International Journal of Economics and Financial Issues

ISSN: 2146-4138

available at http: www.econjournals.com

International Journal of Economics and Financial Issues, 2020, 10(6), 163-171.

Effects of COVID-19 Pandemic on International Capital Markets

Paulo Vitor Souza de Souza[1]*, César Augusto Tibúrcio Silva[2]

[1]Institute of Applied Social Sciences, Federal University of Pará, Belém, Pará, Brazil, [2]Department of Accounting and Actuarial Sciences, University of Brasilia, University Campus Darcy Ribeiro - FACE, Brasília, Federal District, Brazil.
*Email: paulovsouza@ufpa.br

Received: 01 September 2020 **Accepted:** 05 November 2020 **DOI:** https://doi.org/10.32479/ijefi.10702

ABSTRACT

In this paper, we analyzed the effects of the crisis generated by the COVID-19 pandemic on international capital markets. We used the most representative indexes belonging to the stock markets of 44 world economies in daily time series with data from 01/02/2019 to 05/15/2020. Correlation analysis and average price tests, graphical analysis of returns, and multiple linear regression analysis of index efficiency were made, together with the cultural dimensions and macroeconomic aspects of the markets. The findings provide evidence that in the periods after the pandemic, the markets became more correlated by increasing the correlation levels of their indexes. We found a significant difference in the correlation coefficients of the periods before and after the pandemic, indicating a change in behavior of the correlation indexes. Markets presented a reduction in their returns and an increase in their volatility after the pandemic. The pandemic affected the efficiency behavior of the market indexes. In the pre-pandemic period reduced the market's efficiency by individualism and aversion to uncertainty and increased inflation. In the post-pandemic period, efficiency was increased by individualism and reduced by indulgence. These results provide evidence that the behavior of efficiency changed, indicating an adaptive behavior of international capital markets.

Keywords: Economic Crisis, Uncertainty, Pandemic, Adaptive Markets.
JEL Classifications: G14, G15, G41

1. INTRODUCTION

The COVID-19 pandemic created a major uncertainty shock – even more significant than the one created by the 2008-09 financial crisis – and this increase in uncertainty may be associated, among others, with measures that result in restrictions on economic activities (Baker et al., 2020). Turbulent periods in the markets have significant implications for the behavior of agents (Brogaard and Detzel, 2015). Studies show that periods of high uncertainty compromise economic performance, affecting stock markets (Arbatli et al., 2017), result in reduced returns (Baker et al., 2012) and increased volatility (Arouri et al., 2016).

The efficiency of the bonds follows the changes that have occurred in the economic environment, performing periodically according to market conditions (Noda, 2016). Thus, as environments of uncertainty represent changes in market conditions, it is corroborated by the idea that markets adapt to these environments (Lo, 2004) since efficiency in capital markets is not constant (Urquhart and Hudson, 2013).

Therefore, the adaptability of the markets is seen as an evolution of market efficiency, considering the limited rationality of economic agents about information available in the markets (Dourado and Tabak, 2014). Thus, market efficiency presents variation through changes in market conditions (Ghazani and Araghi, 2014), which in this research is represented by the pandemic itself, which represents a significant change in the economic environment of several countries.

As explained, environments of uncertainty tend to generate impacts on securities traded in capital markets. Therefore, we aim to verify

This Journal is licensed under a Creative Commons Attribution 4.0 International License

the effects of the COVID-19 pandemic on the indices representing international capital markets.

The principal motivation from this study was an unexpected scenario resulting from a pandemic. Therefore, we noted that capital markets had been significantly affected, and analyzing how the pandemic has affected the efficiency of these markets becomes relevant for several economic agents. Thus, understanding how prices, returns, and the efficiency of securities reacted to this crisis aims to contribute to the literature on corporate finance.

2. MATERIALS AND METHODS

2.1. Sampling and Data Collection

The most representative indexes of 44 countries worldwide were selected. We selected this quantitative that comprises the sample because of the six Cultural Dimensions of Hofstede (DCH) as additional variables of analysis, which provide complete data only for this number of countries.

We obtained the information regarding the daily prices of the indexes from the platform called *Stooq* (https://stooq.com/), which provides daily data about the stock market indexes. Therefore, Table 1 provides a list of the countries used with their respective indexes analyzed in this paper.

For each of the countries above, we collected data from the index prices, comprising daily information from 01/02/2019 to 05/15/2020. We highlight that the final date for the collected data comprises the last day with the information made available by the markets at the time of this paper. We analyzed information referring to 358 daily observations about the representative indexes of each one of the 44 markets. Note there were countries' particularities (holidays, for example), observations are missing due to the non-functioning of these markets on a given date.

2.2. Price and Return Analysis of Securities

Before proceeding to an inferential analysis employing regression models, we analyzed the data in a time series descriptively. We analyzed the prices of each market and their behavior since the period before the crisis generated by COVID-19.

Hence, the moment when the markets reacted to the crisis was verified and analyzed of the ten largest markets for the amounts of gross domestic product (GDP). For this purpose, we verified the daily relative variation of each of the market indicators to identify which period of most significant negative variation in prices, which we consider the period in which the markets were most affected by the COVID-19 crisis. Table 2 provides numerical results about the date and the value of the most significant negative relative variation in the countries' indexes.

We observed that among the ten largest economies, six showed the most significant drop in the price of their market indices on the same date, i.e., Germany, United Kingdom, France, Italy, Brazil, and Canada showed a substantial drop in the price of their market indices with an average of 12.99% on March 12th, 2020. The United States and India presented the second-largest drop in the price of their indexes on 03/12/2020, thus providing evidence of the event that substantially affected the representative indexes of the markets on this date.

Table 1: Countries and indexes used in the study

Countries and indexes	
Australia (Aor)	Lithuania (Omx Vilnus)
Belgium (Bel20)	Malasia (Kuala Lumpur)
Brazil (Ibov)	Mexico (Ipc)
Bulgaria (Sofix)	New Zealand (Nzx50)
Canada (Tsx)	Norway (Ose All Share Index)
Chile (Ipsa)	Pakistan (Kse100)
China (Sci)	Philippines (Psei)
Estonia (Omx Tallinn)	Portugal (Psi)
Finland (Omx Helsinki)	Czech Republic (Px)
France (Cac40)	Romania (Bet)
Germany (Dax30)	Russia (Rts)
Gra-Bretagne (Ftse250)	Singapore (Sti)
Greece (Athex)	Slovakia (Sax)
Holland (Aex)	South Korea (Kospi30)
Hong-Kong (Hsi)	Spain (Ibex)
Hungary (Bux)	Suecia (Omx Stockholm)
Iceland (Omx Iceland)	Switzerland (Smi)
India (Sensex30)	Taiwan (Taiex)
Indonesia (Jci)	Thailand (Set)
Italy (Ftse)	Turkey (Xu100)
Japan (Nikkei225)	Argentina (Merval)
Latvia (Omx Riga)	United States (Djia)

Table 2: Periods of most significant impact on security prices by COVID-19

Country	Index	Date	Variation
United States	DJIA	03/16/2020	–0.1293
China	Shanghai Comp. Index	03/08/2020	–0.0440
Japan	NIKKEI225	03/13/2020	–0.0608
Germany	DAX30	**03/12/2020**	–0.1224
United Kingdom	FTSE250	**03/12/2020**	–0.0935
France	CAC40	**03/12/2020**	–0.1228
India	SENSEX30	03/23/2020	–0.1315
Italy	FTSE MIB Index	**03/12/2020**	–0.1692
Brazil	IBOV	**03/12/2020**	–0.1478
Canada	TSX Comp. Index	**03/12/2020**	–0.1234

This reflex in the international capital markets converges with the World Health Organization (WHO) announces of the COVID-19 outbreak. We understand that the markets, at the international level, suffered significant impacts on the price of their securities after the WHO announcement. We consider the period with the most significant (negative) variation in the indexes as how the markets perceived the crisis. Thus, on 03/12/2020, the sample was segregated into before and after the crisis generated by the COVID-19 outbreak.

We divided the sample into two sub-samples, before and after March, 12th 2020, to verify if the prices of titles started to present a correlation between themselves after the crisis, as H1 of this research points out. Thus, for the 44 markets, it will be made a linear correlation analysis.

The analysis of correlations of these securities in the two respective periods, we have made graphical analyses of the logarithmic

returns of the time series to verify if the countries present the same trends in their returns according to the impacts of the crisis generated by COVID-19. Above the values obtained for the daily returns of the 44 countries' securities, we analyzed whether the present series aspects denote similarities in the effects of the crisis resulting from COVID-19 in these international markets.

2.3. Calculation of the Efficiency of Securities

After a descriptive analysis of prices and securities returns, we have run inferential analyses on the effects of COVID-19 on the efficiency levels of the international markets. We adopted Hurst Exponent (HE) to obtain the respective values referring to the degree of efficiency observed by a given market in periods before and after COVID-19.

The HE aims to provide information on the existence of long-term correlations in a time series, thus representing that series that present long-term dependence has a certain degree of relative inefficiency in their titles (Couillard and Davison, 2005; Santos, 2018). The exponent obtained by calculating the Rescale Range (R/S) through the ratio between the range of the series (R) and the standard deviation of the series (S). Thus, we obtained the Hurst Exponent (EH) through the following equation:

$$HE = \frac{\log(R/S)}{\log(N)} \quad (1)$$

Where:
HE = Hurst Exponent; log = natural logarithm; *R* = difference between the maximum and minimum cumulative deviation of the series; *S* = standard deviation of the series; *N* = number of observations.

The HE in this paper varies between -0.5 and 0.5 and values below zero represent negative long-term dependence and values above zero represent evidence of long-term memory, i.e., we assume that the closer the HE is to zero, the more efficient this market is in this period (Santos, 2018). Thus, in this paper, the HE will be modulated to identify whether the values are closer or farther from zero.

2.4. Variables and Regression Models Used

Obtaining values referring to prices of the constant indexes in the research sample, we will make distinct clippings for the calculation of HE to identify the cultural and macroeconomic aspects that are associated with the levels of efficiency in periods before and after the pandemic. For such analysis, we will use the multiple linear regression method to verify if the announcement of the COVID-19 pandemic significantly affected the relationship of culture and macroeconomic aspects with its efficiency.

For this, we will use three models through regression analysis. These models have as dependent variable the market efficiency obtained through the modulated, HE but calculated in three different ways. In the models, we will use as independent variables the cultural dimensions of Hofstede (1980), Inflation, and gross domestic product (GDP). The variables used in this research are presented in Table 3, as follows.

According to the information presented in Table 3, the equations referring to the three models used in this study are as follows:

$$|HE2019|_i = \alpha_0 + \beta_1 PD_i + \beta_2 IND_i + \beta_3 MSC_i + \beta_4 AVU_i + \beta_5 LTRO_i + \beta_6 IDG_i + \beta_7 INF_i + \beta_8 GDP_i + \mu_i \quad (2)$$

$$|HE2020|_i = \alpha_0 + \beta_1 PD_i + \beta_2 IND_i + \beta_3 MSC_i + \beta_4 AVU_i + \beta_5 LTRO_i + \beta_6 IDG_i + \beta_7 INF_i + \beta_8 GDP_i + \mu_i \quad (3)$$

$$|RVHE|_i = \alpha_0 + \beta_1 PD_i + \beta_2 IND_i + \beta_3 MSC_i + \beta_4 AVU_i + \beta_5 LTRO_i + \beta_6 IDG_i + \beta_7 INF_i + \beta_8 GDP_i + \mu_i \quad (4)$$

Table 3: Definition of independent and dependent variables

Variable	Definition	Source
Dependent variables		
Hurst exponent before COVID-19 (HE2019)	It measures efficiency and predictability, calculated for daily data before the pandemic, between 2019 to March 11th, 2020	International Market Indexes Historical Data (https://stooq.com/)
Hurst exponent after COVID-19 (HE2020)	It measures efficiency and predictability calculated for daily data after the pandemic	International Market Indexes Historical Data (https://stooq.com/)
Relative variation of hurst exponent (RVHE)	Relative Variation (RV = EH2020 - EH2019 / EH2019) of efficiency.	International Market Indexes Historical Data (https://stooq.com/)
Independent variables - Cultural aspects		
Power distance (PD)	It equals the degree of tolerance of inequality in wealth and power	Cultural Dimensions of Hofstede (https://geerthofstede.com)
Individualism (IND)	The degree is individual integrated into groups	Cultural Dimensions of Hofstede (https://geerthofstede.com)
Masculinity (MSC)	Measure where society emphasizes male values	Cultural Dimensions of Hofstede (https://geerthofstede.com)
Aversion to uncertainty (AVU)	A measure where people are uncomfortable with uncertain situations	Cultural Dimensions of Hofstede (https://geerthofstede.com)
Long term orientation (LTRO)	Degree of focus where people will employ their efforts	Cultural Dimensions of Hofstede (https://geerthofstede.com)
Indulgence (IDG)	A measure that represents permission for gratification related to enjoying life	Cultural Dimensions of Hofstede (https://geerthofstede.com)
Independent variables - Macroeconomic aspects		
Inflation (INF)	Average inflation of the country at the end of 2019	The World Bank (https://databank.worldbank.org)
Gross domestic product (GDP)	GDP of the country at the end of 2019	The World Bank (https://databank.worldbank.org)

We used the first model (Eq. 2) to identify the cultural and macroeconomic aspects associated with efficiency levels before the arrival of COVID-19 in capital markets. The second model (Eq. 3) aims at identifying whether these cultural and macroeconomic aspects associated before the crisis remain related to efficiency levels after COVID-19 or whether other aspects become statistically significant. Finally, the third model (Eq. 4) aims to verify which cultural and macroeconomic aspects are associated with the positive and negative variations of efficiency levels reported from the pre-pandemic period.

The research data were tabulated in Excel spreadsheets and later treated in Gretl software. We generated descriptive statistics and time series analysis and regression models through this system.

3. LITERATURE REVIEW

3.1. Efficiency, Adaptability, and Uncertainty in Capital Markets

In an efficient capital market, asset prices fully reflect the information available there (Fama, 1965). For Fama (1970), the efficient markets hypothesis (HME) provides evidence that the market reflects in the securities the values of available information, according to the reactions of rational individuals resulting in a behavior called random walk.

The HME treats market participants as rational beings who make optimal decisions, thus contributing to the formation of an efficient market. However, according to Lo (2005), individuals are intelligent but make mistakes, resulting in limited rationality on the part of these individuals.

Therefore, in order to reconcile the idea that markets are efficient by reflecting information instantly with the limited rationality of market agents, Lo (2004) provides evidence that the predictability of returns emerges cyclically from time to time, according to changes in market conditions, the behavior of individuals and institutional factors, thus resulting in the adaptive markets hypothesis (HMA). Thus the HMA is now seen as a new version of the HME through the evolution of its principles.

Urquhart and Hudson (2013) comment that in the adaptive market, the efficiency of the titles diminishes in specific times and returns in moments where the market conditions make the strategies on resource allocation more propitious. However, the efficiency of these bonds follows the changes that have occurred in the economic environment, appearing periodically according to market conditions (Noda, 2016).

Turbulent periods that the markets present in specific periods cause these economies to present particular uncertainty (Antonakakis et al., 2014). Thus, environments that denote uncertainty have significant implications on the behavior of market agents, thus causing the behavior of the economy to change according to the levels of uncertainty reported in these periods (Brogaard and Detzel, 2015). Therefore, we understand that these environments of uncertainty represent changes in market conditions, corroborating the idea that markets adapt to these environments, as Lo (2004) points out.

The political and economic uncertainty in capital markets has come to call attention in recent decades due to concerns with several international crises, such as the European immigration crisis, the results of the elections in the United States, the failed coup in Turkey, the results of the elections in Brazil and South Korea, among others. All these cases in these markets have significantly affected these countries (Arbatli et al., 2017).

Studies like Arbatli et al. (2017) show that periods of high uncertainty compromise economic performance, affecting stock markets. Baker et al. (2012), in their study, show that periods of high levels of uncertainty result in a reduction in returns. Arouri et al. (2016) point out that the high volatility of securities in the American stock market is related to periods of high political and economic uncertainty.

Therefore, as explained above, markets are not always efficient, and these markets are affected by changes in market conditions and institutional factors, thus corroborating the adaptability of markets. In turn, as Arbatli et al. (2017) point out, periods of crisis denote levels of uncertainty in the economies, and this uncertainty may affect the functioning of the markets, with impacts on the securities of these economies. We will provide information on the crisis the market is currently experiencing and the possible impacts through the design of the research hypotheses.

3.2. Economic Impacts of COVID-19

The first reported coronavirus disease appears in Wuhan, a city located in Hubei Province, China (Baker et al., 2020; Toda, 2020). This disease has spread rapidly around the world, and on March 27th, 2020, it reached a total number of cases over 460,000, with over 20,000 deaths worldwide (Toda, 2020).

Since then, while the number of new cases has stabilized in China, the number of cases has grown exponentially worldwide (Toda, 2020). Thus, as a way to prevent the massive spread of the virus, federal, state, and local governments around the world have adopted measures to control its spread and limit the economic burden that the disease imposes (Alfaro et al., 2020). These measures aimed at preventing the spread of the virus, according to Toda (2020, p. 1), include, among others: "[…] Restricting travel, ordering social distancing and closing schools, bars, restaurants, and other businesses."

The measures related to travel restrictions, social distancing, and other policies to contain the virus have the objective of maintaining the health care of the world population. However, these policies bring economic damages, having instantaneous reflex damages in the stock markets, as observed recently (Baker et al., 2020).

However, even with adverse effects on the economies, the adoption of these measures becomes necessary because it correlated with the outbreak (Alfaro et al., 2020). However, there is an urgent need to implement policies to contain the crisis created by

COVID-19 "[…] less comprehensive that does not strangle the economy" (Baker et al., 2020, p. 5). The containment measures of COVID-19 taken at the international level may significantly impact the economy of all the countries that are adopting them. Therefore, we expect that these capital markets will follow the same pace, being more correlated with this pandemic.

The impact of the crisis generated by OVID-19 on the US capital markets has caused an increase in current levels of volatility that have outpaced the impacts of previous crises, so it is relevant to analyze recent behavior in stock markets (Baker et al., 2020). The COVID-19 pandemic created a tremendous shock of uncertainty until that associated with the 2008-09 financial crisis:

[…] The infectivity, prevalence, and lethality of the virus; the availability and deployment of antigen and antibody testing; the ability of health systems to meet an extraordinary challenge; the time it will take to develop and deploy safe and effective vaccines; the final size of the mortality shock; the duration and effectiveness of social withdrawal, market blockages and other mitigation and containment strategies; the short-term economic impact of pandemic responses and policies; the speed of recovery as the pandemic retreats; whether "temporary" government interventions and policies will persist; the extent to which pandemic-induced changes in consumer spending patterns will persist; and the impact on business survival, new business formation, R&D, investment in human capital, and other factors were affecting productivity in the medium to long term (Baker et al., 2020, p. 2).

Therefore, assessing the economic impact generated by the COVID-19 pandemic is essential primarily for policymakers, given that the crisis has unfolded at high speed (Baker et al., 2020) and using measures of return, volatility, uncertainty, and market efficiency can contribute in some way to understanding and assessing future implications for economies.

Thus, as explained above, about the effects that the crisis generated by the COVID-19 pandemic has had on capital markets worldwide, this study presents the following hypotheses:

H_1: The crisis generated by the COVID-19 pandemic generated an increase in the correlation presented by the prices of indices representing international capital markets.

H_2: The crisis generated by the COVID-19 pandemic has negatively affected the returns of the representative indices of the international capital markets.

H_3: The crisis generated by the COVID-19 pandemic affected the efficiency behavior of the representative indexes of the international capital markets.

The next section of this study will address the methodological aspects used in this research, which will test and provide the relevant results the hypotheses outlined above.

4. RESULTS AND DISCUSSION

4.1. Effects of the Crisis on Prices

In the section, we present the results regarding the price analysis of representative indexes belonging to 44 international markets. The prices of the securities of the largest markets were analyzed, according to the International Monetary Fund (IMF) list of countries. The analysis provided evidence that 1 day after the announcement of the pandemic by the WHO, the markets had the most significant negative impacts on the prices of their indices.

Based on the result of the date that affected the prices of the world indices, it is necessary to proceed with the correlation analysis between the prices of the 44 markets. Thus, correlation coefficients between the prices of the titles of the sample are analyzed 2-time clippings, bring them in: previous period (01/02/2019 to 03/11/2020) and posterior period (03/12/2020 to 05/15/2020) to the impact of the COVID-19 in the prices of the world indices.

As the correlation matrix is extensive, with cross data referring to 44 countries, we will present the results using figures representing a heat map, where: the red points represent high positive correlations, the blue points represent high negative correlations, and the white points represent the absence of correlation. Thus, the closer to the white color, the point of intersection is, the closer to zero the coefficient is, thus denoting the absence of correlation. Figure 1 shows bond prices correlated before and after the impact of COVID-19 on capital markets.

After the pandemic announcement, markets became more correlated since the crisis affected the entire world economy. There is a reduction in blue points (negative correlation) and neutral points (no correlation), also noted by a test of differences of averages for 946 coefficients of correlations. The mean of the coefficients of the first sample was 0.3601 (deviation = 0.4734), versus 0.6473 of the second sample (deviation of 0.3565). The test result showed a $P > 0.000$, denoting the existence of a difference between the means. After the pandemic, the markets started to be more correlated, corroborating H_1.

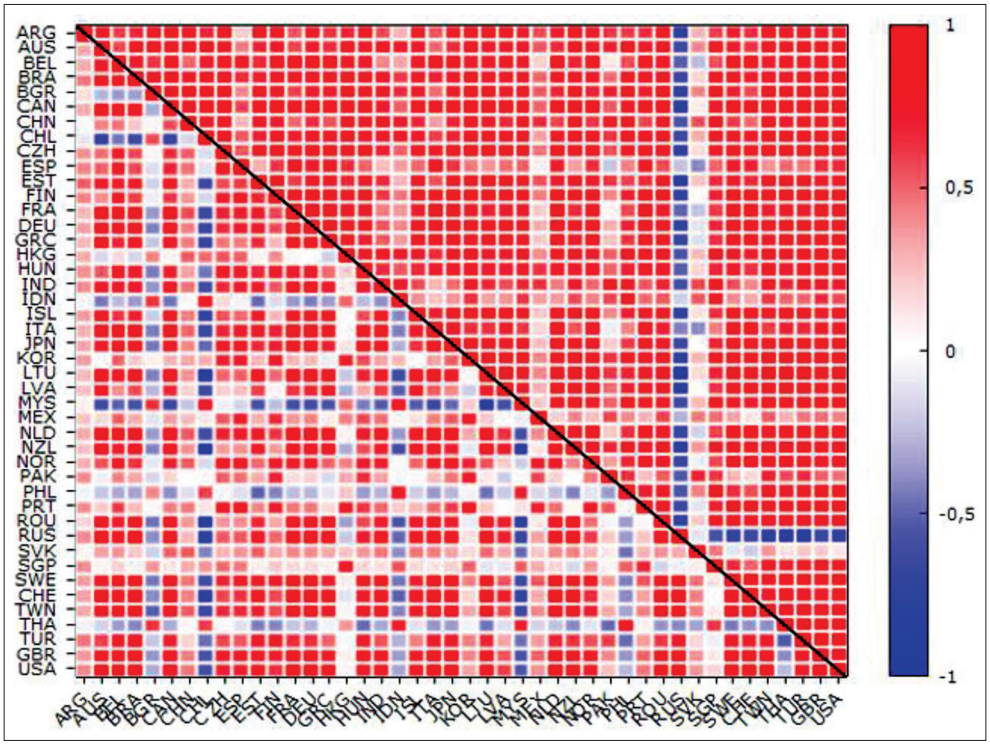
4.2. Effects of the Crisis on Returns

Using the returns from the markets (Figure 2), it is possible to see that, except for Argentina, the data followed a stationary process. On March 12th, the series started to present greater volatility of their returns, with their values moving away from the previous average values. COVID-19 affected bond prices and their volatility.

These results corroborate the studies of Baker et al. (2012) and Arouri et al. (2016), which pointed out that periods of high uncertainty, in this study represented periods of the pandemic crisis, result in reductions in returns and increased volatility of securities traded in capital markets. In addition to reductions in the prices, the markets showed a drop in their returns and increased volatility.

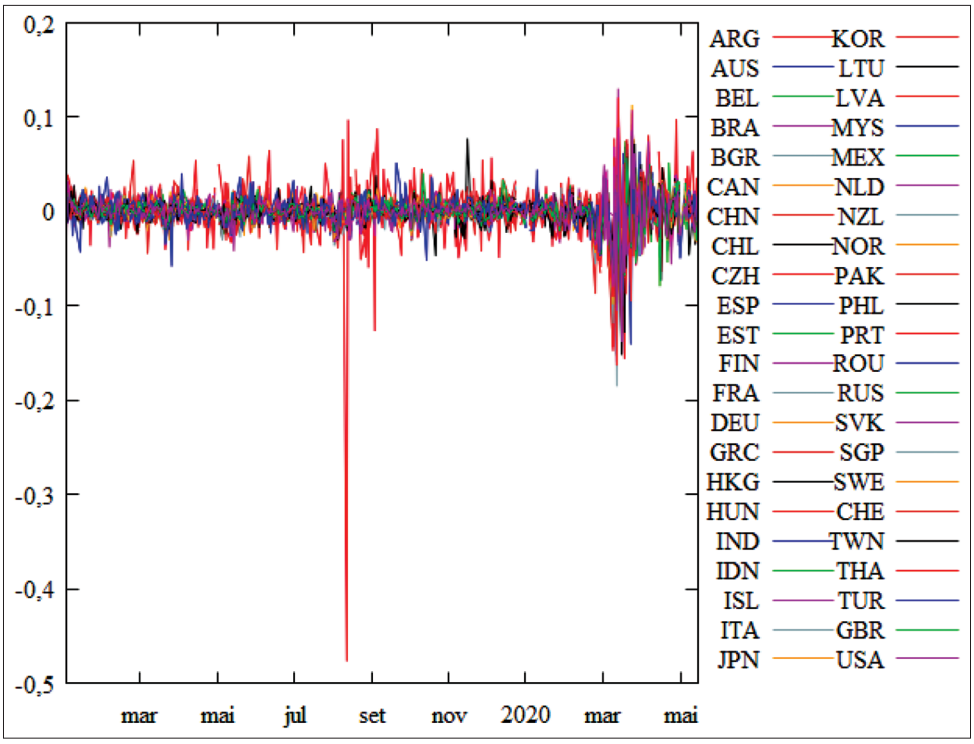
Again, this finding shows that from March onwards, more specifically after the announcement of the pandemic by the WHO on March 11th, 2020, the markets reacted negatively, with reflexes in the decrease of the index prices, and according to Figure 2, with negative reflexes in the returns of these international capital market indexes, which started to present greater volatility. Thus,

Figure 1: Correlation between index prices before and after COVID-19



The colors below and above the diagonal line represent the correlation levels before and after COVID-19

Figure 2: Index returns between 01/02/2019 and 05/15/2020



we noted that worldwide the capital markets were affected by the coronavirus, at significant levels, by observing both the prices and the returns of representative indexes in these capital markets.

Therefore, as explained above, these results corroborate the H2 of this survey, which pointed out that the crisis caused by the COVID-19 pandemic would cause a reduction in international market indices.

4.3. Effect of the Crisis on Efficiency

This subsection presents the results of models 1 to 3. For this, results are provided for three regression models: before the crisis

(01/02/2019 to 03/11/2020); after the crisis (after 03/12/2020); and relative efficiency variation. These results are shown in Table 4, as follows:

The results provided above show that before the impact of the pandemic on capital markets, from 01/02/2019 to 03/11/2020, the cultural dimension of Aversion to Uncertainty (AVU) was the only aspect related to market efficiency. The result denotes that in economies where individuals are more averse to uncertain or ambiguous situations, there is a more significant inefficiency or lower efficiency of securities.

However, for the period after the arrival of the COVID-19 pandemic in capital markets, the Aversion to Uncertainty ceased to be a significant cultural aspect, giving rise to another cultural aspect, called Individualism (IND). That is, economies that are more individualistic, where individuals are less integrated with groups, tend to present less inefficiency or greater efficiency in their securities. These findings may be related to possible impacts of the pandemic, since, as Baker et al. (2020) point out, policies to contain the virus, such as social distancing, aim, among others, to reduce economic losses in the long term. Therefore, more individualistic economies may have shown significant adaptation to the social distancing measures resulting from the pandemic, with positive repercussions on levels of efficiency.

Finally, the regression that analyzes the relative variation of the efficiency indexes from the pre-pandemic period to the post-pandemic period did not provide statistical significance in any independent research variables. The findings above provide evidence that market efficiency is not constant, and cultural aspects affect markets differently. Thus, the crisis affected the behavior of efficiency levels in these international markets, thus corroborating the H3 of this research.

4.4. Additional Analysis

Additionally, an analysis was issued to select the most critical variables in the regression using the stepwise method. The stepwise method (stepwise regression) decides which is the best set of independent variables for the regression model, based "[…] on the contribution of that variable to the sum of the squares explained, according to the F test" (Gujarati and Porter, 2011, p. 360). Thus, the results shown below in Table 5 use this method to select these variables:

The results of Table 5 show that before the pandemic, economies with lower individualism (IND), aversion to uncertainty (AVU), and inflation (INF) is associated with the efficiency of markets, i.e., more individualistic, more conservative economies with lower inflation were less efficient in the period. After the arrival of the crisis, the aversion to uncertainty and inflation lost statistical significance, and Individualism had a signal reversal. The results of the variation between the periods show that the economies with increased efficiency were the most individualistic and less indulgent.

There is thus evidence that economies with individuals less integrated into groups tend to present greater efficiency in their titles. These findings may be related to possible impacts of the pandemic, since, as Baker et al. (2020) point out, policies to contain

Table 4: Regressions of the dependent variable EH

Variable	Model 1 – Before	Model 2 – After	Model 3 – Variation
Constant	0.037615 (0.2801)	0.134433 (0.0040)***	5.336980 (0.3317)
PD	–0.000118 (0.6758)	–0.000443 (0.2215)	–0.002024 (0.9639)
IND	0.000394 (0.1172)	–0.000835 (0.0111)**	–0.071214 (0.0749)*
MSC	–1.147e–05 (0.9554)	0.000197 (0.4502)	–0.013596 (0.6757)
AVU	0.000332 (0.0790)*	–0.000341 (0.1518)	–0.012054 (0.6805)
LTRO	–2.286e–05 (0.9182)	6.790e–05 (0.8104)	–0.018077 (0.6082)
IDG	–0.000302 (0.2199)	–0.000209 (0.5004)	0.048262 (0.2159)
INF	–0.001027 (0.1415)	0.000240 (0.7835)	0.020346 (0.8517)
GDP	–8.991e–011 (0.9453)	–9.580e–010 (0.5658)	–1.054e–07 (0.6114)
R^2	0.250140	0.265406	0.193972
P-value – Heteroc.	0.060954	0.825442	0.80067
P-value - Normality	0.817322	0.625929	0.000000
N	44	44	44

The values outside the brackets represent the regression coefficients, the values inside the brackets represent the P-value and ***, **, and * correspond to the statistical significance at the levels of 1%, 5%, and 10%, respectively. Being: PD: Power distance, IND: Individualism, MSC: Masculinity, AVU: Aversion to uncertainty, LTRO: Long term orientation, IDG: Indulgence, INF: Inflation, GDP: Gross domestic product

Table 5: HE dependent variable regression - stepwise method

Variable	Model 1 – Before	Model 2 – After	Model 3 – Variation
Constant	0.014689 (0.3399)	0.079482 (0.0001)***	2.286160 (0.1755)
IND	0.000360 (0.0347)**	−0.000619 (0.0049)***	−0.074307 (0.0097)***
AVU	0.000364 (0.0408)**	-	-
IDG	-	-	0.060170 (0.0597)*
INF	−0.001091 (0.0917)*	-	-
R^2	0.208560	0.173965	0.167300
N	44	44	44

The constant values outside the brackets represent the regression coefficients, the values inside the brackets represent the P-value and ***, **and * correspond to the statistical significance at the levels of 1%, 5%, and 10%, respectively. Being: IND = Individualism; AVU = Aversion to Uncertainty; IDG = Indulgence; and INF = Inflation.

the virus, such as social distancing, aim, among others, to reduce economic losses in the long term. Therefore, more individualistic economies may have shown significant adaptation to the social distancing measures resulting from the pandemic, with positive repercussions on levels of efficiency.

These findings show us that periods of crisis affect the functioning of the market as a whole, thus corroborating the study of Arbatli et al. (2017). Thus, the results provide evidence of the adaptive behavior of economies, which work differently given market conditions, according to Lo (2004). Market efficiency is not constant, and cultural aspects affect markets. The crisis has affected the behavior of market efficiency, corroborating the H3 of this research.

5. CONCLUSION

The uncertainty generated by the pandemic caused by COVID-19 resulted in several economic shocks worldwide. As the pandemic represents a time of high uncertainty, the economic performance of the economies is compromised, which is affecting capital markets (Arbatli et al., 2017).

Thus, this article aimed to verify the effects that the pandemic has generated on representative indices in international capital markets. For this, aspects related to prices, returns, volatility, and efficiency of these representative indices were analyzed. We carried out correlation tests, average tests, graphical analysis, and multiple linear regression tests to achieve the objective of this research.

The results, in summarized form, provide evidence that after the pandemic, the markets started to be more correlated, and they present significant differences in their correlation coefficients, which denotes that the pandemic significantly affected the prices of these securities, which started to follow the same course, that is, they were negatively affected by the pandemic.

By analyzing variations in the returns of the indexes graphically, we noted that after the WHO announced the pandemic outbreak, the markets, almost instantly, had a drop in their returns, 1 day after the announcement. Also, in the period after the announcement of the pandemic, the variations in returns became more volatile. These findings corroborate Baker et al. (2012) and Arouri et al. (2016), as they show that the period of uncertainty resulting from the pandemic reduced returns and increased the volatility of indices representing international markets.

Concerning the inferential analysis, through the regression test of the efficiency index, we observed that in the pre-pandemic period, market efficiency got reduced by cultural aspects related to Individualism and aversion to the uncertainty of individuals belonging to these economies, as well as, efficiency was increased by inflation. However, in the post-pandemic period, market efficiency was increased by Individualism and reduced by indulgence. Thus, in a way, it can be noted that policies to contain the virus may have had positive effects because, in economies where individuals were less integrated into groups (more individualistic and less indulgent), they began to show greater efficiency of their securities compared to other economies. This finding corroborates with Baker et al. (2020), who pointed out that social distance could reduce economic losses in the long term.

In general, this paper findings indicate the pandemic affected the international markets in their representative indexes, focusing on the behavior of the efficiency of these markets, which changed due to changes in world market conditions (Ghazani and Araghi, 2014; Lo, 2004; Noda, 2016). These results aim to contribute to the various market agents, who need information, mainly, on resource allocation. Therefore, this study provides evidence on markets that present better adaptability to uncertain environments, specifically about the pandemic that is affecting the world economy. This work can also contribute to the literature on corporate and behavioral finance by providing aspects related to the behavior of individuals that affect the efficiency of these markets.

Using information regarding 44 economies in a single time cut is one of this paper's limitations. We understood that this limitation arises from the fact that culture is an attribute that does not change over time. We suggest future studies to analyze other aspects of these economies, besides culture.

REFERENCES

Alfaro, L., Chari, A., Greenland, A.N., Schott, P.K. (2020), Aggregate and Firm-Level Stock Returns during Pandemics, in Real Time, No. W26950. Cambridge: National Bureau of Economic Research.

Antonakakis, N., Chatziantoniou, I., Filis, G. (2014), Dynamic spillovers of oil price shocks and economic policy uncertainty. Energy Economics, 44, 433-447.

Arbatli, E.C., Davis, S.J., Ito, A., Miake, N., Saito, I. (2017), Policy Uncertainty in Japan, No. W23411. Cambridge: National Bureau of Economic Research.

Arouri, M., Estay, C., Rault, C., Roubaud, D. (2016), Economic policy uncertainty and stock markets: Long-run evidence from the US. Finance Research Letters, 18, 136-141.

Baker, S.R., Bloom, N., Davis, S.J. (2012), Has economic policy uncertainty hampered the recovery? In: Government Policies and the Delayed Economic Recovery. United States: Hoover Institution.

Baker, S.R., Bloom, N., Davis, S.J., Terry, S.J. (2020), COVID-Induced Economic Uncertainty, No. W26983. Cambridge: National Bureau of Economic Research.

Brogaard, J., Detzel, A. (2015), The asset-pricing implications of government economic policy uncertainty. Management Science, 61(1), 3-18.

Couillard, M., Davison, M. (2005), A comment on measuring the Hurst exponent of financial time series. Physica A: Statistical Mechanics and its Applications, 348, 404-418.

Dourado, G.D.A., Tabak, B.M. (2014), Teste da hipótese de mercados adaptativos para o Brasil. Revista *Brasileira de Finanças*, 12(4), 517-517.

Fama, E.F. (1965), The behavior of stock-market prices. The Journal of Business, 38(1), 34-105.

Fama, E.F. (1970), Efficient capital markets: A review of theory and empirical work. The Journal of Finance, 25(2), 383-417.

Ghazani, M.M., Araghi, M.K. (2014). Evaluation of the adaptive market hypothesis as an evolutionary perspective on market efficiency:

Evidence from the Tehran stock exchange. Research in International Business and Finance, 32, 50-59.

Hofstede, G. (1980), Culture and organizations. International Studies of Management and Organization, 10(4), 15-41.

Lo, A.W. (2004), The adaptive markets hypothesis. The Journal of Portfolio Management, 30(5), 15-29.

Lo, A. W. (2005). Reconciling efficient markets with behavioral finance: the adaptive markets hypothesis. Journal of investment consulting, 7(2), 21-44.

Noda, A. (2016), A test of the adaptive market hypothesis using a time-varying AR model in Japan. Finance Research Letters, 17, 66-71.

Santos, M.A.D. (2018), Hipótese de Mercados Adaptativos e Fatores Econômico-Institucionais: Uma Abordagem Multinível, Doctoral Tesis. São Paulo: Universidade de São Paulo.

Toda, A.A. (2020), Susceptible-Infected-Recovered (SIR) Dynamics of COVID-19 and Economic Impact, arXiv Preprint NO. 2003.11221.

Urquhart, A., Hudson, R. (2013), Efficient or adaptive markets? Evidence from major stock markets using very long run historic data. International Review of Financial Analysis, 28, 130-142.