



## CRYPTOCURRENCIES AND G7 CAPITAL MARKETS INTEGRATE IN PERIODS OF EXTREME VOLATILITY?

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**Abstract:** *The purpose of this study is to examine the synchronism between the US capital markets (DJ, S&P 500), the United Kingdom (FTSE 100), Canada (S&P/TSX), Germany (DAX 30), France (CAC 40), Japan (Nikkei 225), Italy (Italy Ds Market and major cryptocurrencies such as Bitcoin (BTC), Litecoin (LTC), Ethereum (ETH), and the Crypto 10 index, from February 2018 to November 2021. Based on the findings, we found that BTC and ETH cryptocurrencies drastically reduced their level of integration with their peers over the 2020 worldwide pandemic era, whereas LTC maintained. We also discovered that the Dow Jones, S&P 500, and DAX 30 stock indexes lowered their level of integration when compared to the pre-covid subperiod. For the UK capital market (FTSE 100), Canada (S&P/TSX), Japan (Nikkei 225), France (CAC 40), and Italy (Italy Ds Market) the level of integration increased significantly. These findings support, in part, our research question, that during periods of stress and uncertainty in the global economy capital markets tend towards integration, thus calling into question the hypothesis of efficient portfolio diversification.*

**Keywords:** *Covid-19, cryptocurrencies, G7 financial markets, financial integration, portfolio diversification*

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## **1. Introduction**

BTC was introduced in 2008 as a "peer-to-peer electronic cash system," or decentralized electronic money system. This cryptocurrency has effectively been a revolutionary phenomenon for financial markets since 2016, as it has been particularly appealing to investors and a growing target of attention by international participants and authorities, and it is already acknowledged as an investment asset. The development of its quote, which increased by more than 1358 percent in 2017, reflected this exponential interest (Dyhrberg, 2016; Wang et al., 2016, Baur et al., 2018; Corbet et al., 2018; Berentsen and Schar, 2018; Bourri et al., 2018).

LTC was developed in 2011 and is based on a modified BTC paradigm, with the objective of developing more reliable and efficient digital currency. This currency has also gained prominence after 2017 when its value increased by almost 7291 percent (Jana et al., 2019). ETH, on the other hand, was founded in 2015 and, like BTC, had significant growth in its early years, with its share price peaking on January 13<sup>th</sup>, 2018, settling at \$1,432.88. At the moment, this cryptocurrency is the second digital currency reference in the market (Jana et al., 2019; Meshcheryakov & Ivanov, 2020).

The Crypto 10 index was first introduced in 2018 and represents the top ten leading digital currencies in the market, including BTC (26,458%), ETH (23,607%), Polkadot (15,130%), Binance Coin (11,050%), ChainLink (6,695%), LTC (6,627%), Bitcoin Cash (6,141%), EOS (2,183%) and Bitcoin SV (2,111%). This index was chosen for research because it is widely acknowledged as a reference for the cryptocurrency market, and its examination would allow the volatility and sentiment of the overall cryptocurrency market to be examined.

This research aims to analyze financial integration in the US capital markets (DJ, S&P 500), UK (FTSE 100), Canada (S&P/TSX), Germany (DAX 30), France (CAC 40), Japan (Nikkei 225), and Italy (Italy Ds Market), and cryptocurrencies (BTC LTC, ETH, and crypto index 10) during the pandemic outbreak (Covid-19). The majority of the results show that capital markets increased the level of integration in the 2020 pandemic sub-period, while digital currencies tended towards segmentation.

This investigation presents the following structure. In addition to the current introduction, in section 2 we can find the literature review on investigations that examined the phenomenon of integration into international financial markets. Section 3 contains the data and methodology, while in section 4 the results are presented. Section 5 presents the main findings of the research

## **2. Literature review**

The terms co-movement and financial market integration, despite both relate to synchronization between two or more financial markets, the literature presents them as distinct concepts (Gaio et al., 2014).

In a simplified way, the term co-movement means "moving with" or "joint or shared movement" in the same direction. When there is commotion one can say that there is correlation between the time series. Time series if they are negatively correlated, it means that both are moving in opposite directions, and conversely, a positive correlation will mean that the variables are moving in the same direction over time (Bhattacharyya, 2019; Kotu & Deshpande, 2019). Existing empirical studies on market integration generally tend to show that high co-movement may translate into a high degree of integration. However, although this theory would be commonly accepted it should be interpreted with some caution, as markets may be correlated and yet not be integrated as well as the opposite.

Conceptually, markets are said to be financially integrated when assets of similar risk are associated with similar returns, and these assets are from different markets. Empirically, the term integration can be defined as the situation in which individual series that are nonstationary when linearly combined become stationary. In this sense, to assess the degree of integration between two markets, it is currently customary to estimate the differences between the averages of the series prices and assess whether this difference remains constant, i.e., whether it deviates in opposite directions in a long-term perspective, because if financial markets tend toward integration, prices will eventually return to a balanced situation (Bhattacharyya, 2019).

The recent financial crises have had a considerable influence on international financial markets; research has shown that when capital markets are uncertain, the phenomenon of integration tends to increase, calling the implementation of an efficient portfolio diversification strategy into doubt (Pardal et al., 2021; Horta et al., 2022).

Corbet et al. (2018) examined the relationships between three cryptocurrencies and a variety of other financial assets, the authors show relative isolation of digital currencies from financial and economic assets, showing that cryptocurrencies can offer diversification benefits to investors with short investment horizons. In addition, Pavković et al. (2019) analyzed the diversification properties of cryptocurrencies for European traders. The authors' show that Bitcoin and Ripple have shown to be viable diversification options, particularly in the European markets studied, where dynamic correlation coefficients are negative.

Liu (2019) investigated the impact of diversification in the cryptocurrency market and concluded that including cryptocurrencies in investment portfolios may greatly boost investing performance.

Kantaphayao & Sukcharoensin (2021) investigated the long-term relationships and volatility between cryptocurrencies and other financial assets. Although the authors suggest the existence of long-term relationships between cryptocurrencies, stocks, bonds, and commodities, evidence suggests that the level of integration verified does not cause significant movements. Finally, the authors show how, due to their tenuous linkages with traditional financial assets, cryptocurrencies might be advantageous for portfolio diversification.

Letho et al. (2022) evaluated portfolio diversification through the examination of traditional assets (stocks, bonds, currencies), alternative assets (commodities, real estate), and cryptocurrencies, from August 2015 to October 2018. The authors show that portfolio diversification using cryptocurrencies is achievable, as well as that cryptocurrencies offer safe haven asset characteristics. Furthermore, Huang et al. (2022) investigated the diversification advantages of nine cryptocurrencies and discovered that six of them offer considerable diversification benefits, suggesting that the lower the investor risk aversion, the more beneficial cryptocurrencies are as portfolio diversifiers. During uncertain economic environments, such as the Covid-19 pandemic period, cryptocurrencies provide the same diversification benefits as in more stable environments.

The authors, Jiang et al. (2022) analyzed the synchronizations between cryptocurrencies and conventional assets from a market risk perspective, demonstrating the existence of risk spillovers, which contradicts the majority of the research that verifies Bitcoin's separation from traditional assets. In addition, this article finds two significant network factors to explain the return of cryptocurrencies. Specifically, risk contagion occurs in extreme market conditions, while network diversification occurs only when the market is in difficulty.

### **3. Methodology**

#### **3.1. Data**

The risk diversification assessment will be based on daily prices for US capital markets (DJ, S&P 500), the United Kingdom (FTSE 100), Canada (S&P/TSX), Germany (DAX 30), France (CAC 40), Japan (Nikkei 225), Italy (Italy Ds Market), as well as Bitcoin (BTC), Litecoin (LTC), Ethereum (ETH), and the Crypto 10 index. The quotes span the time period from February 2018 to November 2021, and the sample was divided into two subperiods: the pre-pandemic period, which runs from February 2018 to December 2019, and the worldwide pandemic period, which runs from January 2020 to November 2021.

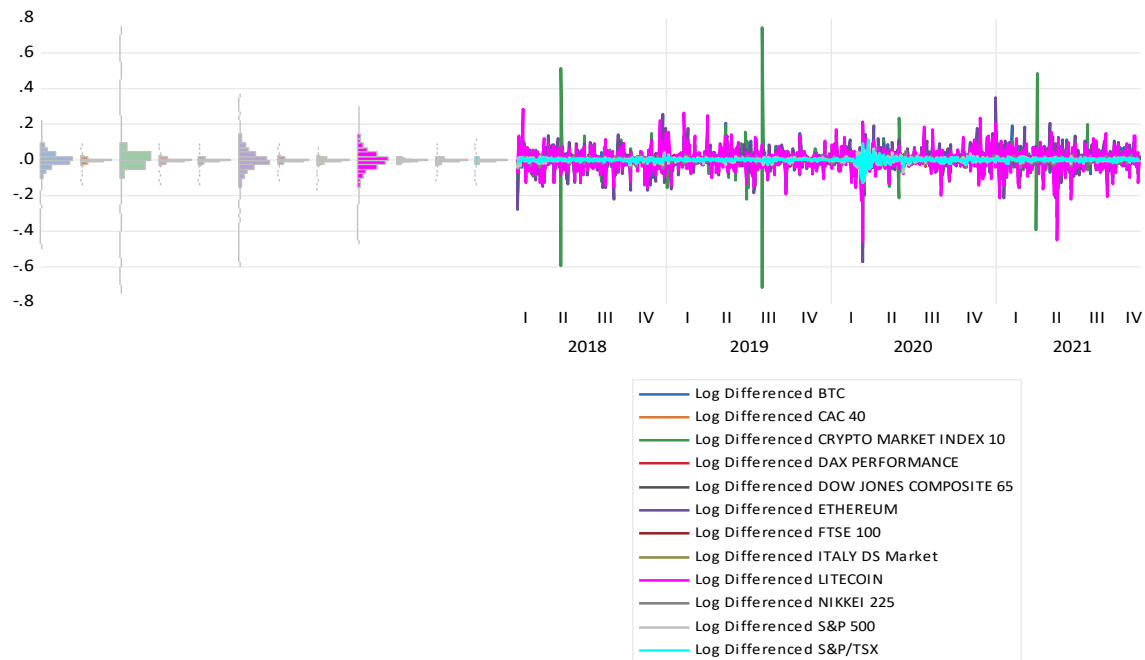
The data was gathered from the Thomson Reuters (DataStream) platform and for the purpose of mitigating currency distortions we chose to leave the time series in local currency, while cryptocurrencies were in US dollars.

#### **3.2. Methodology**

The methodology used in this investigation is structured as follows: in a first phase we performed descriptive statistics (mean, standard deviation, asymmetry and kurtosis). To validate the distributions of the time series, the Jarque & Bera test (1980) was applied. To answer the research question, we used a Gregory and Hansen model (1996), considering regime changes. This technique is robust for studying complicated and tumultuous times in financial markets since the authors expand traditional cointegration tests when the cointegration vector changes at an unknown date. For a better understanding, see Dias et al. (2019), Pardal et al (2021).

### **4. Results**

Figure 1 shows the evolution in, returns, of the US capital markets (DJ, S&P 500), the United Kingdom (FTSE 100), Canada (S&P/TSX), Germany (DAX 30), France (CAC 40), Japan (Nikkei 225), and Italy (Italy Ds Market), and BTC, LTC, ETH and the Crypto 10 index, from February 2018 to November 2021. The time series exhibit comparable synchronization and dispersion around the average, however when we compare capital markets to cryptocurrencies, we discover that cryptocurrencies have more volatility.



**Figure 1.** Evolution of the returns, of the financial market under analysis, in the sample period

Source: Own elaboration

Table 1 shows descriptive statistics for BTC, LTC, ETH and crypto 10 index. We can see that the average daily returns are positive, BTC has the highest average daily rate of return (0.001921), while LTC has the lowest average daily return (0.000494). The Crypto 10 index has the sharpest standard deviation (6.6383%), while BTC has the lowest standard deviation (4.7959%). In terms of skewness, we discovered that all digital currencies have negative values, with BTC being the most asymmetric digital currency (-1.228043). In relation to the kurtosis, we notice that the time series under study have values higher than 3, namely the Crypto 10 index (46.44371), BTC (16.25200), ETH (12.72397), LTC (10.07312). These results are validated by the Jarque and Bera test (1980) which rejected the null hypothesis with a significance level of 1%.

**Table 1.** Descriptive statistics, regarding the cryptocurrencies under analysis, for the period from 1<sup>st</sup> February 2018 to 18<sup>th</sup> November 2021.

	Mean	Std. Dev.	Skewness	Kurtosis	Jarque-Bera	Obs.
BTC	0.001921	0.047959	-1.228043	16.25200	7500.545***	991
CRYPTO 10	0.001545	0.066383	-0.128788	46.44371	77934.83***	991
ETH	0.001450	0.063070	-0.855004	12.72397	4025.103***	991
LTC	0.000494	0.063079	-0.623852	10.07312	2130.062***	991

Source: Own elaboration

Note: The asterisks \*\*\* represent the rejection of the null hypothesis at a significance level of 1%

Table 2 shows descriptive statistics of the US capital markets (DJ, S&P 500), UK (FTSE 100), Canada (S&P/TSX), Germany (DAX 30), France (CAC 40), Japan (Nikkei 225), and Italy (Italy Ds Market). All the capital markets show positive average daily returns, with the exception of the

UK market (FTSE 100). In addition, we can infer that the DJ index has the sharpest standard deviation (0.013685).

In terms of asymmetries, we discovered that all of the stock indexes under consideration have negative values, with a particular emphasis on the Italian stock index (-3.047814). When we examined the kurtosis, we saw that it is greater than 3, and the Canadian market (S&P/TSX) has a more significant value (47.89022). As a result of these observations, the time series do not exhibit normal distributions, as evidenced by the Jarque & Bera test (1980).

To summarize, we may conclude that G7 capital markets are less volatile than the cryptocurrencies under consideration.

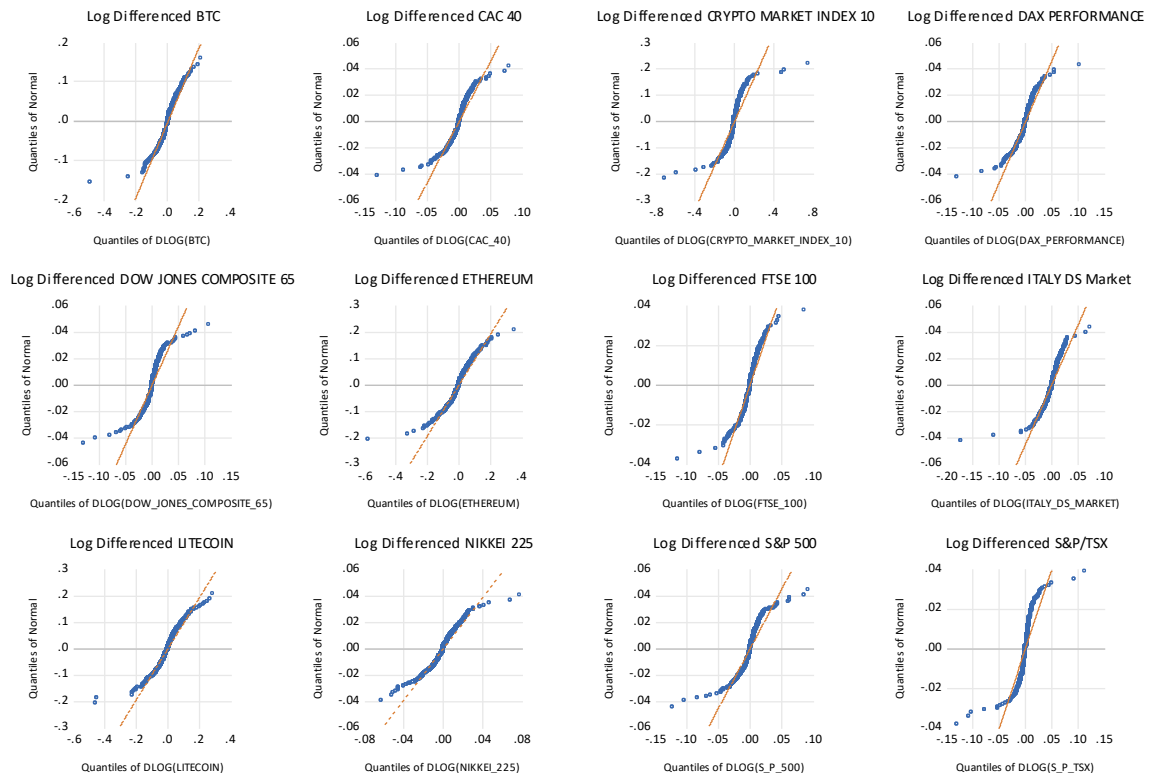
**Table 2.** Descriptive statistics for the stock market under analysis for the period from 1<sup>st</sup> February 2018 to 18<sup>th</sup> November 2021

	Mean	Std. Dev.	Skewness	Kurtosis	Jarque-Bera	Obs.
CAC40	0.000274	0.012696	-1.425271	20.98341	13689.38***	991
DAX 30	0.000225	0.013066	-1.016863	20.09637	12239.76***	991
DJ	0.000343	0.013685	-0.995243	24.44722	19157.07***	991
FTSE100	-2.72E-05	0.011475	-1.231606	19.99246	12173.24***	991
ITALY	0.000141	0.013112	-3.047814	41.32004	62168.00***	991
NIKKEI 225	0.000233	0.012148	-0.162946	8.059633	1061.447***	991
S&P500	0.000257	0.013513	-1.067602	21.21429	13887.19***	991
S&P/TSX	0.000314	0.011704	-2.109583	47.89022	83943.19***	991

Source: Own elaboration

*Note: The asterisks \*\*\* represent the rejection of the null hypothesis at a significance level of 1%*

Figure 2 illustrates the quantile graphics of the G7 capital markets and cryptocurrencies, and we can see that the data distribution does not coincide with the line of the normal distribution, indicating that we are dealing with data asymmetry, as previously demonstrated.



**Figure 2.** Quantile graphics, in returns, of the 12 financial markets under analysis for the period from 1<sup>st</sup> February 2018 to 18<sup>th</sup> November 2021

Source: Own elaboration

*Note: Data worked by the author (software: Eviews12)*

Table 3 illustrates the results of the integration test between the US (DJ, S&P 500), the United Kingdom (FTSE 100), Canada (S&P/TSX), Germany (DAX 30), France (CAC 40), Japan (Nikkei 225), and Italy (Italy Ds Market) capital markets, as well the cryptocurrencies, namely BTC, LTC, ETH, and the Crypto 10 index, before and during the 2020 global crisis.

In the pre-covid period, we found that the most integrated capital markets are DJ (11 out of 11 possible) and S&P 500 (6 integrations out of 11 possible). BTC and LTC integrated with 9 and 8 markets, respectively. The Crypto 10 index is integrated with all digital currencies, and with 6 capital markets. The German (DAX 30), Japanese (Nikkei 225), and Italian (Italy Ds Market) stock indexes have 4 integrations (out of 11 possible). The capital markets (UK, Canada, France) and the cryptocurrency LTC have 2 integrations, thus showing some isolation, which shows that investors will be able to implement strategies to diversify their portfolios.

Capital markets increased the amount of integrations among themselves during the 2020 worldwide pandemic era (Covid-19), with the S&P 100 showing 7 integrations and the S&P 500, Nikkei 225, and Italy DS market indexes showing 5 integrations (out of 11 possible). Moreover, the (DJ), S&P/TSX, and CAC 40 all have four integrations throughout this time period, while the DAX 30 has three (out of 11 possible). When we examined the cryptocurrency market, we discovered that the digital currencies BTC and ETH dramatically reduced the amount of integrations throughout the crisis era. Furthermore, BTC, LTC, and the Crypto 10 index remained connected with other digital currencies, but they were separated from the G7 stock markets. The same thing happened with the ETH, which appears to have been separated from the rest stock indexes following the shock, with the exception of the S&P 500.

These findings are not confirmed by the authors Dias et al. (2021), Pardal et al. (2021) which show that international financial markets tend towards integration in the period marked by the global pandemic of 2020.

**Table 3.** Summary of the results obtained in the Gregory-Hansen tests for the financial markets under analysis, in the Pre-Covid and Covid period

	<b>Pre-Covid 19</b>	<b>Covid-19</b>	<b>Evolution</b>
BITCOIN	9/11 possible	2/11 possible	↓
ETHEREUM	8/11 possible	4/11 possible	↓
LITECOIN	2/11 possible	2/11 possible	=
CRYPTO 10	9/11 possible	3/11 possible	↓
DOW JONES	11/11 possible	4/11 possible	↓
FTSE 100	2/11 possible	7/11 possible	↑
DAX 30	4/11 possible	3/11 possible	↓
S&P 500	6/11 possible	5/11 possible	↓
S&P/ TSX	2/11 possible	4/11 possible	↑
NIKKEI 225	4/11 possible	5/11 possible	↑
CAC 40	2/11 possible	4/11 possible	↑
ITALY DS MARKET	4/11 possible	5/11 possible	↑

Source: Own elaboration

## **Conclusion**

The purpose of this article was to examine the synchronizations between the US capital markets (DJ, S&P 500), the United Kingdom (FTSE 100), Canada (S&P/TSX), Germany (DAX 30), France (CAC 40), Japan (Nikkei 225), and Italy (Italy Ds Market), and BTC, LTC, ETH, and the Crypto 10 index from February 2018 to November 2021. When compared to the prior subperiod (pre-covid), BTC and ETC dramatically dropped their level of integration with their peers, while LTC maintained.

Furthermore, in terms of integration, the North American (DJ, S&P 500) and German (DAX 30) stock markets dropped when compared to the pre-covid sub-period. We discovered that the level of integration has increased when we analyzed the FTSE 100, S&P/TSX, Nikkei 225, CAC 40, and Italy Ds Market stock indexes.

Finally, the authors present substantial data to regulators, supervisors, investors, and hedger managers interested in investing in these markets by developing strategies and



diversifying their portfolios based on different frequencies. These results have important implications for the role of cryptocurrencies as investment assets.

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