interpersonal communication skills, as listed: **Self-disclosure, Expressiveness, Supportiveness, Immediacy**, and **Environmental control**.

The findings show that following the training, the strength of the correlations is even higher compared to the correlations obtained in the questionnaire that the subjects filled out before the training.

The higher the level of **Conscientiousness**, the higher the probability of a higher level of interpersonal communication skills of **Social relaxation**, both before and after participating in the training. No significant relationships were found in the other factors of communication skills.

According to the findings, there were no significant correlations between Emotional stability and Interpersonal communication skills prior to participating in the training, whereas after taking part in the training, it was found that **Emotional stability** is correlated with communication skills such as **Expressiveness, Immediacy, and Environmental Control.**

The research also indicates a significant correlation of **Openness to Experiences** with various communication skills of the subjects, in about half of the factors tested. The most prominent figure in this context is regarding **Assertiveness**. Before participating in the training there was a high and significant positive correlation between **Openness to Experiences** and **Assertiveness**, while after the training the correlation was deleted.

Analyzing the changes before and after the training using Personality traits variable as an intervening variable

To examine whether the **personality traits** before the training are intervening variables in the changes of the respondents in the various parameters - **Interpersonal Communication Skills, Trust** and **Negotiation approach**, the sample was divided into two groups according to their ratings in the five dimensions of personality traits.

**Table no. 2 – The distribution of the values of personality traits according to low/high**

| **Personality traits** | | **N** | **%** |
|---|---|---|---|
| Extraversion | Low (1-4) | 71 | 55.9 |
| | High (4.5-7) | 56 | 44.1 |
| Agreeableness | Low (1-4.5) | 40 | 31.5 |
| | High (5-7) | 87 | 68.5 |
| Conscientiousness | Low (1-5) | 24 | 18.9 |
| | High (5.5-7) | 103 | 81.1 |
| Emotional stability | Low (1-4.5) | 37 | 29.1 |
| | High (5-7) | 90 | 70.9 |
| Openness to Experiences | Low (1-4.5) | 39 | 30.7 |
| | High (5-7) | 88 | 69.3 |

The findings presented below are limited to those that demonstrate that personality traits variables affect changes in the ratings of respondents following the training.

***Extraversion (Personality traits) variable as an intervening variable***

An analysis was conducted using Dawson (2014)'s approach to examine the regression coefficients associated with low (one standard deviation below the mean) and high (one standard deviation above the mean) levels of Extraversion. A significant interaction was found by **Extraversion** (low/high) in the **Self-disclosure** variable $F=4.72$; $p<.05$: The average rating of the **Self-disclosure** among the low Extraversion group increased following participation in the training (from 3.7 to 3.8), while among high Extraversion group the average ratings of **Self-disclosure** decreased following the training (from 4.0 to 3.9). Before the training there

was a significant gap between the two groups in self-disclosure ratings, while participation in the training narrowed the gap to a small difference.

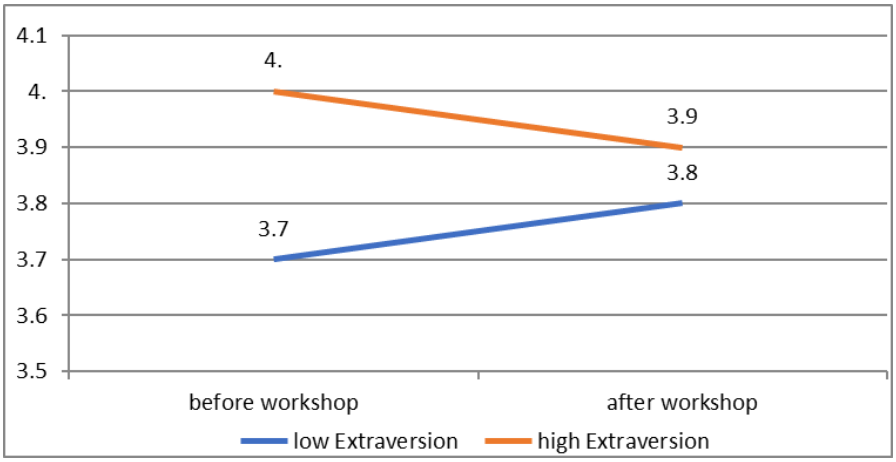


**Figure no. 1 – Average rates of Self-disclosure, before and after the training**

An interaction was found by **Extraversion** (low/high) in the **Assertiveness** variable F=3.58; p=.060: The average rating of the **Assertiveness** among the low Extraversion group increased following participation in the training (from 3.2 to 3.5), while among high Extraversion group the average ratings of **Assertiveness** decreased following the training (from 3.6 to 3.4). Before the training there was a significant gap between the two groups in **Assertiveness** ratings, while participation in the training narrowed the gap to a small difference.

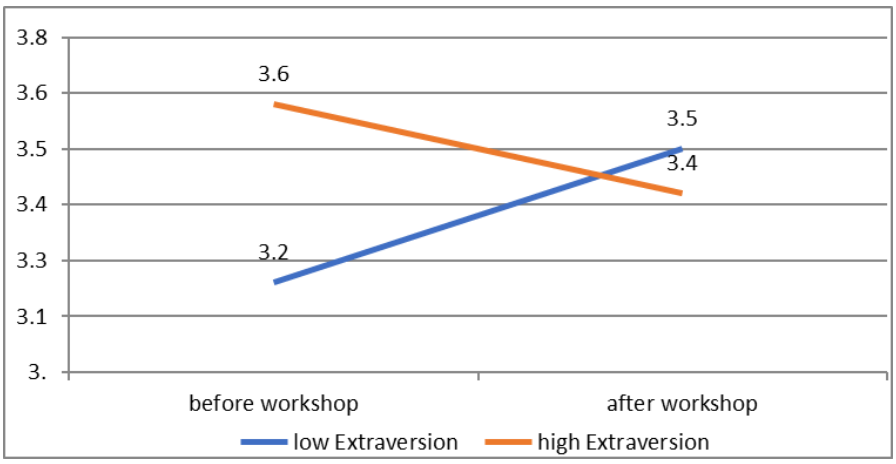


**Figure no. 2 – Average rates of Assertiveness, before and after the training**

An interaction was found by **Extraversion** (low/high) in the **Empathy** variable F=3.39; p=.068: The average rating of the **Empathy** among the low Extraversion group decreased following participation in the training (from 4.2 to 4.1), while among high Extraversion group the average ratings of **Empathy** increased following the training (from 4.2 to 4.3). Before the training there was no gap between the two groups in **Empathy** ratings, while participation in the training increased the gap between the groups.

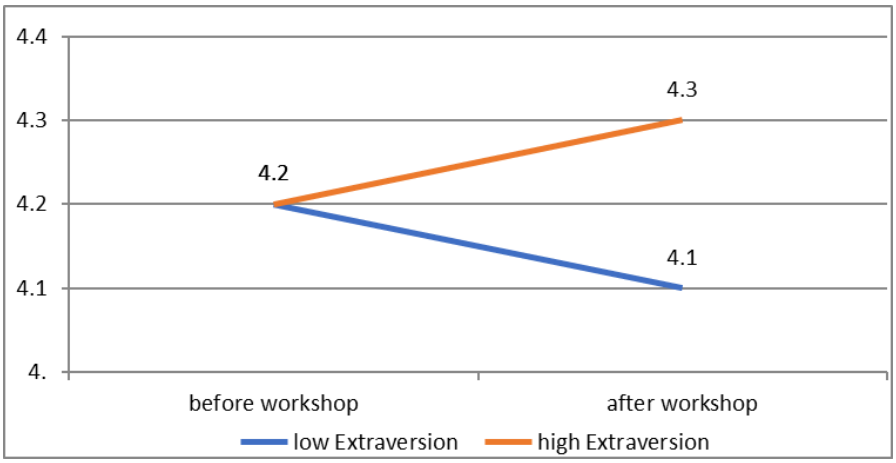


**Figure no. 3 – Average rates of Empathy, before and after the training**

***Agreeableness (Personality traits) variable as an intervening variable***

An analysis was conducted using Dawson (2014)'s approach to examine the regression coefficients associated with low (one standard deviation below the mean) and high (one standard deviation above the mean) levels of Agreeableness. No significant interactions Were found at all according to Agreeableness as an intervening variable in the changes in the ratings of the respondents following the training.

***Conscientiousness (Personality traits) variable as an intervening variable***

An analysis was conducted using Dawson (2014)'s approach to examine the regression coefficients associated with low (one standard deviation below the mean) and high (one standard deviation above the mean) levels of Conscientiousness. A significant interaction was found by **Conscientiousness** (low/high) in the **Assertiveness** variable F=4.82; p<.05: The average rating of the **Assertiveness** among the low Conscientiousness group increased following participation in the training (from 3.1 to 3.5), while among high **Conscientiousness** group the average ratings of **Assertiveness** almost didn't change following the training (3.3, 3.4).

An interaction was found by **Conscientiousness** (low/high) in the **Supportiveness** variable F=3.78; p=.054: The average rating of the **Supportiveness** among the low Conscientiousness group increased following participation in the training (from 3.7 to 3.9), while among high **Conscientiousness** group the average ratings of **Supportiveness** didn't change at all following the training (3.8).

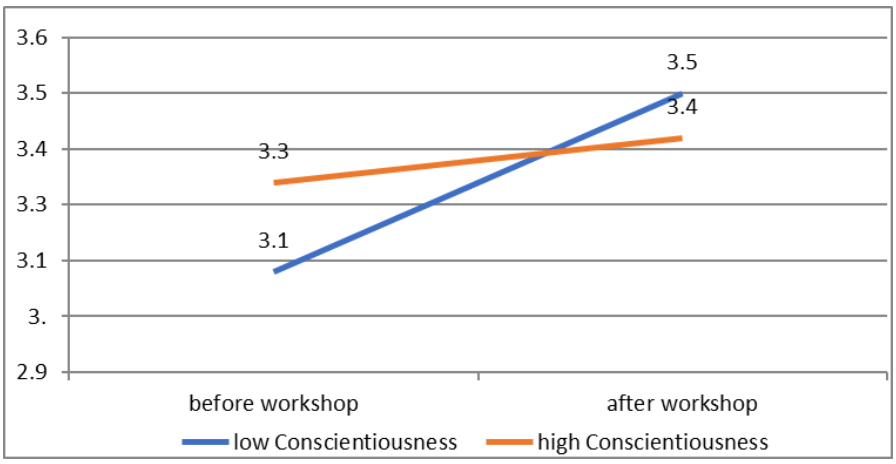


**Figure no. 4 – Average rates of Assertiveness, before and after the training**

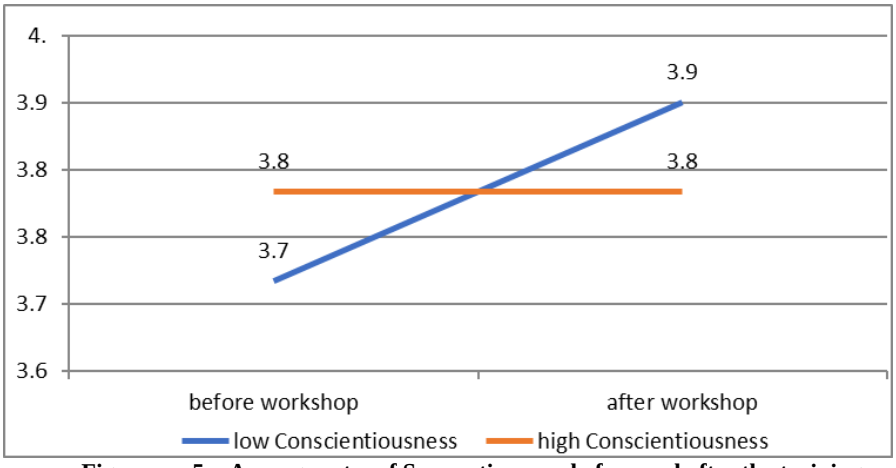


**Figure no. 5 – Average rates of Supportiveness, before and after the training**

***Emotional stability (Personality traits) variable as an intervening variable***

An analysis was conducted using Dawson (2014)'s approach to examine the regression coefficients associated with low (one standard deviation below the mean) and high (one standard deviation above the mean) levels of Emotional stability. No significant interactions Were found at all according to Emotional stability as an intervening variable in the changes in the ratings of the respondents following the training.

***Openness to Experiences (Personality traits) variable as an intervening variable***

An analysis was conducted using Dawson (2014)'s approach to examine the regression coefficients associated with low (one standard deviation below the mean) and high (one standard deviation above the mean) levels of Openness to Experiences. A significant

interaction was found by **Openness to Experiences** (low/high) in the **Self-disclosure** variable F=5.81; p<.05: The average rating of the **Self-disclosure** among the low **Openness to Experiences** group increased following participation in the training (from 3.7 to 3.9), while among high **Openness to Experiences** group the average ratings of **Self-disclosure** decreased a little following the training (from 3.9 to 3.8).

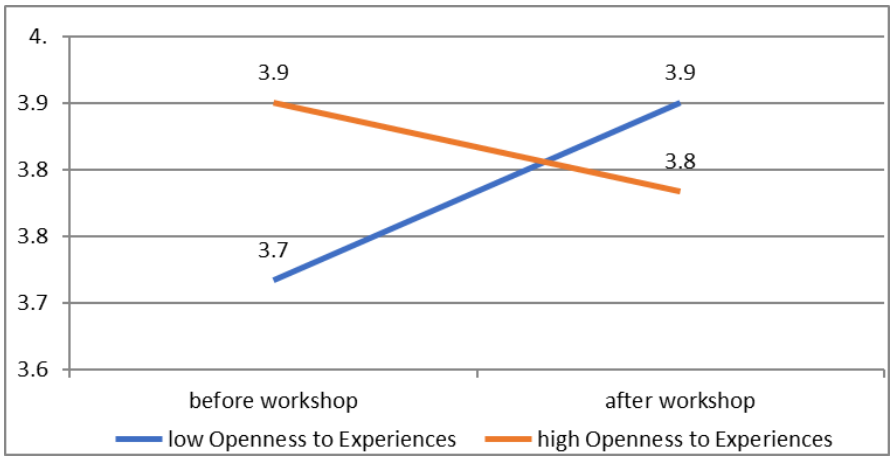


**Figure no. 6 – Average rates of Self-disclosure, before and after the training**

An interaction was found by **Openness to Experiences** (low/high) in the **Expressiveness** variable F=2.83; p=.095: The average rating of the Expressiveness among the low **Openness to Experiences** group increased a little following participation in the training (from 3.7 to 3.8), while among high **Openness to Experiences** group the average ratings of **Expressiveness** decreased a little following the training (from 4.0 to 3.9). Following the participation in the training, the gap in ratings between the two groups narrowed.

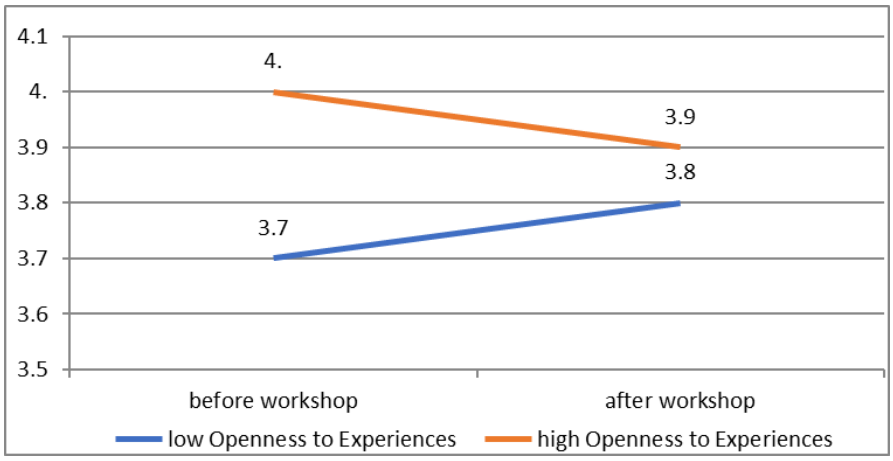


**Figure no. 7 – Average rates of Expressiveness, before and after the training**

An interaction was found by **Openness to Experiences** (low/high) in the Immediacy variable F=3.46; p=.065: The average rating of the Immediacy among the low **Openness to Experiences** group increased a little following participation in the training (from 4.0 to 4.1), while among high **Openness to Experiences** group the average ratings of Immediacy decreased a little following the training (from 4.4 to 4.3). Following the participation in the training, the gap in ratings between the two groups narrowed.

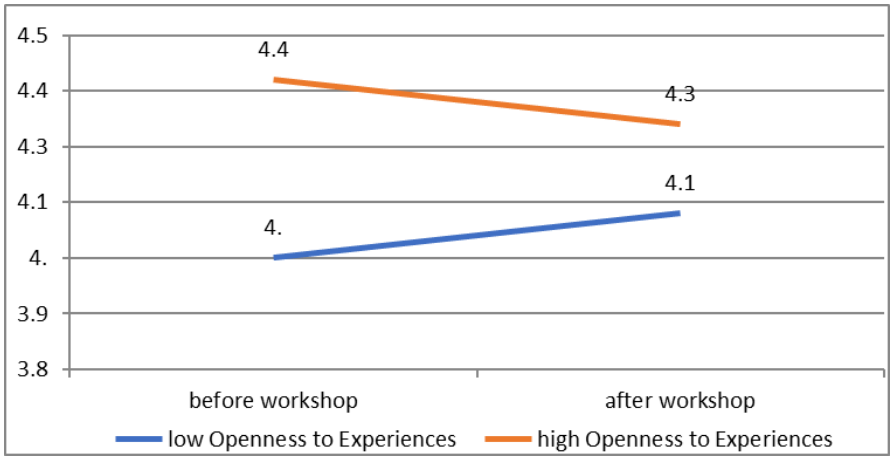


**Figure no. 2 – Average rates of Immediacy, before and after the training**

## 6. DISCUSSION SUMMARY

Personality attributes show increasing stability with age and experience, which is normal for the idea of traits; differences in temporary states can appear, due to training exposure – and this is what we also registered. Based on the findings, it can be said that the results partially support the hypothesis H1 a-e that personality traits are related to interpersonal communication skills improvement.

A significant improvement was found in the **Emotional stability** following the training.

Participating in the training changed the way people associate personality traits with **Interaction management**.

### Assessing the changes before/after the training, with an Intervening variable

***Extraversion (Personality traits)***

- Among people with **Low extraversion**, the level of **Self-disclosure** increased after the training, compared to those with high extraversion who showed the opposite trend. Before the training there was a significant gap between the two groups in the Self Disclosure ratings, while participation in the training reduced the gap to a small difference.
- Among people with **High extraversion**, the level of **Empathy** increased after the training, compared to those with low extraversion who showed the opposite trend. Before the training there was no gap between the two groups in **Empathy** ratings, while participation in the training increased the gap between the groups.

- Among people with **Low extraversion**, the level of **Assertiveness** increased after the training, compared to those with high extraversion who showed the opposite trend. Before the training there was a significant gap between the two groups in **Assertiveness** ratings, while participation in the training narrowed the gap to a small difference.
- Among people with low extraversion, the level of **Competing** did not change after the training, compared to those with high extraversion who showed strong decreased.
- Among people with low Extraversion the level of **Accommodating** didn't change following participation in the training, while among people with high Extraversion the ratings of Accommodating increased following the training. Before the training there was a gap between the two groups in Accommodating ratings, while participation in the training narrowed the gap to a small difference.

***Conscientiousness (Personality traits)***

- Among people with **low Conscientiousness** the level of **Assertiveness** increased following the training, while among people with high Conscientiousness the level pf Assertiveness almost didn't change.
- Among people with **low Conscientiousness** the level of **Supportiveness** increased following the training, while among people with high Conscientiousness the level of **Supportiveness** didn't change at all following the training.

***Openness to Experience (Personality traits)***

- Among people with **low Openness to Experience** the level of **Self-disclosure** increased following the training, while among people with high Openness to Experience the level of Self-disclosure decreased a little following the training.
- Among people with **low Openness to Experience** the level of **Expressiveness** increased a little following the training, while among people with high Openness to Experience the level of **Expressiveness** decreased a little following the training. Following the training, the gap between the two groups narrowed.
- Among people with low Openness to Experience the level of **Immediacy** increased a little following the training, while among people with high Openness to Experience the level of **Immediacy** decreased a little following the training. Following the training, the gap between the two groups narrowed.

Synthesizing, the training in interpersonal communication skills positively affected emotional stability, for all participants. Introverted people increased their self-disclosure and assertiveness, while extroverted people increased their empathy and accommodating tendency, and decreased their competing tendency level. People with high levels of conscientiousness increased their assertiveness, and those with low levels of conscientiousness increased their supportiveness. Finally, highly open to experience participants decreased their level of immediacy, self-disclosure, and expressiveness, while less open to experience participants increased their self-disclosure, expressiveness and immediacy. This shows that different personality traits lead to different effects when training in interpersonal communication skills is delivered, suggesting that such trainings should be designed in accordance with the personality of participants and their precise job needs.

## 7. CONCLUSIONS AND IMPLICATIONS

In Klein (2009)'s study, among the personality variables, extraversion showed the strongest relationship with Interpersonal communication skills. It could be argued that extroverts develop stronger social bonds with others through purity number of interactions. At the same time, each of the other personality variables assessed in this research proved worthy of consideration, as each of them were related to various interpersonal skills in important ways. Several other studies, such as Rowold (2007), have provided mixed findings regarding how personality characteristics affect interpersonal skills.

The current study used one-time training to examine how personality traits and interpersonal skills relate among 127 managers from a wide variety of professions in Israel. The manuscript underlined a significant improvement in the Emotional stability following the training process and the way people associate personality traits with Interaction management. As a theoretical contribution, the current study verified the effect of personality characteristics on the improvement in interpersonal communication skills through an interventional quasi-experimental action research. A more in-depth examination of an intervening variable found that those with more solid personality characteristics such as low extraversion and high conscientiousness made an improvement in skills that require more activity such as assertiveness, empathy, supportiveness, openness to experience and self-disclosure, while those with less solid personality characteristics showed a smaller improvement or even decreased in these skills, following the training. These findings confirm those of Hullman *et al.* (2010), which revealed that extraverts, agreeable, conscientious individuals, and individuals with a high degree of self-efficacy, based on their own assessments, exhibit higher levels of self-disclosure, social relaxation, expressiveness, immediacy, and empathy. As such, this set of skills represents half of the competencies examined in the study, in addition to representing a mix of self-oriented and other-oriented skills.

Interestingly, a link emerged between those with an elevated level of extraversion and assertiveness, but a low level of agreeableness and conscientiousness (outgoing incompetence). These variables did not correlate with immediacy, supportiveness, alter centrism, or empathy, as stated by Hullman *et al.* (2010) – so our study contradicts previous findings. In the current study, individuals with high extraversion demonstrated an increase in empathy following the training, as opposed to those with low extraversion, who demonstrated the opposite result. The level of assertiveness increased after the training among individuals with low extraversion, whereas the level of assertiveness decreased among individuals with high extraversion. However, the training narrowed the gap to a small amount.

Therefore, the ability to differently improving interpersonal communication skills justifies identifying the influencing factors, particularly those related to personality, measured through the Big Five inventory. The relationships tested between the big five personality dimensions and the interpersonal communication competencies are a novel theoretical contribution of our study. Also, important managerial implications exist, in terms of designing training services in accordance with the personality structure of the trainees. Because these interpersonal soft skills are more and more important in the labor market, companies invest in these types of training, without being aware of the fact that results can be contradictory, depending on the personalities of their employees. Our study shows that it is necessary to isolate the various influence factors in order to optimize and refine the training so that organizations can gain a high ROI on their investment.

Several limitations have to be inherently considered, as well. We did not control for the different fields of activity of the training participants; when companies order training programs, the participants usually come from one and the same field, and thus both the previous job background and the expectations are more similar than in our case, for which participants had different jobs and company backgrounds; assessment of interpersonal skills was based on self-reporting.

Also, the duration of the training was shorter than in real life, and we only had one training session; longer trainings and repeated sessions might show different relationships.

For future clarifications and advances, several research directions are possible: longer and repeated training exposure, including with groups separated based on personality traits versus mixed groups; manipulation of training content, with different weights for the interpersonal communication competencies targeted to be improved; experimenting with two different trainers, so that we could test the effect of trainer-trainees personality compatibility.

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# Exploring Economic Development Strategies for Canadian Indigenous Communities Post-Pandemic

**Alex V. Teixeira**[*], **Ken Coates**[**]

**Abstract:** The COVID-19 pandemic has strongly impacted the Indigenous Canadian economy. Indigenous enterprises exist in every industry, from small proprietorships to major organizations employing thousands of people. The research concerning the effects of such peculiarities on Indigenous corporations is sparse. This research aimed to examine how the pandemic affected development companies by comparing pre-epidemic forecasts to the trajectory of Indigenous-owned firms after two years of the pandemic and analyzing its singularities. The study was conducted by the Canadian Council for Aboriginal Business (CCAB) and supported by mixed methods techniques such as surveys, interviews, and non-participatory observations obtained from ten distinct Canadian Indigenous Economic Development Corporations, revealing a reality in which Indigenous businesses confront significant challenges in terms of access to public finance, human resources, community well-being, company diversification, and innovation. The result compared pre-pandemic forecasts and analyses that found Indigenous enterprises failing to recover and move ahead on company diversification and innovations, public finance, human resources, and sustainable development.

**Keywords:** indigenous business; indigenous corporations; indigenous economy; indigenous labor.

**JEL classification:** P52; O36.

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## 1. INTRODUCTION

The COVID-19 epidemic presented unprecedented problems to Indigenous enterprises, businesses, and communities throughout Canada. Over three years, businesses and organizations faced public health restrictions, lockdowns, capacity limitations, and operation interruptions. Indigenous-owned operations faced unique and compounding challenges, with limited access to health care, digital infrastructure, and emergency financing (Pergelova *et al.*, 2022).

The Indigenous economy is a comprehensive but overlooked part of the broader economy and Canada's reconciliation efforts. The last data from the Government of Canada estimates that there are over 50,000 Indigenous businesses in Canada, which has significantly increased since Statistics Canada reported in 1996.

The Canadian Council for Aboriginal Business (CCAB, 2019) developed research in 2019 and reported that Indigenous businesses could support 24% of the Federal government's procurement needs. Besides, before the COVID-19 pandemic, the Indigenomics Institute estimated that the Indigenous economy in Canada was valued at some $32 billion with the potential to grow to $100 Billion by 2023-24 (Hilton, 2021).

By 2027, the Indigenous youth population in Canada is expected to reach one million and is growing at four times the national average for youth, making it a significant part of the country's future labor force (Kamalnath, 2021; Statistics Canada, 2021).

Indigenous businesses operate in all industries, from sole proprietorships to large firms employing thousands of individuals (Volynets, 2015), and Economic Development Corporations (EDC) hold a unique place in the indigenous economy. One or more Indigenous communities own these businesses or corporations and act as revenue generation for investors and community members. The EDC operates at arm's-length from Indigenous leadership but often works to employ community members (Volynets, 2015), contribute to community socioeconomic well-being (Kamalnath, 2021), and own or invest in local businesses (CCAB, 2019).

The larger scale of operations compared to many Indigenous businesses and their connections to the well-being of their community makes them an essential part of the Indigenous economy.

Research problems emerge regarding how the EDCs are preparing for post-pandemic recovery and how the pre-pandemic projections related to the trajectory of Indigenous-owned business successes have been impacted.

This study aimed to explore how the pandemic has impacted development corporations.

The research justification arises to answer a need for a more thorough understanding of the Indigenous economy in Canada and how it is faring in the period of economic recovery post-pandemic. In addition, as an academic contribution, after a comprehensive bibliometric review, this article explores the Canadian Indigenous business realities, providing an essential discussion of how the pandemic has impacted these corporations, collaborating to build precise literature and a better understanding of the Indigenous business development.

This article is structured following the research process. Section 2 presents the literature review supported by a bibliometric evaluation of the central concepts studied. The methodology is described in Section 3 and includes where the data were obtained, the technique used to retrieve information, and the methods used. In Section 4, findings are presented and comparably discussed. The earned results are shown in Section 5, which also brings research limitations and further research recommendations.

## 2. LITERATURE REVIEW

The First Nation communities, which have the largest indigenous population in Canada, play a unique role in the Canadian business scenario. They are notably adept at growth, as highlighted by more than 1.6 million people identifying as Aboriginal during the 2016 Census of Canada. In addition, those communities have pursued business development with increasing success in recent decades.

Indigenous communities usually own businesses for economic development that meet community goals (Hotte *et al.*, 2018; Jarvis *et al.*, 2018; Kamalnath, 2021) such as employment for community members, access to training and skills development and financial transfers to support programs and service delivery. However, the literature is few, especially those depicting the Canadian First Nation's business reality, whose lack of research was also highlighted by Gordon *et al.* (2017); Ratten and Dana (2017); Gladun *et al.* (2021); Kant and Vertinsky (2022).

Considering aligned literature, the Indigenous Economic Independence Study (Jarvis *et al.*, 2018), which focused on the indigenous business development in northern Australia, has contributed to support the proposition that expenditure on Indigenous land and sea management programs generates positive spillovers for other Indigenous businesses, creating a solid chain (Jarvis *et al.*, 2018).

On the other hand, the Indigenous Economies in the Artic Study (Gladun *et al.*, 2021) focused on explaining the different types of Indigenous economies on the continuum between subsistence and market across three Arctic countries: Russia, Finland, and the United States (Alaska). The research demonstrated that some features of Indigenous economies are a crucial part of Indigenous culture and help sustain the traditional way of life and interaction with the market economy. The study discussed Indigenous economies, differentiating three types: subsistence, redistribution, and market economies, which included corporations, nonprofit organizations, and enterprises. The Arctic's research emphasized a concern in its conclusion regarding the Indigenous communities and businesses being forced to adapt to new circumstances associated with the transformation of their economic and cultural life.

Nevertheless, most of the literature explored the importance of separating Indigenous EDCs from politics (Tulk, 2013; Poelzer and Coates, 2015; Hotte *et al.*, 2018; Kamalnath, 2021), and notwithstanding its importance, the EDC's management operations, profits, and community connections remain less explored. Indigenous EDCs can also be considered part of a broader set of social enterprises, defined as hybrid organizations that pursue economic and social objectives.

This article reinforces the concept that Aboriginal Economic Development Corporations are community-based organizations that provide unique revenue streams, helping Indigenous communities to prosper (Gladun *et al.*, 2021). Besides, these corporations tend to be larger than Indigenous privately-owned businesses, which has allowed some of them to be pathfinders, breaking into the regional supply chain (Poelzer and Coates, 2015; Hotte *et al.*, 2018; Pergelova *et al.*, 2022).

While Canadian Indigenous economic development has been academically explored, there is still a lack of information about the operations and their singularities, primarily related to the effects of the COVID-19 pandemic.

This study was carried out by the Canadian Council for Aboriginal Business, using a research methodology approved by its board. The approach involved conducting surveys and interviews with ten different Canadian Indigenous Economic Development Corporations. Mixed methods supported the study, consolidating it as a quasi-experimental study (Leech and Onwuegbuzie, 2009; Yin, 2017).

Effectively, the mixed-methods approach comprised quantitative and qualitative analysis, and the survey instrument contained twenty-two questions that had been informed by previous CCAB questionnaires with additional questions designed by CCAB, the University of Saskatchewan, and the Northern Policy Institute. The researchers re-interviewed participants who took part in the 2019/2020 Aboriginal business survey and compared the findings.

The new survey was divided into two sections: the first examined current business characteristics using the same questions as the 2019 business survey, and the second covered future business trends. The second segment examined the pandemic's consequences on five themes: general implications, effects on relationships, finance and funding, and outlook and recovery.

According to Yin (2017), the survey participants were chosen intentionally, and 10 Canadian Indigenous EDCs were chosen. Once the sample mirrored to the best of our abilities at a nationwide range, it was tested and authorized. The sample included Four First Nation EDCs from Saskatchewan, three from Yukon, one from the Northwest Territories, one from Nova Scotia (representing Atlantic Canada), one from Ontario, and one from British Columbia are in the sample, making it well-rounded and representative.

The Ten CEOs were selected across Canada using purposive sampling, which considered industry diversity and company size. The interviews lasted for six months, with each session lasting one hour. A semi-structured guide covered topics such as leadership styles, organizational challenges, and strategic decision-making.

The CEOs were contacted via email and scheduled based on their availability. Interviews were conducted by phone or video conference to ensure a comfortable and confidential setting. The meetings and phone calls were authorized to be recorded for academic purposes.

The executives from the chosen EDCs completed a survey and were thoroughly interviewed, supporting the mixed-methods technique. Eight (8) of the ten top executives of EDCs took part in the last national business survey, which was held in 2020. The Web of Science database was searched using keywords and related phrases to methodologically support the study and find scientific output surrounding the issue, as shown in Table no. 1.

**Table no. 1 – Boolean classification of Web of Science database**

| | Research Area | Year of Publication | Country | Author(s) |
|---|---|---|---|---|
| 1st | Indigenous Corporations (Government Law) (40.00%) | Indigenous Corporations (2020) (40.00%) | Indigenous Corporations (Australia) (60.00%) | Indigenous Corporations (Addison, Jane) (20.00%) |
| 2nd | Indigenous Labor (History) (37.50%) | Indigenous Business (2021) (17.21%) | Indigenous Labor (USA) (42.50%) | Indigenous Economy (Gladun, Elena) (8.00%) |
| 3rd | Indigenous Business (Business) (36.505%) | Indigenous Economy (2019) (16.00%) | Indigenous Business (Australia) (28.57%) | Indigenous Business (Dana, Leo-Paul) (3.17%) |
| 4th | Indigenous Economy (Business Economics) (32.00%) | Indigenous Labor (2019) (12.50%) | Indigenous Economy (USA) (24.00%) | Indigenous Labor (Acharya, Arun) (2.50%) |

*Source*: authors

Therefore, this research is classified as exploratory descriptive in terms of its purpose, mixed in terms of the nature of the data, and non-experimental based on delimited surveys, content and documental analysis, and bibliometrics.

## 3. CONTEXT

Economic Development Corporations (EDCs) are organizations that operate businesses on behalf of Indigenous communities, serving as umbrella entities that are larger than privately owned businesses owned by individuals from those communities. With the ability to generate millions of dollars in assets, EDCs allocate funds to generate greater wealth for their shareholders. A comprehensive sample of ten EDCs with the topmost economic performances across Canada has been researched and listed. In addition, these ten EDCs are investing in major industrial projects across Canada, including natural resources, energy, construction, hospitality, travel and tourism, the arts, professional services and information technology.

Creating more Indigenous businesses is essential for fostering even more independence from the government for Indigenous people, besides developing a close connection with communities where businesses are located. However, the COVID-19 pandemic has created a disruptive scenario for businesses, corporations, and Indigenous communities in Canada.

The last Canadian census in 2016 reported that there were 744,855 Status First Nations people in Canada, of whom 44% or 327,736 lived on reserve. Indigenous Services Canada (ISC, 2022) reports on confirmed cases of COVID-19 testing results daily. However, it notes that due to home testing and some individuals choosing not to get tested, these numbers underestimate all positive COVID-19 cases in First Nations communities.

As of January 6, 2022, Indigenous Services Canada was aware of 57,344 confirmed positive COVID-19, 3927 active cases, 2,472 hospitalizations, 52,848 recovered cases and 569 deaths (ISC, 2022).

This research used the 2016 census population counts as a denominator to provide a relatively accurate on-reserve Indigenous Death Rate for Canada and compare it to the national level to provide one proxy measure of the impacts of the pandemic on Indigenous Canada, as shown in Table no. 2.

**Table no. 2 - Canadian living on-reserve: death rates per 100,000 Indigenous**

| | |
|---|---|
| Canada Total Deaths | **30,788** |
| Canada 2016 Census Population | **35,151,728** |
| Death Rate /100,000 | **87.59** |
| Canada's Total Deaths – Not On-Reserve | **30,219** |
| Canada Pop – Not On-Reserve | **34,820,703** |
| Death Rate rest of Canada /100,000 | **86.78** |
| Deaths On-Reserve | **569** |
| Canada 2016 On-Reserve Pop | **331,025** |
| Death Rate On-Reserve /100,000 | **171.89** |

*Source:* authors

Using the ISC numbers and Census 2016 population figures, it is possible to estimate the death rate per 100,000 First Nation people on reserve, the death rate for Canadians nationally, and the death rate for those not living on First Nation reserves. The numbers are substantial, with the on-reserve death rate being twice that of Canadians not living on reserves at 172/100,000 compared to 86.8/100000 nationally.

The Canadian responses to the pandemic leave it internationally ranked amongst the more prosperous Western nations, especially compared to the USA at 257/100,000 or the United

Kingdom at 226/100,000. In contrast, the death rates on-reserve in Canada are comparable to the South and Central American nations of Uruguay (179), Panama (176) and Bolivia (174), all of which have high Indigenous population counts, as informed by Johns Hopkins Coronavirus Resource Center (2022). Therefore, the pandemic has resulted in massive reductions in productivity in the labor force and workplace, affecting different sectors of the economy. Due to school closures and connectivity issues, the Indigenous youth were significantly affected, which will reinforce the local labor force. Many respondents highlighted this topic:

> *"We have low population numbers and high barriers to the workforce, you know, through generational trauma. So, it definitely amplified that and made it a lot worse*" (CCAB, 2020a).

> *"There are few people that are not working right now. Besides, if they are not working because they are on the Canadian Workers Compensation Board, they can't physically work. So that labor pool is dramatically shallow"* (CCAB, 2020a).

> *"Yeah, it's been getting intense because I remember we used to have job ads out for just our convenience store, just gas attendants, and we used to have well over 100 applicants every time we put ads out, and now I got like four* (CCAB, 2020a).

The older and less adaptable members of indigenous communities will experience difficulty finding new employment, and many who were earlier highly productive members of the workforce will become permanently unemployed (Hotte *et al.*, 2018; Brüssow and Timmis, 2021; Gladun *et al.*, 2021; Knoerr *et al.*, 2021).

On the other hand, First Nations economic development corporations are business ventures that invest community-held monies and have oversight of at least one subsidiary business on behalf of the Indigenous community they represent. The EDCs are essential actors within a thriving Indigenous economy (Kamalnath, 2021) and are estimated to be close to 500 corporations, as informed by the CCAB (2020b).

These corporations help promote economic stimulation and business development for First Nation, Metis, and Inuit communities. The primary forms of community reinvestment are related to employment and skills development. As a key economic driver, EDCs often have a diverse business portfolio in economic sectors ranging from natural resources, energy, construction, hospitality, travel and tourism, the arts, professional services, and information technology. Within this capacity, collaborating with the community allows EDCs to provide tools and resources for long-term prosperity and increased self-sustainability amongst Indigenous communities.

### 3.1 First Nations Economic Development Corporations

The survey was conducted, and the results indicate that the COVID-19 pandemic had negative impacts on EDC finances, especially on business revenues, but also some unique outcomes related to employee-management relations and community response.

Financial outcomes depend on the industrial sectors in which the EDC is involved. Industries like tourism and retail sales were heavily impacted, along with sectors tied to exporting commodities such as fish and seafood.

The severity of public health measures enacted locally, such as lockdowns and restrictions, leading to either temporary or permanent closures meant that some industries were more impacted than others.

The EDCs that participated in this study had a business portfolio consisting of eighty-seven businesses, ranging between two and eighteen separate business entities (Table no. 3).

**Table no. 3 – Industry and number of businesses**

| TOP INDUSTRIES | 2019 | 2021 |
|---|---|---|
| Fisheries, gaming, retail, real estate, renewable energy | 6 | 7 |
| Investments, forestry | 6 | 7 |
| Forestry, retail, construction | 2 | 8 |
| Tourism, retail, Industrial services, agriculture | 12 | 13 |
| Industrial construction, mining | 6 | 7 |
| Retail, manufacturing, hospitality, property development | 13 | 18 |
| Utilities, real state, communications infrastructure | 11 | 10 |
| Fuel, mechanical, and professional services | 5 | 4 |
| Mining, retail, real estate, tourism | 5 | 8 |
| Hydro, construction, fisheries | - | 5 |

*Source*: authors

As many of the EDCs studied in this study are active in the natural resource sector, it was common to see drilling firms, camp catering companies, and heavy iron/machinery firms in their business portfolios. Firms that specialize in tertiary-level skill sets such as surveying and remote sensing, GIS mapping, and aviation.

The sample also demonstrates the increasing propensity of EDCs to sell services or goods into other provinces or territories in Canada, representing market expansion and diversification of markets. Four respondents said they were selling services or goods internationally, thirty percent (30%) of whom noted selling in the USA and Mexico.

Due to the larger and more diversified business structure of EDCs compared to a typical Indigenous business, they are often capable of handling extensive procurement opportunities. Often, companies within their portfolios operate in sectors commonly sought out by government procurement opportunities like construction or manufacturing and generally have more experience managing large contracts.

However, the research has identified in the sample that only one EDC worked with the federal government, while nine EDCs interviewed were actively involved in sales to a provincial or territorial government.

Canada's Indigenous Business Directory, part of the Procurement Strategy for Indigenous Business program, is designed to assist and support Indigenous businesses in the pursuit of business opportunities, including federal procurement. This directory is a resource available to all government and private sectors. It is used to identify Indigenous businesses and assess their capabilities to carry out partnerships related to work completion.

However, while these collaborative opportunities exist, the lack of federal procurement business activity suggests barriers to accessing federal contracting opportunities, which continues to be an issue faced by EDCs and Indigenous businesses in Canada more broadly.

### 3.2 Funding programs and Aboriginal Financial Institutions

Regarding financial support during the pandemic, the study identified that all EDCs surveyed have applied for COVID-related funding from the federal government, although 20% of EDCs stated they did not qualify for any of the assistance programs. Among those who have qualified for funding, the most common programs accessed were Canada Emergency Business Account (CEBA), Canada Emergency Wage Subsidy (CEWS), Canada Emergency Rent Subsidy (CERS), and Indigenous Community Business Fund (ICBF).

On the other hand, 50% of the EDCs applied for COVID-related funding at the provincial or territorial level of government, but most businesses that accessed COVID-related funding said that the money they received was helpful but fell short of their larger funding needs.

The study also identified those who were denied funding support lacked the financial records required to meet government approval, specifically, not being able to prove revenue from the prior fiscal year.

To investigate the motivations and financial sources, the research asked if, prior to the pandemic, the EDC had outstanding loans with banks or an AFI (Aboriginal Financial Institution) such as NACCA (National Aboriginal Capital Corporations Association).

While there is a general perception that most EDCs receive considerable support from their banks or their regional NACCA, it appeared that when it came to financial management issues, the interviewees had less contact than expected based on the questions related to loans.

The study identified that 60% of EDCs had loans prior to the pandemic, and among those, only 20% had financial commitments with an AFI or the FNFA (First Nation Financial Authority), reinforced by the following quote: "The FNFA was open to assisting us with payment plans and granted it. It was a bit of a process, but it saved $200,000 in interest. Charter banks not that open." (CCAB, 2020b).

Throughout the pandemic, NACCA helped manage government funding for Indigenous businesses in line with their mandate to find solutions and support Indigenous entrepreneurship. A CCAB (2022) survey found that (43%) of Indigenous corporations had no current lending relationships with AFIs, banks, credit unions, or government lenders (CCAB, 2022), a finding that mirrors data gathered within this research.

This lack of an existing lending relationship may pose a barrier to organizations requiring quick access to capital in a crisis or when projects have short or limited time.

### 3.3 EDCs Finance, Revenue and Employment

This study has access to eight of ten EDCs' financial reports regarding finance and revenue. These eight collectively had revenues of just over an estimated $291 million in gross revenue in 2018 and had 1247 employees working for them and their subsidiaries.

In the 2018 report, the EDC revenues ranged from $2.5M to more than $90.0M, and only one had less than $10M.

The picture had radically changed in 2021, with five of the eight EDCs reporting losses in gross revenue totaling $141M. The total revenue generated by the ten EDCs in 2021 was estimated to be $302 million, but $74 million of this increase was generated by one outlier firm, which increased its revenue from over $90 million to just over $165 million in the three-year interval 2018 to 2021.

Removing this exception from the equation, the study has revealed revenues for the other firms dropping from $200 million to $86 million, a 57% reduction in revenue generation, as shown in Table no. 4.

**Table no. 4 - Estimates of Gains and Losses by ADCs 2018-2021**

| Organization | Revenue 2018 (EST) | Revenue 2021 (EST) | Change 2018-2021 | % Change |
|---|---|---|---|---|
| ***EDC 1*** | $13,700,000 | $318,000 | -$14,018,000 | -102.3% |
| ***EDC 2*** | $10,000,999 | $870,000 | -$9,130,999 | -91.3% |
| ***EDC 3*** | Not Reported | ≈$42,500,000 | Estimated Loss | - |
| ***EDC 4*** | $57,604,000 | $14,000,000 | -$43,604,000 | -75.7% |
| ***EDC 5*** | $28,500,999 | $42,850,000 | $14,349,001 | 50.3% |
| ***EDC 6*** | $75,202,997 | $2,300,000 | -$72,902,997 | -96.9% |
| ***EDC 7*** | $92,000,000 | $166,000,000 | $74,000,000 | 80.4% |
| ***EDC 8*** | $2,501,998 | $1,300,000 | -$1,201,998 | -48.0% |
| ***EDC 9*** | No Survey | $5,000,000 | Estimated Loss | - |
| ***EDC 10*** | $11,500,000 | $25,000,000 | $13,500,000 | 117.4% |

*Source:* authors

The study discovered three EDCs reporting revenue increases, one of which jumped from around $90M to over $160M, an increase of approximately 80%.

Collaborating with this complex scenario, one of the EDC senior interviewees, who has decades of experience, mentioned posting a 50% revenue reduction.

> *"Seafood did take a substantial hit. This year, countries like China and Italy got hit pretty hard with COVID, and our top three biggest exports had massive crashes within for seafood sales, especially lobster and scallops"* (CCAB, 2020a).

The business adjustments to provide digital services as a strategy to overcome the pandemic were costly, not only based on new equipment but also on training the local force to a new business reality. Besides, most Indigenous communities lack good network providers or even options to improve it.

However, this EDC leader's ability to respond to the pandemic was in the minority. Most went into "survival mode," with an emphasis on protecting their community, their family members, and their staff.

Losses could be genuinely staggering for partnerships that failed during the pandemic, as shown by the collapse of one EDC's gross revenues, which had been steadily climbing since the formation of their construction partnership 2015-2016, as shown in Figure no. 1.

The surveyed EDC reported that the partnership ended in 2021 under the pressure of the pandemic, and for 2021, estimated revenues of $2.3M, a staggering 97% decline in revenue over two years. In this circumstantial scenario, the Indigenous Economic Development Corporations suffered during the pandemic, especially those with revenue streams from tourism and casinos.

Furthermore, on Canada's coasts, where Indigenous fisheries have become big business, with hundreds of millions in investment going into fishing fleets, processing plants, fishing quotas, and fish farms, the EDC noted that their international sales for specialist products had taken a significant hit. One of the EDC's senior managers mentioned that countries such as China

and Italy got hit hard by the pandemic, which caused an enormous consumption reduction of seafood from the Canadian Atlantic, putting the indigenous EDC's exportations in check.

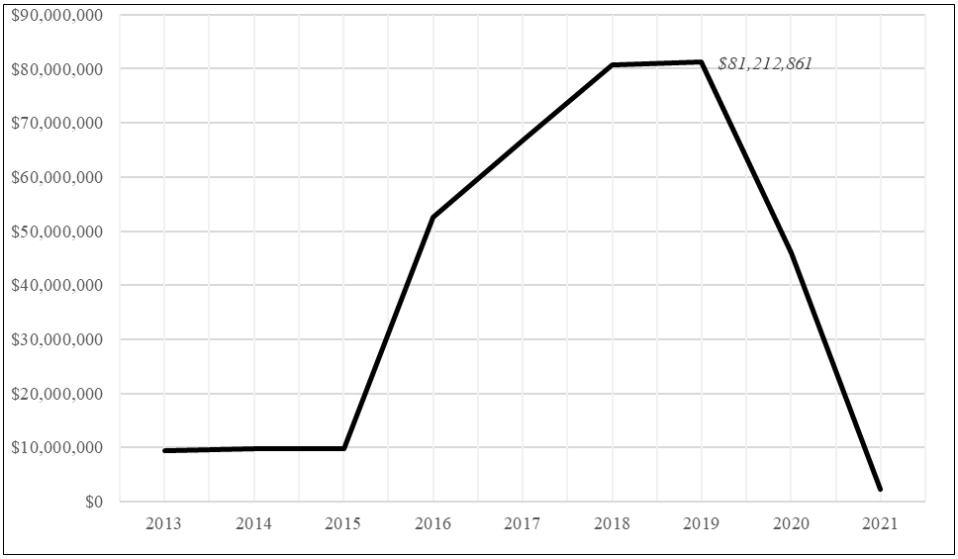


**Figure no. 1 - Consolidated Revenue Financial Statement**

In this scenario of revenue loss, 70% of the EDCs interviewed in this research reported lower revenue between 2018 and 2021, with losses ranging from 48% to a staggering 102%, once this last one has configured a negative revenue position as the EDC paid down debt owing to its Trust.

However, the EDCs interviewed also showed initiative in adapting their business, despite that some of the EDCs surveyed had not pivoted their products or services due to the industries specificities they are part of, such as gaming and hotels, construction, mining, and energy services. These corporations focused on continuity and adapting their processes to working from home rather than changing their products or services and diversifying their portfolios.

Regarding employment, in the first quarter of 2022, the Canadian federal government announced that Job vacancies climbed to 957,500, the highest quarterly number on record. Notwithstanding all the employer's efforts, businesses have faced an increasingly tight labor market driven by the lack of workers.

The challenge of finding employees increased during the pandemic. It was a topic that arose in many interviews once some EDCs struggled to find human resources before the pandemic, highlighting the importance of local training programs. The digital divide urges as one of the most significant factors contributing to issues surrounding employment within Indigenous communities because as Canada's socioeconomic makeup becomes digitized, the pre-existing connectivity issues faced by Indigenous peoples are becoming amplified.

Regarding businesses in rural Canada, the top industries are retail trade (28.6%), agriculture, forestry, fishing and hunting (14.8%), construction (12.5%), manufacturing (12.4%), and wholesale trade (11.1%). Therefore, the rural nature of many Indigenous

communities and businesses, which have less reliable internet and connectivity overall, made the online shift a challenge for the EDCs.

In addition to the employment scenario, the EDCs respondents specifically mentioned CERB as a factor in finding employees. This is a challenge identified by other studies, alongside other reasons. In July 2020, a survey by the Canadian Federation of Independent Businesses showed that of the 858 business owners whose staff refused to return to work, 62% said their staff preferred CERB (ISC, 2022). Respondents were also concerned with their own physical health and that of their loved ones (47%), childcare obligations (27%), believed there were no hours available (16%), and were concerned about public transport (7%).

Indigenous businesses have previously noted obstacles to attracting employees with the right qualifications (39%) and retaining employees (30%) (CCAB, 2016). In this study, several development corporations perceived CERB to be exacerbating this issue, noting that it had created an extra challenge in filling open positions. However, they mentioned other factors, including job risks, health, access to childcare, and lack of training.

### 3.4 Pandemic and the Indigenous Economy

Statistics Canada reported in December 2021 that compared with December 2019, total employment among Indigenous people was up 10.4% (+67,000) in December 2021. Increases in manufacturing (+19,000; +47.8%) and public administration (+15,000; +32.7%) contributed most towards these gains (Figure no. 2).

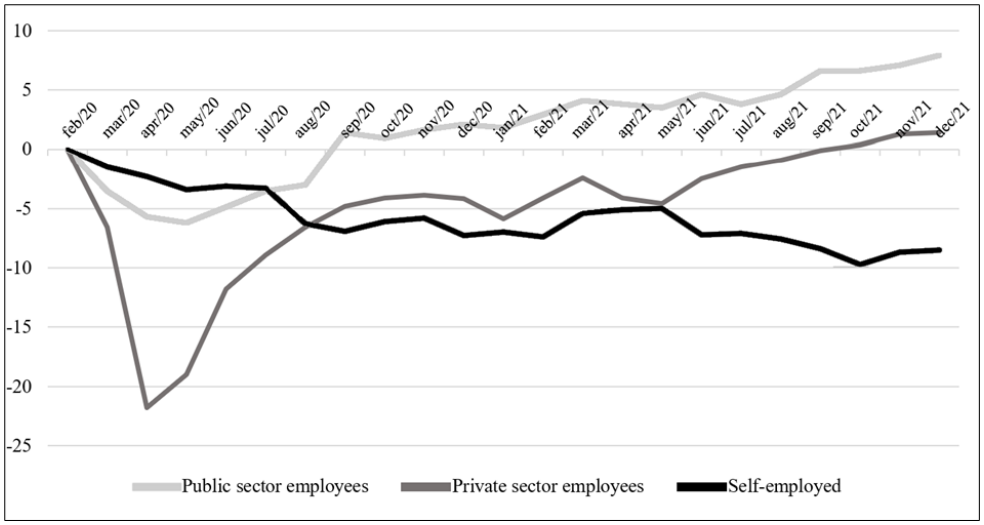


**Figure no. 2 – Compared Labor Force Survey in Canada**
*Source*: Statistics Canada (2016b, 2016a)

Over the same period, employment increased by 0.7% (+138,000) among non-Indigenous people (Statistics Canada, 2022). While this points to a recovery in the Indigenous labor force, it does not necessarily equate with long-term recovery. In addition, in the Yukon Territory, the Indigenous governments acted as a security net for their people during this

period of high unemployment, adding jobs in the First Nation government to help community members bridge a period of considerable distress.

Indigenous self-employment, while a small percentage of the total employment of First Nation people in Canada, at only 4.7% of all workers, which is less than the Canadian non-Indigenous rate of 7.6%, is an essential foundation for building entrepreneurship and wealth in the Indigenous economy (Table no. 5).

**Table no. 5 – Indigenous vs. non-Indigenous: Canada Labor Parallel through 2017 to 2021**

| | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|
| **Total (x 1000)** | 1,033.50* | 1,073.80* | 1,114.30* | 1,153.80* | 1,195.90* |
| | 28,730.70** | 29,146.70** | 29,580.50** | 29,898.80** | 30,130.20** |
| **Percentage Change** | - | 3.9%* | 3.8%* | 3.5%* | 3.6%* |
| | - | 1.4%** | 1.5%** | 1.1%** | 0.8%** |
| **Not in Labor Force** | 375.6* | 393* | 409.5* | 454.1* | 433.2* |
| | 9,873.00** | 10,110.60** | 10,164.30** | 10,737.70** | 10,535.40** |
| **Annual % Change** | - | *4.6%** | *4.2%** | *10.9%** | *-4.6%** |
| | - | *2.4%*** | *0.5%*** | *5.6%*** | *-1.9%*** |
| **Participation rate** | 63.7* | 63.4* | 63.3* | 60.6* | 63.8* |
| | 65.6** | 65.3** | 65.6** | 64.1** | 65** |
| **Unemployment Rate** | 11.4* | 10.4* | 10.2* | 14.2* | 11.6* |
| | 6.2** | 5.8** | 5.6** | 9.4** | 7.4** |

Note: *Indigenous; **Non-Indigenous

*Sources*: Statistics Canada (2016b, 2016a)

However, these are often small business owners working on contracts in the construction, transportation, and resource extraction industries, as well as in service industries such as professional services, health care, hairdressing, and retail trade.

## 4. CONCLUSION

This study focused on exploring how the pandemic has impacted development corporations by surveying EDCs after a long pandemic period. The methodology applied and research questions were satisfactorily answered and concatenated to support the conclusion, which converged inquietudes such as: How have First Nation economic development corporations weathered pandemic-related economic uncertainty? How are these EDCs preparing for the era of post-pandemic recovery?

The research's main objective, to develop a comprehensive understanding of how the pandemic in Canada has impacted the Indigenous Development Corporations, was achieved.

The study has found that the most pressing need brought forward by Indigenous businesses continued to be the return to normal. Some EDCs are unable to adapt to remote work or have faced cancellation of contracts due to the pandemic, with 72% responding that they still needed financial support.

The EDC’s responses were summarized by common difficulties faced during the pandemic and listed in Table no. 6.

**Table no. 6 – Relation of EDCs and their difficulties**

| EDCs | Findings |
|---|---|
| EDC3; EDC5; EDC6; EDC8; EDC10 | 1. Declining or no cash flow due to prolonged business closure and decreased demand for services or cancelled contracts was especially challenging for the tourism industry. |
| EDC1; EDC2; EDC3; EDC10 | 2. Prolonged lockdowns and restrictions impacted businesses, especially in retail and hospitality, and gravely affected revenues such as casino profits, which has limited the ability of the EDCs to support their First Nation governments and other programs financially. |
| EDC1; EDC3; EDC6; EDC8; EDC10 | 3. Meeting public health regulations were costly (paying for PPE, body temperature scanners, increased cleaning, reducing in-store capacity), and some reported challenges communicating the protocols to staff. The two-week isolation period and travel restrictions were difficult for remote, northern, and border communities with a labor shortage and more dependent on the tourism industry. In some cases, EDCs were dependent upon interprovincial or migrant workers. |
| EDC3; EDC4; EDC5; EDC8; EDC10. | 4. Communication with community, leadership, and governments became more difficult for a variety of reasons, not the least the decision by many First Nation governments to shut down without work-from-home plans or limited access to the internet and the tools to work from home. Some EDCs took a while to adjust to videoconferencing and working from home. |
| EDC2; EDC4; EDC5; EDC9 | 5. Lack of childcare was especially problematic as daycares and schools were closed, which either affected staff's ability to concentrate while working from home, or they could not work in the office/site because they had to stay home and take care of their children. |
| EDC1; EDC2; EDC3; EDC4; EDC5; EDC6; EDC8; EDC10 | 6. The cost of doing business drastically increased as construction and raw materials prices increased, and the availability of goods and services became a worldwide issue magnified in remote poor communities, as well as difficulties finding labor and enacting and understanding health regulations. |
| EDC2; EDC4; EDC5 EDC;7 EDC9; EDC10 | 7. Some challenges are historical and remain, including access to capital, equity, and funding, intergenerational trauma, state dependency for some Indigenous people, and communication of health and safety protocols with governments. |

The EDC staff responded quickly, and in most cases effectively, to the pandemic despite no playbook for managing businesses during a pandemic. Some EDCs effectively transitioned to a digital transformation using different technologies to continue to operate their businesses and protect their corporate assets. Even though some EDCs thrived during the pandemic, increasing their revenue and growing their assets, it was not the case for all participants or the most representative of the experiences of Indigenous-owned companies during the pandemic. Despite the flexibility offered by remote work, which allows their staff to stay safe and care for their families, the changing landscape of remote work presented a challenge for EDCs since reserves and remote communities disproportionately lack access to reliable internet.

Several EDCs credited their diversified industries with helping them survive the pandemic. This allowed them to adapt to changes in employment and revenues when industries like tourism were closed. Alongside diversification and adaptation, another theme was planning and evaluation. The EDCs looked for opportunities and reviewed the state of their assets in a rapidly changing landscape.

A significant challenge during the pandemic was hiring, a prominent theme in nearly every interview. There simply were not enough people to fill vacant or new roles in the EDCs and their subsidiaries. Participants noted difficulty attracting people with the expertise required for

specific positions in remote or northern areas. Some mentioned a lack of amenities found in larger cities, making it difficult to attract people from the rest of the country. Additionally, pandemic restrictions meant they could not bring in foreign workers, whom they usually rely on. Respondents felt that CERB contributed to the challenging situation, with several noting that roles like cashier or gas bar attendant were proving challenging to fill.

It was consistent and notorious for the consulted EDCs that operational costs were increased during the pandemic. The lack of skilled laborers has significantly aggravated an already deficient situation.

In this scenario, many respondent EDCs, upwards of 70% in this study and 73% in a national survey completed by CCAB, saw their revenues drop precipitously and even closed businesses.

The scenario after the pandemic remains seriously complex. The EDCs are struggling to access funding to move forward and overcome the strong losses. The skilled workforce's low rates remain critical, which is a strong pushback for sustainable growth.

The valuable data collected from this research illustrates important economic landscapes related to Indigenous economies in Canada. The findings highlight the resilience and opportunity for prosperity associated with Indigenous economic development corporations. Parallel to this, the data also reiterated some of the pre-existing socioeconomic issues within Indigenous communities, which have become aggravated during the pandemic. Problems like employment and employee retainment were exacerbated, reflected in (48%) of Indigenous businesses laying off staff either temporarily (33%) or permanently due to the pandemic (15%). In comparison, only 11% of new staff were hired, as CCAB (2020b) noted.

The study's limitations include its focus on only ten Indigenous Economic Development Corporations, which may limit the generalizability of the broader Indigenous business landscape. Additionally, the study's two-year post-pandemic analysis timeframe may overlook long-term effects and recovery trends.

However, to achieve progress in the future, it is advisable to allocate resources fairly across various areas. These encompass employment strategies, digital accessibility, and skill enhancement. Enhancing crisis and strategy planning, fostering diverse alliances, and developing assets is equally crucial. Moreover, establishing a strategic EDC association can facilitate negotiations and funding access at the provincial and federal levels.

Furthermore, this study recommends undertaking comprehensive research on EDC's digital transformation. The research should aim to bridge the gap between diverse technological environments across Canada and uncover potential business disparities.

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# Volatility and Return Connectedness Between the Oil Market and Eurozone Sectors During the Financial Crisis: A TVP-VAR Frequency Connectedness Approach

**Lamia Sebai*, Yasmina Jaber**, Foued Hamouda*****

**Abstract:** This paper analyzes the returns and volatility connectedness between oil prices and Eurozone sector returns during the global financial crisis. We employ the TVP-VAR frequency connectedness approach with daily data of Brent prices and 18 Eurozone supersector indices from 15 November 2014 to 24 November 2023. Our results show a high average connectedness of the returns and volatilities. Industrial Goods are the largest transmitter contrariwise Media supersector is the largest receiver of shocks on returns. The same finding is for volatility, the result shows that Industrial Goods and Services transmit the highest risk in contrast, the Media has the highest receiver volatility indices. The time-varying connectedness (TCI) of returns and volatilities in both show a drastic increase in March 2020. This increase is a result of COVID-19. Whereas, there has been no rise in connectivity following Russia's invasion of Ukraine. Our result highlighted that Brent was a net receiver of volatility shocks during the Russian invasion of Ukraine.

**Keywords:** oil market; Eurozone Super sectors; TVP-VAR frequency connectedness; volatility transmission; volatility spillovers.

**JEL classification:** G15; D53.

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## 1. INTRODUCTION

For a loan, the macroeconomic effect of commodity price shocks is an important theme that has attracted the attention of several researchers over the past decade. Crude oil prices are considered a leading economic indicator, with Sokhanvara and Bouri (2022), and others suggesting a significantly negative relationship between high oil prices and economic growth. Lorusso and Pieroni (2018) found that the consequences of oil price changes on UK macroeconomic aggregates depend on different oil types shocks. Cai *et al.* (2022) show that OPEC and non-OPEC oil supply shocks decrease industrial production but increase the employment rate in the Euro area. Since the second half of 2021, energy prices have risen sharply in the EU and globally. Fuel prices have risen further following Russia's unprovoked and unprovoked aggression against Ukraine, which has also raised concerns about the security of EU energy supplies. Russia's decision to suspend gas supplies to several EU member states has further aggravated the situation. The Russian-Ukrainian war has negative consequences on global energy and food security, characterized by higher inflation, which affects the United States and the leading European economies. The 2022 annual average OPEC oil price stands show at 104.01 U.S. dollars per to 69.72 U.S. dollars the previous year is explained by and comes in the wake of an energy supply shortage and sanctions on Russia following the Russia-Ukraine war. Le and Luong (2022) found that oil prices and sentiment are net transmitters of shocks in the US. The relationship between oil price, stock market returns, and investor sentiment is time-varying and driven by time-specific developments and events. Yuan *et al.* (2022) found that Stock markets are more affected by negative oil returns, while oil markets are more affected by positive stock returns. Hernandez *et al.* (2022) examined the return spillovers between US stock sectors under low and high volatility regimes. They show evidence that oil volatility has a causal impact on the spillover dynamics of US stock sectors and that the effect is particularly strong in the high volatility regime.

Diebold and Yilmaz (2014) affirm that Connectedness would appear central to modern risk measurement and management, and indeed it is. It features prominently in key aspects of market risk (return connectedness and portfolio concentration), credit risk (default connectedness), counter-party and gridlock risk (bilateral and multilateral contractual connectedness), and not least, systemic risk (system-wide connectedness). It is also central to understanding underlying fundamental macroeconomic risks, in particular business cycle risk (intra- and inter-country real activity connectedness). Two objectives are presented in this study. First, we analyze the volatility connectedness between oil prices and the Eurozone supers sector. Second, we investigate the conditional correlation between oil prices and super sector returns.

Even though previous papers showed that the financial crisis induced significant changes in the oil-stock market relationship for some studied markets, no studies investigated the spillover connectedness between oil prices and super sector returns. Furthermore, to my knowledge, no previous study has analyzed the volatility connectedness between the oil market and Eurozone sectors.

This article aims to fill this gap by examining the volatility connectedness between oil prices and Eurozone sector returns. We offer new insights into the returns and volatility spillovers between oil and the super sector, particularly during highly uncertain periods such as COVID-19 and the Russia-Ukraine war. We employ the TVP-VAR frequency

connectedness approach with daily data of Brent prices and 18 Eurozone supersector indices covering the period from 15 November 2014 to 24 November 2023.

The rest of the paper is organized as follows. Section 2 presents a literature review. Section 3 adopted the data. Section 4 describes the methodology. Section 5 presents empirical findings Section 6 concludes.

## 2. LITERATURE REVIEW

### 2.1 Theoretical Framework

There is no controversial that the Generalized Vector Autoregressive (VAR) method, developed by Koop *et al.* (1996) and then Pesaran and Shin (1998) often referred to as KPPS remains the basis of the various alternative methods often utilized for analyzing spillover in the literature. However, partially due to its relative newness and robustness, the Diebold and Yilmaz (2014) method has been widely accepted as the well-liked measure of the connectedness index. Unlike the conventional VAR, the DY which uses decomposition of forecast error variance from VAR is suitable for evaluating the degree of interdependence among oil markets and Eurozone supersector indices.

### 2.2 Empirical Literature

The connectedness effect is defined as the information links between financial markets; its essence is the risk transfer between markets: Udeaja (2019) shows that the increasing integration of financial markets across the globe has further exacerbated the vulnerability of economies around the world, to systemic shocks either emanating domestically, from intra-financial markets connectedness or globally, from the perspective of inter financial market connectedness. While acknowledging the potential of such integration to facilitate trade among nations, the risks and uncertainties associated with such connectedness remain a major source of concern. Li *et al.* (2021) investigate the impact of information transmission speed on stock volatility. They found the information transmission speed is slow, and stock volatility decreases with the increase of the information transmission speed. Volatility spillovers may also affect financial contagion. Liu *et al.* (2022) employed the delta Co VAR and Co VAR networks to analyze the risk spillovers from oil markets to the G20 stock system from both otherwise and systemic perspectives. They found, illustrated significant risk spillovers from oil to G20 stocks only during the crisis period. Also, the results show that the G20 stock contagion presents regional characteristics and oil-related characteristics conditional on oil in extreme risk, and verify the significant risk spillovers from the oil market to the global stock system. Huang *et al.* (2023) investigate the dynamic volatility spillover among energy commodities and financial markets in pre- and mid-COVID-19 periods by utilizing a novel TVP-VAR frequency connectedness approach and the QMLE-based realized volatility data. Their findings indicate that the volatility spillover is mainly driven by long-term components and prominently time-varying with a remarkable but short-lived surge during the COVID-19 outbreak. They further spot that WTI and NGS are prevailingly transmitting and being exposed to the system volatility simultaneously, especially during the global pandemic, suggesting the energy commodity market becoming more integrated with, more influential, and meanwhile vulnerable to global financial markets. The consistently growing

interconnectedness of drastic volatilities in energy commodities and fluctuations in non-energy commodities and other financial assets attracts much attention from financial investors, policymakers, and academic researchers as Adekoya and Oliyide (2021); Balcilar *et al.* (2021); Shah *et al.* (2021); Farid *et al.* (2022). Farid *et al.* (2022) and Gong and Xu (2022) find that the return and volatility transmission among energy commodities and global financial assets are significantly strengthened and increasingly complex due to globalization, technological development, and the financialization of commodity markets. It is widely acknowledged that global market integration and financialization not only result in increased liquidity and ease of trading in energy commodity markets but also tend to foster speculation and thus increase market volatilities, which may serve as the channel for the time-varying and asymmetric volatility spillovers across energy commodities and non-commodity markets. Umar *et al.* (2022) investigate the impact of geopolitical risks caused by the Russian-Ukrainian conflict on Russia, European financial markets, and the global commodity markets. We measure the dynamic connectedness among them using time- and frequency-based time-varying parameter vector autoregression (TVP-VAR) approaches. The empirical findings indicate that: first their relationship has changed due to the conflict; second European equities and Russian bonds are the net transmitters of shocks; and finally the conflict affects return and volatility connectedness among them in terms of short- and long-term frequencies, respectively. Hernandez *et al.* (2022) investigated the return spillovers between US stock sectors under low and high volatility regimes by implementing a Markov regime-switching vector autoregression. They concluded that energy is the largest transmitter and receiver of spillovers to/from other sectors. Mensi *et al.* (2022) used the asymmetric Baba-Engle-Kraft-Kroner (BEKK)-GARCH model and the frequency spillover methodology by Barunik and Ellington (2020) to examine spillovers and portfolio management between crude oil and US Islamic sector stocks. The authors find significant time-varying spillovers between oil and Islamic sectors. Ahmad *et al.* (2021) examined the spillover role of the implied volatilities of oil, gold, and the stock market with US equity sectors. They concluded that the market's expectation of oil price volatility (OVX) spillovers less strongly on the US sectorial returns than the market's expectation of US stock market volatility (VIX). The authors also found that the US equity sectors' spillovers on the VIX and OVX strengthened because of the coronavirus (COVID-19) outbreak. He *et al.* (2021) used the TVP-FAVAR model to study the spillover effect of international EPU on the energy sector in the Chinese stock market. They argue the that Chinese energy sector's stock volatility is positively related to EPU shocks. Zhang *et al.* (2022) applied the asymmetric ARMA-EGARCH-ARJI model to analyze the dynamic jumps in global oil prices and their impacts on China's industrial sector at the aggregate and subsector levels. The authors that caused the oil price have the impacts on the return and volatility of China's industrial sector. Mensi *et al.* (2022) examined the frequency dynamics of volatility spillovers between Brent crude oil and stock markets in the US (S&P500 index), Europe (STOXX600 index), Asia (Dow Jones Asia index), and stock markets of five vulnerable European Union (EU) countries known as the GIPSI (Greece, Ireland, Portugal, Spain, and Italy). They found that the spillover effect between the oil and the considered stock markets is time-varying, crisis-sensitive, and frequency-dependent. Aslan and Posch (2022) investigate how the volatility of carbon emission allowance (EUA) prices affects European stock market sectors using a network analysis of prices of EUA futures and FTSE stock market sector indices and they found that the EUA is mostly a net receiver of volatility connectedness and significantly receives volatility across most sectors

during the recent European energy crisis. Urom *et al.* (2022) used the Time-Varying Parameter (TVP-VAR) model to characterize the level of spillovers among the clean energy sectors and oil market uncertainty under different investment horizons. They found that the level of shock spillovers is weak in the short-term but strengthens towards the intermediate- and long-term. Tiwari *et al.* (2018) used asymmetric quantile regression to investigate the impacts of oil price shock on the Indian stock market sectorial index. Their results found that oil price tail risk affects all sectorial indices than the carbon sector and a contagion effect for negative oil price shocks is found in six sectors. Cevik *et al.* (2020) examined the relationship between crude oil prices and stock market returns in Turkey, considering volatility spillovers that exemplify second-moment moment effects. Their empirical results suggest that crude oil prices significantly affect stock market returns in Turkey.

### 2.3 Hypotheses

Even though previous papers showed that the financial crisis induced significant changes in the oil–stock market relationship for some studied markets, no studies investigated the spillover connectedness between oil prices and super sector returns. So, our paper tests the hypotheses presented below:

***H1:*** *During the financial crisis, there is a significant relationship between the oil market and the performance of Eurozone sectors*

***H2:*** *The oil market is a transmitter of shock volatility for the Eurozone super sector.*

## 3. DATA

Our dataset consists of daily returns for Brent crude oil prices and daily supersector per sector indices for the period from 15 November 2014 to 24 November 2023. The analysis sector-wise is focused on the Eurostoxx indices, from which the Eurostoxx 50 is derived. According to the Industry Classification Benchmark (ICB), we use 18 super sectors (automobiles and parts, bank, primary resources, chemicals, construction and materials, financial services, food and beverages, health care, industrial goods and services, retail, insurance, media, oil and gas, real estate, technology, telecommunications, travel and leisure, and utilities). The prices are listed in EURO and the data can be sourced online at Energy Information Administration (EIA) for the Oil prices while the Eurostoxx super sector indices are collected from the STOXX limited database. The daily sector returns $\left(R_{iES,t}\right)$ and the Brent Oil market returns $\left(R_{BO,t}\right)$ is defined as:

$$R_{i,t} = Ln\left(p_{i,t}\right) - Ln\left(p_{i,t-1}\right) \quad (1)$$

where $p_{i,t}$ is the price of (Sector, Brent Oil) $(i = 1,2 \ldots . n)$. Our empirical analysis begins with calculating summary statistics for the Sector and Brent Oil price returns. The Augmented Dikey-Fuller $(ADF)$ and Phillips- Perron $(PP)$ tests are used to examine the existence of unit roots in the price returns. Furthermore, Engle's ARCH –LM test for ARCH effects is used to examine whether volatility modeling is needed for the price returns of each variable. The test results suggest that the closing price sectors of all sectors and Brent Oil are stationary and exhibit ARCH effects and a multivariate GARCH methodology can be used not to investigate

only to model the returns (sector, Brent oil) conditional variances but also to analyze the volatility transmission effects between them.

## 4. METHODOLOGY

This paper investigates volatility transmission effects between Brent Oil prices and the Eurozone supersector returns, which are determined through the conditional covariance matrix. The conditional mean equation is written as:

$$R_{it} = c + \varepsilon_t \tag{2}$$

where $\boldsymbol{R_{it}}$ is a $(2 \times 1)$ vector of the price returns for $sector_i$ $(iES)$ and Brent Oil WTI $(BO)$ at time$t$; $c$ is the vector of the mean of the returns and $\varepsilon_{it}$ is the vector of residuals with a conditional covariance matrix $H_t$ given the available information set $\varphi_{t-1}$.

**The TVP-VAR connectedness**

Antonakakis *et al.* (2020) presented a TVP-VAR connectedness methodology based on Diebold and Yilmaz (2014) connectedness approach; Antonakakis *et al.* (2020) achieved this by allowing the variance-covariance matrix to vary via a Kalman filter estimation with forgetting factors, following Koop and Korobilis (2014). The total connectedness index (TCI) is defined as:

$$C_t(H) = \frac{\sum_{i,j=1,i\neq j}^{m} \tilde{\phi}_{ij,t}(H)}{\sum_{i,j=1}^{m} \tilde{\phi}_{ij,t}(H)} \times 100 = \frac{\sum_{i,j=1,i\neq j}^{m} \tilde{\phi}_{ij,t}(H)}{m} \times 100 \tag{3}$$

The total directional connectedness to others, that is, *i* propagating its shock to all other variables *j* is defined as:

$$C_{i\rightarrow j,t}(H) = \frac{\sum_{i,j=1,i\neq j}^{n} \tilde{\phi}_{ij,t}(H)}{\sum_{i,j=1}^{n} \tilde{\phi}_{ij,t}(H)} \times 100 \tag{4}$$

The total directional connectedness from others, that is, *i* receives from all other variables *j* is given as:

$$C_{i\leftarrow j,t}(H) = \frac{\sum_{i,j=1,i\neq j}^{n} \tilde{\phi}_{ij,t}(H)}{\sum_{i,j=1}^{n} \tilde{\phi}_{ij,t}(H)} \times 100 \tag{5}$$

Net total directional connectedness:

$$C_{i,t}(H) = C_{i\rightarrow j,t}(H) - C_{i\leftarrow j,t}(H) \tag{6}$$

## 5. EMPIRICAL FINDINGS

### 5.1 Descriptive statistics

Table no. 1 reports the results of the descriptive statistics for the returns. The mean returns of indices are positive for all sectors except Bank, Basic Resources, Media, Oil and Gas, Retail, Telecom, and Utilities. The highest standard deviation is attributed to the Construction and Material returns. The Oil indices confirm the negative and significant correlation between all sectors except for the Chemicals returns and Telecom are positive and significant. The kurtosis statistics are greater than the acceptable level, another notable statistic of returns observed. In contrast, during this period, the opposite result was true for the price returns of Auto and Parts, Construction and Material, Food and Beverages, and positively skewed Media, indicating that high positive price returns are more common than significant negative returns. The test normality for all price return series is also confirmed by the Jarque-Bera (JB) test results, which reject the null hypothesis of normally distributed returns for all the returns series.

**Table no. 1 – Descriptive statistics of stock returns**

| | Mean$10^{-3}$ | Max | Min | Standard Deviation | Skewness | Kurtosis | J-B | Corrélation |
|---|---|---|---|---|---|---|---|---|
| **Auto and Parts** | 0.08 | 0.049 | -0.043 | 0.012 | 0.098 | 38.68 | 21.02 | -0.038 |
| **Bank** | -0.4 | 0.066 | -0.198 | 0.020 | -1.35 | 15.81 | 4591.2 | -0.093 |
| **Basic Resources** | -0. 3 | 0.083 | -0.097 | 0.021 | -0.175 | 5.71 | 200.3 | -0.027 |
| **Chemicals** | 0.18 | 0.046 | -0.052 | 0.012 | -0.167 | 3.89 | 24.56 | 0.078 |
| **Construction and Material** | 0.09 | 5.851 | -0.131 | 0.231 | 25.01 | 631.2 | 106265 | -0.003 |
| **Financial services** | 0.23 | 0.050 | -0.105 | 0.014 | -1.01 | 9.95 | 1404.9 | -0.06 |
| **Food and Beverages** | 0.01 | 0.128 | -0.127 | 0.019 | 0.299 | 9.71 | 1215.7 | -0.037 |
| **Health Care** | 0.02 | 0.149 | -0.167 | 0.032 | -0.046 | 6.41 | 312.3 | -0.088 |
| **Industrial Goods and Services** | 0.2 | 0.034 | -0.069 | 0.012 | -0.516 | 4.98 | 134 | -0.062 |
| **Insurance** | 0.22 | 0.043 | -0.119 | 0.014 | -1.20 | 11.92 | 2284.9 | -0.101 |
| **Media** | -0.03 | 0.308 | -0.029 | 0.007 | 0.365 | 4.332 | 61.77 | -0.061 |
| **Oil and Gas** | -0.26 | 0.061 | -0.084 | 0.016 | -0.141 | 4.67 | 76.75 | -0.046 |
| **Real Estate** | 0.12 | 0.043 | -0.101 | 0.012 | -0.865 | 9.73 | 1292.9 | -0.103 |
| **Retail** | -0.19 | 0.023 | -0.021 | 0.004 | 0.112 | 6.48 | 326 | -0.063 |
| **Technology** | 0.33 | 0.053 | -0.055 | 0.013 | -0.207 | 4.19 | 42.89 | -0.045 |
| **Telecom** | -0.07 | 0.046 | -0.089 | 0.013 | -0.373 | 6.96 | 434.4 | 0.028 |
| **Travel and Leisure** | 0.22 | 0.049 | -0.089 | 0.013 | -1.01 | 9.46 | 1230.2 | -0.045 |
| **Utilities** | -0.26 | 0.062 | 0.042 | 0.086 | 0.012 | 3.662 | 7.97 | -0.075 |
| **Brent** | 0.01 | 0.045 | -0.090 | 0.013 | -0.540 | 6.22 | 308.8 | 1 |

*Sources*: conducted by authors

### 5.2 Connectedness analysis

Overall, the TVP-VAR frequency connectedness model employed in this paper provides a comprehensive picture of the return and volatility transmission among Brent Oil and the Eurozone supersector returns. The connectedness measures include the estimated spillovers

of returns and volatility based on the Forecasted Variance Decomposition methodology developed by Diebold and Yilmaz (2014).

Tables no. 2 and no. 3 report the results of the average connectedness values for the returns and the volatilities among oil prices and the Eurozone supersector during the global financial crisis. We find that the spillover effects are high indicating raised interconnectedness over time, which may indicate an increase in uncertainty and systemic risk. The average connectedness results show that the total spillover connectedness of the returns and volatilities are 70.05% and 65.64%, respectively. The industrial Goods and Services supersector is the largest transmitter of shocks (109.27%) on returns. Retail (95.16%) transmits the second-highest spillovers. By contrast, Brent propagates the lowest shocks to the returns of the other indices (15.92%). However, we note that Media is the most receiver of return shocks (89.2%). Brent; Insurance; Chemicals; Food and Beverages; Media; Oil and Gas, Real Estate, and Health Care are the net receivers of shocks; whereas the remaining return series are the net transmitters.

As per the volatilities, Industrial Goods and Services transmit the highest volatility shocks (101.26%). Retail transmits the second-largest volatility shock (90.97%). In contrast, the Media has the highest receiver volatility indices (85.24%). Industrial Goods and Services; Auto and Parts; Technology; Telecom; Utilities; Travel and Leisure; Oil and Gas; Basic Resources and Retail are the net transmitters of volatility shock; while the rest are the net receivers of shocks volatility.

Figure no. 1 presents the time-varying connectedness (TCI) of returns and volatilities to account for time-varying connectedness dynamics. Both indices notably surged in March 2020 and hit their apexes (70% and 90%, respectively). This increase is a result of the COVID-19 virus spreading quickly. Our findings indicate that the global pandemic significantly intensifies cross-market volatility. This result corroborates the finding of Huang *et al.* (2023). Whereas, there has been no rise in connectivity following Russia's invasion of Ukraine. We provide the net directional connectivity in Figures no. 2 and no. 3 to categorize the transmitters and recipients of return and volatility over time. Based on Figures no. 2 and no. 3 several conclusions can be drawn. First, Industrial Goods and Services; Auto and Parts; Bank; Basic Resources; Construction and Material; Financial services; Industrial Goods and Services; Retail; Technology; Telecom; Travel and Leisure; Utilities are the net transmitters of the return over most of the study period. Contrary, Insurance and Services and Brent their role is the net receiver of return. Second, our result highlighted that Brent and Real Estate are the net receivers of volatility shocks. By contrast, Industrial Goods, and Services and Technology are the net transmitters during the Russian invasion of Ukraine.

**Table no. 2 – Average connectedness values for the returns**

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | FROM |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Auto and Parts** | 35.70 | 11.0 | 0.66 | 4.01 | 9.34 | 9.28 | 0.82 | 6.04 | 1.37 | 0.94 | 1.37 | 1.13 | | 5.97 | 1.31 | 1.28 | 1.26 | 1.08 | 1.61 | 64.30 |
| **Bank** | 13.3 | 23.88 | 0.65 | 3.78 | 12.34 | 13.69 | 0.89 | 9.09 | 0.98 | 0.82 | 0.95 | 0.93 | 1.13 | 6.51 | 0.85 | 1.03 | 1.01 | 0.92 | 0.92 | 76.12 |
| **Basic Resources** | 0.99 | 0.95 | 67.25 | 0.82 | 1.06 | 0.72 | 4.35 | 1.07 | 2.13 | 3.25 | 1.55 | 2.04 | 0.93 | 1.03 | 2.71 | 2.76 | 1.88 | 3.09 | 1.01 | 32.75 |
| **Chemicals** | 5.21 | 7.88 | 0.86 | 39.01 | 9.20 | 10.44 | 1.00 | 8.21 | 1.23 | 1.16 | 0.90 | 0.99 | 2.04 | 3.92 | 1.27 | 1.21 | 1.13 | 1.02 | 1.33 | 60.99 |
| **Construction and Material** | 11.1 | 11.92 | 0.60 | 5.11 | 17.74 | 16.14 | 0.68 | 11.18 | 1.01 | 0.90 | 0.89 | 0.85 | 0.99 | 8.14 | 0.95 | 0.94 | 1.03 | 0.89 | 0.97 | 82.26 |
| **Financial services** | 9.51 | 13.45 | 0.48 | 5.16 | 15.44 | 20.44 | 0.60 | 11.55 | 0.97 | 0.85 | 0.81 | 0.79 | 0.85 | 7.08 | 0.93 | 0.83 | 1.04 | 0.81 | 0.97 | 79.56 |
| **Food and Beverages** | 1.00 | 0.99 | 5.07 | 0.86 | 1.02 | 0.81 | 52.24 | 1.10 | 3.82 | 8.10 | 3.33 | 3.48 | 0.79 | 1.59 | 2.83 | 4.05 | 3.81 | 4.15 | 0.79 | 47.76 |
| **Health Care** | 4.67 | 11.23 | 0.79 | 4.44 | 12.58 | 15.23 | 0.98 | 24.56 | 1.24 | 1.18 | 0.97 | 0.88 | 3.48 | 8.45 | 1.24 | 0.99 | 1.19 | 1.16 | 1.50 | 75.44 |
| **Industrial Goods and Services** | 0.45 | 0.51 | 3.09 | 0.51 | 0.40 | 0.39 | 2.02 | 0.54 | 19.62 | 8.55 | 7.35 | 12.73 | 0.88 | 0.37 | 13.71 | 8.64 | 11.8 | 8.32 | 0.49 | 80.38 |
| **Media** | 0.41 | 0.47 | 2.68 | 0.46 | 0.32 | 0.32 | 2.33 | 0.42 | 15.69 | 10.80 | 8.73 | 12.86 | 12.73 | 0.38 | 11.76 | 10.75 | 11.0 | 9.70 | 0.44 | 89.20 |
| **Insurance** | 14.49 | 10.32 | 0.80 | 3.80 | 11.52 | 11.41 | 0.92 | 8.41 | 1.32 | 0.99 | 1.24 | 1.05 | 12.86 | 8.92 | 1.19 | 1.19 | 1.14 | 1.04 | 1.12 | 80.88 |
| **Oil and Gas** | 0.63 | 0.56 | 3.86 | 0.79 | 0.47 | 0.46 | 1.93 | 0.55 | 11.71 | 8.21 | 28.36 | 9.20 | 1.05 | 0.42 | 7.23 | 9.12 | 7.89 | 7.61 | 0.48 | 71.64 |
| **Retail** | 0.54 | 0.70 | 3.34 | 0.78 | 0.63 | 0.54 | 2.18 | 0.69 | 13.40 | 7.40 | 6.60 | 22.26 | 9.20 | 0.65 | 10.17 | 9.47 | 11.55 | 8.15 | 0.45 | 77.74 |
| **Real Estate** | 6.97 | 7.83 | 0.84 | 3.49 | 10.09 | 8.41 | 0.98 | 11.07 | 1.18 | 1.06 | 1.10 | 1.06 | 22.26 | 31.64 | 1.13 | 1.04 | 1.44 | 1.21 | 1.48 | 68.36 |
| **Technology** | 0.41 | 0.51 | 2.58 | 0.59 | 0.46 | 0.46 | 1.97 | 0.58 | 16.61 | 8.04 | 5.59 | 11.68 | 1.06 | 0.50 | 22.24 | 7.90 | 10.35 | 8.47 | 0.60 | 77.76 |
| **Telecom** | 0.69 | 0.57 | 2.22 | 0.67 | 0.38 | 0.41 | 2.57 | 0.45 | 10.47 | 8.31 | 7.80 | 10.98 | 11.68 | 0.35 | 8.03 | 24.78 | 9.04 | 11.28 | 0.63 | 75.22 |
| **Travel and Leisure** | 0.42 | 0.57 | 3.13 | 0.65 | 0.49 | 0.59 | 2.23 | 0.51 | 13.96 | 7.18 | 5.68 | 13.37 | 10.98 | 0.46 | 10.09 | 9.20 | 22.52 | 8.04 | 0.52 | 77.48 |
| **Utilities** | 0.74 | 0.56 | 3.06 | 0.69 | 0.39 | 0.45 | 2.46 | 0.41 | 10.36 | 8.09 | 6.70 | 9.38 | 13.37 | 0.47 | 8.73 | 12.48 | 8.50 | 25.28 | 0.63 | 74.72 |
| **Brent** | 3.79 | 2.57 | 1.72 | 2.08 | 2.62 | 3.02 | 0.96 | 2.62 | 1.82 | 1.55 | 1.41 | 1.75 | 9.38 | 2.78 | 1.66 | 1.46 | 2.13 | 1.50 | 61.67 | 38.33 |
| **TO** | 75.44 | 82.60 | 36.46 | 38.67 | 88.75 | 92.78 | 29.87 | 74.49 | 109.27 | 76.58 | 62.97 | 95.16 | 1.75 | 57.99 | 85.78 | 84.35 | 87.3 | 78.43 | 15.9 | 1330.9 |
| **NET** | 11.14 | 6.49 | 3.70 | -22.32 | 6.49 | 13.22 | -17.89 | -0.94 | 28.89 | -12.62 | -22.81 | -8.67 | 17.42 | -10.37 | 8.02 | 9.13 | 9.82 | 3.71 | -22.41 | cTCI/TCI= 73.94/70.05 |

**Table no. 3 – Average connectedness values for the volatilities**

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | FROM |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Auto and Parts** | 38.39 | 6.91 | 2.59 | 2.90 | 6.71 | 5.35 | 4.43 | 2.00 | 1.45 | 7.38 | 1.73 | 3.12 | 4.93 | 1.69 | 1.98 | 2.26 | 1.91 | 2.06 | 2.06 | 61.61 |
| **Bank** | 13.55 | 27.19 | 2.26 | 2.21 | 6.57 | 6.10 | 7.25 | 2.06 | 1.81 | 8.86 | 1.73 | 2.36 | 4.77 | 1.74 | 2.32 | 2.82 | 2.05 | 2.33 | 2.33 | 72.81 |
| **Basic Resources** | 2.69 | 2.28 | 57.16 | 2.64 | 1.66 | 1.68 | 1.64 | 2.21 | 2.22 | 2.48 | 2.53 | 2.90 | 1.73 | 2.27 | 2.74 | 2.12 | 4.07 | 1.66 | 1.66 | 42.84 |
| **Chemicals** | 2.99 | 3.23 | 1.97 | 52.60 | 3.64 | 3.27 | 2.99 | 2.30 | 2.35 | 2.77 | 1.93 | 1.76 | 2.95 | 2.17 | 2.79 | 2.33 | 2.49 | 2.09 | 2.09 | 47.40 |
| **Construction and Material** | 9.45 | 6.45 | 1.92 | 2.66 | 22.16 | 14.98 | 10.32 | 1.79 | 1.69 | 7.70 | 1.43 | 1.90 | 6.29 | 2.01 | 1.87 | 1.71 | 1.57 | 2.17 | 2.17 | 77.84 |
| **Financial services** | 7.76 | 6.51 | 1.84 | 3.08 | 17.83 | 25.43 | 8.17 | 1.81 | 1.85 | 6.48 | 1.65 | 1.90 | 5.14 | 1.90 | 1.84 | 1.66 | 1.52 | 2.01 | 2.01 | 74.57 |
| **Food and Beverages** | 2.15 | 2.58 | 3.82 | 2.91 | 1.56 | 1.71 | 1.46 | 3.19 | 3.79 | 3.22 | 2.28 | 3.20 | 1.12 | 2.80 | 2.78 | 3.21 | 2.86 | 1.60 | 1.60 | 46.24 |
| **Health Care** | 4.75 | 7.74 | 1.69 | 2.08 | 10.13 | 8.66 | 29.43 | 2.09 | 1.78 | 7.64 | 1.95 | 2.03 | 6.44 | 2.47 | 2.46 | 2.49 | 2.05 | 2.37 | 2.37 | 70.57 |
| **Industrial Goods and Services** | 1.17 | 1.09 | 2.05 | 1.11 | 0.58 | 0.58 | 1.46 | 25.96 | 7.00 | 0.80 | 6.05 | 11.51 | 1.18 | 16.09 | 7.70 | 5.48 | 7.47 | 0.93 | 0.93 | 74.04 |
| **Media** | 0.99 | 1.05 | 1.50 | 1.15 | 0.64 | 0.87 | 1.36 | 15.80 | 14.76 | 1.09 | 8.69 | 11.04 | 1.02 | 11.73 | 9.39 | 6.99 | 8.46 | 1.16 | 1.16 | 85.24 |
| **Insurance** | 13.36 | 7.55 | 2.59 | 1.93 | 8.17 | 6.63 | 8.43 | 2.22 | 1.80 | 23.05 | 2.29 | 2.63 | 6.62 | 2.06 | 2.20 | 1.86 | 1.81 | 2.09 | 2.09 | 76.95 |
| **Oil and Gas** | 1.46 | 0.91 | 2.55 | 2.29 | 1.17 | 1.59 | 1.76 | 7.29 | 6.87 | 1.18 | 36.73 | 5.93 | 1.88 | 4.78 | 6.85 | 6.32 | 7.02 | 1.61 | 1.61 | 63.27 |
| **Retail** | 1.47 | 1.18 | 2.94 | 1.79 | 0.94 | 0.84 | 1.21 | 11.87 | 5.03 | 1.21 | 4.87 | 29.85 | 0.96 | 9.06 | 9.10 | 6.99 | 7.11 | 1.01 | 1.01 | 70.15 |
| **Real Estate** | 4.82 | 5.34 | 2.26 | 2.04 | 8.26 | 5.61 | 10.02 | 2.07 | 2.11 | 6.98 | 2.19 | 1.84 | 33.97 | 2.15 | 2.30 | 2.15 | 1.99 | 2.24 | 2.24 | 66.03 |
| **Technology** | 1.22 | 1.26 | 2.40 | 1.30 | 0.75 | 0.59 | 1.66 | 18.34 | 6.16 | 1.07 | 4.23 | 10.10 | 1.09 | 28.28 | 6.37 | 4.60 | 7.67 | 0.88 | 0.88 | 71.72 |
| **Telecom** | 1.89 | 1.55 | 2.93 | 1.56 | 0.91 | 0.84 | 1.28 | 7.86 | 5.63 | 1.72 | 8.16 | 8.21 | 1.25 | 6.45 | 33.01 | 5.09 | 8.43 | 0.99 | 0.99 | 66.99 |
| **Travel and Leisure** | 1.59 | 2.01 | 1.88 | 1.71 | 0.87 | 1.37 | 1.44 | 7.28 | 5.28 | 1.51 | 5.40 | 9.07 | 1.34 | 6.44 | 7.12 | 36.63 | 5.06 | 1.62 | 1.62 | 63.37 |
| **Utilities** | 1.31 | 1.24 | 3.28 | 1.55 | 0.70 | 1.09 | 2.32 | 8.63 | 6.94 | 1.19 | 4.73 | 8.65 | 1.25 | 8.60 | 8.70 | 4.25 | 31.93 | 1.14 | 1.14 | 68.07 |
| **Brent** | 2.86 | 2.91 | 2.60 | 2.64 | 3.44 | 2.95 | 2.83 | 2.46 | 2.01 | 3.62 | 1.87 | 2.81 | 2.81 | 2.44 | 2.07 | 2.56 | 2.46 | 52.59 | 52.59 | 47.41 |
| **TO** | 75.47 | 61.78 | 43.06 | 37.55 | 74.54 | 64.70 | 40.32 | 70.02 | 101.26 | 65.78 | 66.89 | 63.69 | 90.97 | 52.79 | 86.84 | 80.59 | 64.89 | 76.01 | 29.98 | 1247.12 |
| **NET** | 13.86 | -11.03 | 0.23 | -9.86 | -3.30 | -9.87 | -5.92 | -0.55 | 27.22 | -19.46 | -10.06 | 0.42 | 20.82 | -13.24 | 15.13 | 13.60 | 1.51 | 7.94 | -17.44 | cTCI/TCI= 69.28/65.6 |

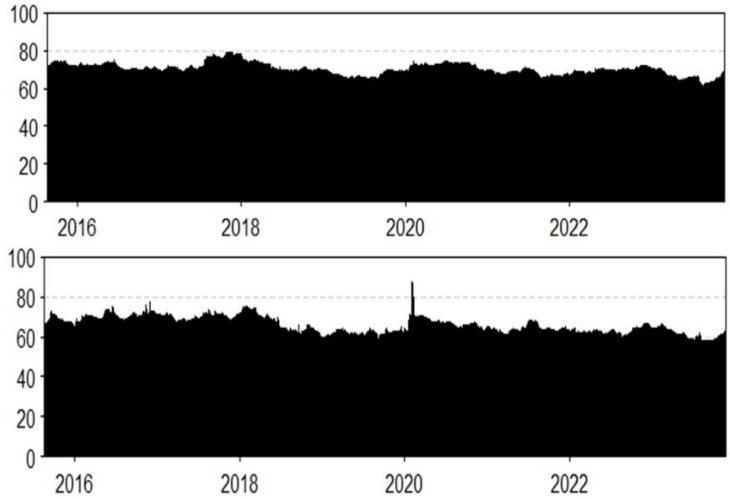
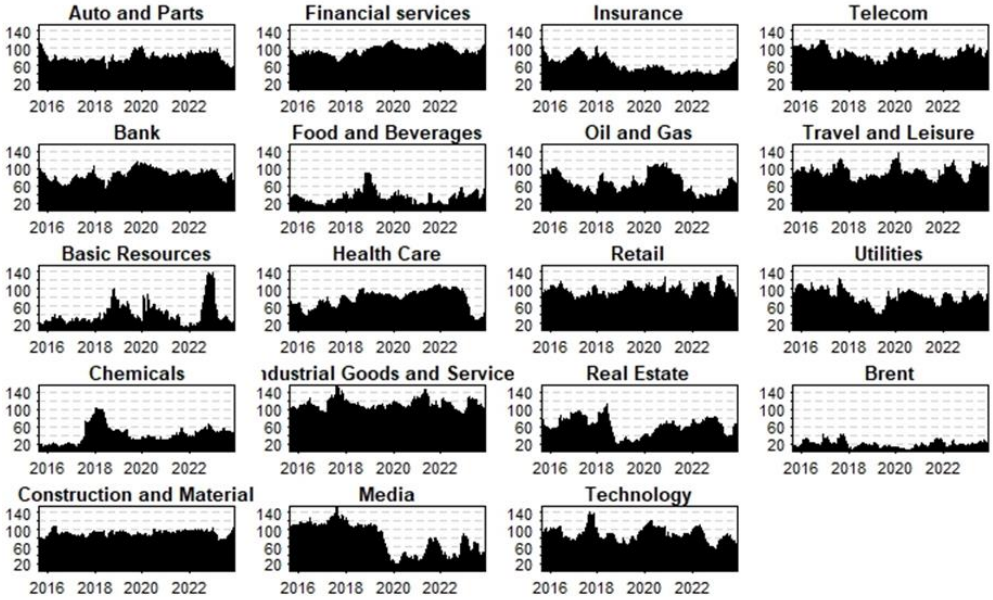
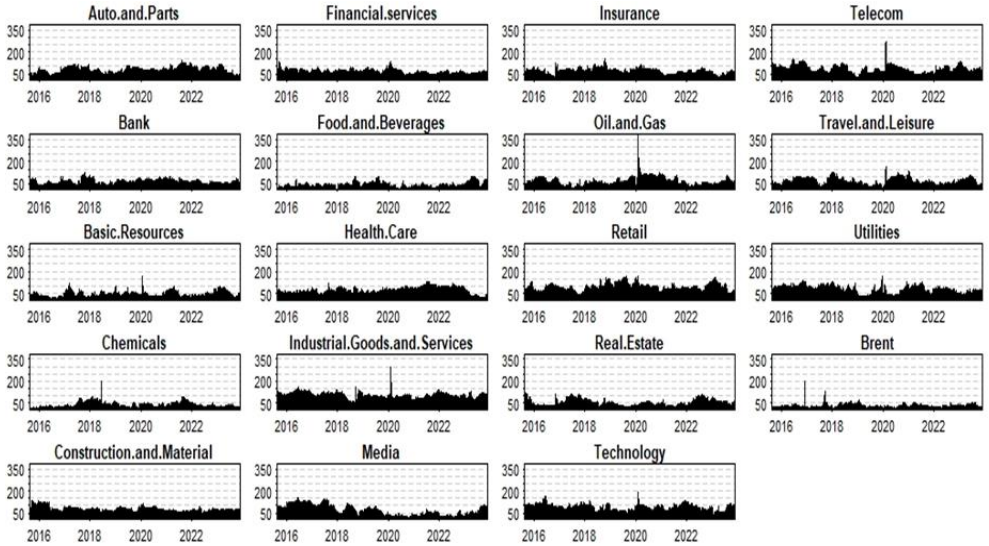



**Figure no. 1 – TCIs of the returns and volatilities: This shows the total connectedness indices of the returns and volatilities of the 18 super sectors and oil**




Notes: This graph displays the net connectedness of oïl prices and the 18 Eurozone supersector. A positive value indicates a net transmitter, whereas a negative value indicates a net receiver.

**Figure no. 2 – Total net time-varying connectedness for the returns**




Notes: This graph displays the net connectedness of oil prices and the 18 Eurozone supersector. A positive value indicates a net transmitter, whereas a negative value indicates a net receiver

**Figure no. 3 – Total net time-varying connectedness for the volatilities**

## 6. CONCLUSION

This research investigates returns and volatility dynamics, interlinkages, and conditional correlation between Brent Oil prices and the Eurozone supersector returns during the global financial crisis. It analyzes the effects of the Oil crash, COVID-19, and Ukraine-Russian crises on volatility transmissions. We employ the TVP-VAR frequency connectedness approach with daily data of Brent prices and 18 Eurozone supersector indices from 15 November 2014 to 24 November 2023. This approach allows for analyzing various risk transmission mechanisms and hedging characteristics across different asset markets at various time horizons and periods, hence providing investors with time-varying connectedness to better manage their portfolios. Our results show a high average connectedness of the returns and volatilities. Industrial Goods and services is the largest transmitter contrariwise Media supersector is the largest receiver of returns shocks. By contrast, Brent propagates the lowest shocks to the returns of the other indices. Brent; Insurance; Chemicals; Food and Beverages; Media; Oil and Gas, Real Estate, and Health Care are the net receivers of shocks; whereas the remaining return series are the net transmitters. As per the volatilities, Industrial Goods and Services receive the highest volatility shocks. The Retail transmits the second-largest volatility shock. Industrial Goods and Services; Auto and Parts; Technology; Telecom; Utilities; Travel and Leisure; Oil and Gas; Basic Resources and Insurance are the net transmitters of volatility shocks; while the rest are the net receivers of shocks. Furthermore, the time-varying connectedness (TCI) of returns and volatilities indices show there was a drastic increase in TACI in March 2020 when the COVID-19 epidemic spread drastically around the world. The result confirms that the COVID crisis mainly affected the relationship, between Brent Oil prices and the Eurozone supersector, of returns and volatilities. Meanwhile, there has been no change in connectivity patterns due to the Russo-Ukrainian War.

The originality of our analysis is due to the rigor of the results because they allow us to understand the financial impacts of the ongoing conflict so that investors, portfolio managers and policymakers can design effective financial strategies.

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