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Spillovers of Political Instability and Covid 19 Pandemic Crisis on Tunisian Sectorial Stock Price Returns

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ABSTRACT

To examine the effects of Political instability (PI) and Covid-19 pandemic crisis measured by death rate (DR) on Tunisian sectorial stock market returns, our paper contributes to the financial literature by providing a new study of these effects based on DCC multivariate GARCH. These effects are specially examined in mean and variance returns equations. Our results show a not significant negative effect of both variables under study in mean but significant coefficients of IP and DR in variance equation. Despite the COVID-19 pandemic crisis positively impacts the investor's fear sentiments; the conditional volatility of all sectorial stock market returns is higher in political instability period leading high-level risk in Tunisian stock market. Our findings offer useful policy and financial implications to the policy makers also to firms, investors and all stakeholders of the Tunisian stock market.

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Introduction

Since December 17, 2010, Tunisia enters in continuous political and social instability. This country lost its social peace with a succession of governments lacking the necessary experience and a clear and effective vision of the future. Moreover, it has been subjected to political tensions between Islamists and secular forces, whose reforms and the economy were the first victims. In fact, the political environment has become very unstable following the Tunisian revolution. This political turmoil has threatened investors on the Tunisian financial market because they consider that this unstable environment would constitute a danger to their strategic objectives.

The political environment has become unbearable especially since 2019 when the elections gave us two presidents (president of the parliament and president of the republic) of great divergence in terms of ideas and tendencies. This divergence has greatly influenced the stability of governments. Thus, the great divergence between the 217 deputies and conflicts between political parties worsened the political conditions and all this had a negative effect on social stability, economic growth and attracting investors. These political events have a consequence, which certainly undermines the economic and financial stability of a country.

Political instability contributes to lower the economic growth by affecting saving, investments, and corporate decisions (Tang and Abosedra, (2014), Aisen and Veiga, (2013)). In Tunisia, it is considered as the most damaging constraint to firm growth after the 2011 Jasmine revolution (Matta, 2016). No doubt, after the revolution, the GDP growth slumped sharply to reach -1.9% in 2011. The World Bank (2016) explained in its report 1 on the outlook of the world economy that Tunisia's weak growth is the result of both security problems linked to strikes, political instability, political assassinations, and terrorist acts [1-3].

Many empirical studies have examined the effect of political risks on certain industries or on the stock market in the country, but much of these works have focused on policy issues in developed countries and fewer studies are done in the context of emerging or developing countries [4-7]. Indeed, following dramatic political events such as the Arab Spring, a lot of influence on the stock markets, especially on the stock markets of countries that experienced the Arab Spring and their neighbors [8, 3, 9 & 10].

As a result of political instability, the rates and indices of the Tunisian economy are catastrophic. In February 2020, the effect of the covid-19 pandemic is added to the economic stagnation.

In the purpose of containing the COVID-19 pandemic, many countries around the world have adopted several drastic measures such as imposing social distancing, avoiding unnecessary travel, and a ban on congregations. By the end of March 2020, more than 100 countries around the world had already undertaken several lockdown restrictions impacting negatively their social and economic activities [11].

The novel coronavirus has particularly affected financial markets all over the world. It created an unprecedented level of risk, causing investors to suffer significant losses in a few days. Many equity markets around the world experienced their fastest price drop in history. Stock markets in Europe, Africa and Asia have also plunged (Ashraf (2020), Ozili (2020) Zhang et al. (2020). Given the dramatic movements observed recently in several financial markets around the world, many recent studies have employed several empirical approaches to investigate the eventual effects of COVID-19 pandemic on stock market returns and risks in several affected countries such as China, the USA, Japan, Korea, Singapore, Germany, Italy, and the UK etc. (Ali et al. (2020) Sharif et al. (2020), Liu et al.(2020), Gil-Alana et al. (2020), Zhang et al.(2020), ...) [12-18].

Indeed, the objective of this article is to examine the effects of political instability and COVID-19 pandemic crisis on Tunisian sectorial stock market returns. We use daily stock market prices of the main Tunisian sectors (Banks, Basic Materials (BM), Building Construct Materials (BCM), Financial services (FS), Automobile and Parts (A&P), Food and Beverage (F&B) and Industrials), Death rate (of infected person number) and dummy variable which takes one if there are political instability events spanning from January 2, 2020- to February 2, 2021. Our methodology is based on DDC GJR-GARCH to show the Tunisian sectors integration and level of the returns volatility in cases of introducing political instability and Coronavirus measures.

Our paper contributes to financial literature by providing new investigation of the impacts of political instability and COVID-19 pandemic crisis on sectorial stock market returns in an emerging country (Tunisia). View that developed countries have well-established financial markets and strong institutions. As a result of negative chocks in these countries are rapidly responding with a package of measures to alleviate shocks, However, in the case of developing countries (Tunisia), institutions are generally weak and financial markets are unstable, the states cannot respond quickly and cannot take policies and measures which can alleviate these negative shocks. This article provides a new contribution to the literature by offering a new empirical study of the effects of both political instability and Coronavirus crisis on sectorial stock market returns based on multivariate DCC- GARCH family model.

The rest of the paper is structured as follow: Section 2 outlines the literature review. The data, model and the underlying methodology are exposed in Section 4. Section 5 reports and discusses empirical findings and Section 6 concludes the paper.

Literature Review

Political Instability Effect on Stock Market Returns

The political instability in several countries in the world across time and its negative impact on their economic performance has triggered the attention of many economists. Since 1980 many studies examine the relationship between stock markets performance and political uncertainty. Except the study of Cutler,et al (1989) which find that political factors did not significantly affect stock returns. Almost, the remaining ones examining this relationship show a significant effect of political uncertainty on stock market returns Aggarwal et al (1999), Kim and Mei (2001), Bailey and Chung (1995), and Boutchkova (2012). Find out that political events contribute significantly to the financial volatility [19-23].

Beaulieu et al (2005) and Suleman (2012) Argue that unfavorable political news increases the volatility of stocks returns, while the favorable ones reduce this volatility. Indeed, the effect of unfavorable political news is higher than the favorable ones [24, 25].

By using the Markov switching process and GARCH family model Khalid and Rajaguru (2010). El-Chaarani (2015). Finds that international national events cause changes in markets volatility. They added that good and bad political news have a significant effect on BSE returns. This effect is positive for the good news and negative for the bed news [26, 27].

With different measure of political uncertainty such as policy uncertainty index of Baker et al (2012), Lubos and Veronesi (2013) find that the effect of political uncertainty on volatility should be stronger in a weaker economy. Dimitrios et al (2016) By using a sample composed of 66 countries indicate that greater political risk imposes higher volatility in North America markets, Greece, Africa-Asian markets and other regions [28-30].

To measure the political risk variable Bekaert et al (2014) Dimic et al (2015) use data from the International Country Risk Guide (ICRG) that the main factors of the political risk are Government Actions, Quality of Institutions, Democratic, Conflicts, and Tendencies. As a result, authors find out that Government actions are considered as the main source of political risk and have negative impact on the stock returns in the three market categories. With political instability Perotti and Oijen (2001), Examined the indirect effect of the emerging economies' privatization policy on stock market development through resolution of political risk. Their findings have revealed that political risk shifts seem to have a strong effect on stock market development. They have also showed that drastic changes in the emerging economies' excess returns tend to persist whenever political risk witnesses an increase or a decrease [31-33].

Based on Tunsian economy Salma (2018), use EGARCH (1.1) model to sectors daily returns and the Benchmark index (Tunindex) from 01/12/2010 to 31/08/2016. Results show that both of good and bad news have increased the volatility of major selected indices, including the TUNINDEX. However, the returns of all indices are not affected by the political new [34].

Ben Moussa and Talbi (2019), Based on EGARCH model, examine the impact of political instability and terrorist attacks on the Tunisian stock market. Empirical evidence shows that political events and terrorist affect the performance and volatility of the Tunindex market especially after the revolution. Indeed, political events and those linked to terrorist attacks reduce returns and increase the volatility of the stock index [35].

Covid-19 Pandemic Crisis Effect on Stock Market Returns

Since December 2019, its start from the Chinese city of Wuhan in early 2020, the COVID-19 is causing huge impact on the financial markets around the world. Dramatic reactions to the pandemic were observed during the virus outbreak. Several empirical investigations have been carried out to examine the effect of Coronavirus effects on a large set of economic variables such growth, consumption inflation and employment and stock markets. The bulk of what little work has been done has focused on the effects of COVID-19 pandemic crisis on stock markets over at best the last half of the previous year 2020.

Ashraf (2020) show that stock markets in many regions are moving up and down with the news of COVID-19 and related control measures or stimulus packages implemented by government, such as direct fiscal support or decrease in interest rates, among others [12]. To investigate the effect of the COVID-19 pandemic on the Chinese stock market Al-Awadhi et al. (2020), use a panel regression approach based on two measurements: daily growth in total confirmed cases and daily growth in total deaths [36]. The results provide evidence of a significant negative effect of both measurements on stock returns Liu et al. (2020). Use a sample major affected country such as Japan, Korea, Singapore, the USA, Germany, Italy, and the UK [17]. They analyze impact of the COVID-19 outbreak on 21 leading stock market indices (data on daily closing prices). Their Results indicate that the COVID-19 outbreak has impacted negatively and significantly the stock market returns of all affected countries and areas.

Zhang et al. (2020), Harjoto et al. (2020), Cepoi (2020), Alqahtani and Chevallier (2020), Liu et al. (2020), Smales (2017), and Ashraf (2020) Used stock market data of a different panel dada of infected countries and by different measurement such as number of confirmed cases, number of deaths, and rate of deaths…. They found that the pandemic has led to great risk and uncertainty in global financial market. The findings also indicate that stock markets react strongly during early days of confirmed cases and confirmed death number, So the markets is negative and significant influenced by different measurement employed as variable presenting novel coronavirus [12, 14, 17, 37- 40].

Bahrini and Filfilan (2020) by using a panel data regression analysis, they find that stock markets in the GCC countries responded negatively and with a great degree to new and total COVID-19 confirmed deaths, while response to the number of COVID-19 confirmed cases is not significant [41].

Jribi and Manzli (2020) Examine the behavior of stock market returns in Tunisia during the OVID19 outbreak. Their analysis is based on OLS regression, and their results show that Bitcoin act as a hedge and Ethereum as a diversifier for Tunisia's stock market before the COVID-19 outbreak; however, Bitcoin and Ethereum cannot generate benefits from portfolio diversification and hedging strategies for financial investors during the COVID-19. Moreover, Dash, Monero, and Ripple act as hedges before the COVID-19. So, their main results indicate that the growth rate of the COVID-19 confirmed cases and deaths harms Tunisia's stock market [42].

Data and Methodology

Data

The data used in this paper are the daily stock prices of seven Tunisian namely Banks, Basic Materials (BM), Building Construct Materials (BCM), financial services (FS), Automobile and Parts (A&P), Food and Beverage (F&B) and Industrials. Return series are computed by taking the logarithm (ln) of two consecutive prices as $r_t = \ln\left(\frac{price_t}{price_{t-1}}\right)$.

The data concerning the Tunisian sector prices are available from Investing.com website and the daily data concerning COVID19, New cases (NC), new deaths (ND), total number of cases (TC) and total number of deaths (TD) are available at ourworldindata.org website.

We calculate the COVID-19 death rate (noted DR) as, $DR_t = \frac{TD_t}{TC_t}$

As data, also, we use a dummy variable to present political uncertainty (PU) presented into political good events and political bad news in Tunisia.

Where $PU = \begin{cases} 1 & if\ t = significant\ \ events\ of\ political\ instability\ (bad\ events) \\ 0 & otherwize \end{cases}$

All significant Tunisian political events are presented in Table 1

Table 1: Political Timeline 2020- February 2021

Date	Political Events
02/01/2020-20/01/2020	Rejection of the government formed by Habib Jemli
15/02/2020	appointment of Flyess Fakhfakh as new government president
19/02/2020-27-02/2020	Investiture of the government of Fakhfakh
06/03/2020	American embassy attack
14/06/2020	Appearance of proof of corruption or conflict of interest of Fakhfakh
22/06/2020	Kamour events and general strike in Tataouine
15/07/2020-30/07/2020	Resignation of Prime Minister Fakhfak
27/07/2020	Withdraw the confidence of President of Parliament Ghannouchi
25/08/2020-02/09/2020	Inauguration of government by Hichem Mechichi
6 and 7/09/2020	attack against members of the National Guard in Sousse
03/11/2020	Call for maximum vigilance against the risk of an attack
16/11/2020-25/12/2020	strike of magistrates and paralysis of justice in Tunisia
21/12/2020	terrorist attack; death of a shepherd in Kasserine
24/12/2020	Arrest of businessman and politician Nabil Elkaroui
14/01/2021-18/1/2021	Social turbulence in Kef, Siliana, Kasserine, Sousse, and suburbs of Tunis
25/01/2021	National Security Council and problem between the three presidents
26/01/2021-02/02/2021	Confidence of 11 new ministers and refusal of president their swearing

We have 270 observations from January 02, 2020 to February 02, 2021, and the summary statistics of sectors stock prices return series are given in the next section.

Summary Statistics ET Model Choice Justification

It is noted that the selected series have diversity in returns and volatility. The average return of the Building Construct Materials sector stock price (0.0010465) is the highest among the selected sectors. The average return of the Banks sector stock price is -0.000954 which is the lowest return as compared to other sectors. The standard deviation represents the risk or volatility of the returns in the stock prices. The standard deviation of the Building Construct Materials stock price returns is 0.014625, which is the highest, while the standard deviation of the Automobile and Parts sector stock price returns (0.0066481) is the lowest among the selected sectors. Except Building Construct Materials sector the skewness of remaining return series is negative, which is evidence for asymmetry in given return series. The kurtosis values represent the fatness of the tails of the distribution and distribution of data around the mean. All the kurtosis values are greater than

3 which show that data are not normally distributed. The Jarque–Bera test of normality rejects the null hypothesis of normality at 1% significance level.

Table 2: Summary Statistics

	Banks	BM	BCM	FS	A&P	Food B	Ind
Mean	-0.000954	-0.000773	0.0010465	0.0002565	-0.000840	0.0006577	0.0006416
Median	-0,000554	-0,000160	8,160E-05	0,00057034	-0,000195	0,0005082	0,0006432
Maximum	0.022176	.0250629	0.043009	0.016707	0.0199826	0.032231	0.0359906
Minimum	-0.04317	-0.050057	-0.048571	-0.02523	-0.039886	-0.056123	-0.041350
Std.Dev	0.0072521	0.0116699	0.014625	0.006715	0.0066481	0.010167	0.012188
Skewness	-1.618879	-0.587250	0.1249829	-0.304509	-1.638119	-0.624806	-0.140871
Kutosis	10.88451	4.443483	4.037565	3.749333	11.02154	7.468329	4.015311
Jarque-Bera	817.296	38.959	12.814	10.489	844.6367	242,1843	12.49016
probability	0.00000	0.00000	0.0016	0.0052	0.00000	0.00000	0.00194
Observations	270	270	270	270	270	270	270

Model Choice Justification

The return series plots are shown in figure 1. The graph of the return series is mean reverting with volatility clustering. Periods with high volatility and periods with low volatility, which indicates that a GARCH model can be used to fit the data.

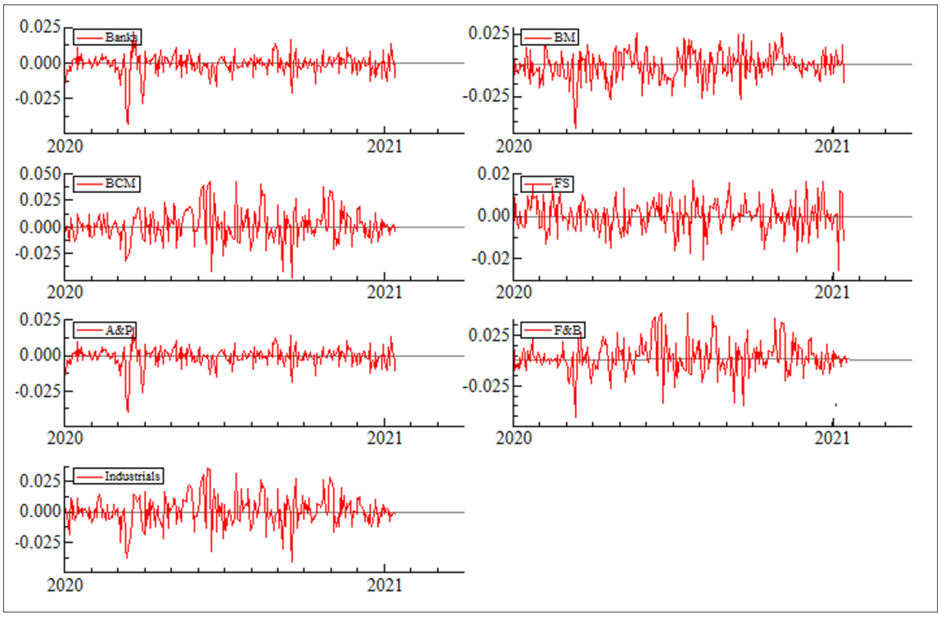

Figure 1: Dynamic of daily Stock prices returns of selected Tunisian sectors

Table3 presents results of correlation matrix of stock price return of the selected Tunisian sectors.

All values are positive which shows that stock price returns move in the same direction. However, the minimum value of the correlation among the stock price returns is 0.059 and the maximum value is 0.696 which is below 0.80 showing low co-movements and absence of multicollinearity. The correlation between Banks sector and Automobile and Parts sectors the highest, while the correlation between financial services and food & Beverage sectors is the Lowest.

Table 3: Correlation Matrix

	Banks	BM	BCM	FS	A&P	F&B	Industrials
Banks	1.0000	0.413536	0.292029	0.140218	0.695997	0.477773	0.365500
BM		1.0000	0.307653	0.038750	0.415738	0.310301	0.384629
BCM			1.0000	0.126289	0.299451	0.237712	0.648756
FS				1.0000	0.197237	0.058969	0.128455
A&P					1.0000	0.476369	0.373305
F&B						1.0000	0.323056
Industrials							1.0000

Figure 2 shows the autocorrelation function of return residuals series (rrs) and Figure 3 shows the autocorrelation function of squared residuals of return series (srrs). If rrs is serially independent, 5% of the lags in the acf-plot in Figure 2 is expected to fall outside the limits (the blue dotted lines). With 100 lags only 5 lags are expected to fall outside. In Figure 2 we see that less than 5 lags fall outside for all series sectors, but the lags that fall outside does not make a pattern, it is random which lag that fall outside, and most of the lags that fall outside are just barely outside the limits. Hence, we can conclude that residual series are uncorrelated.

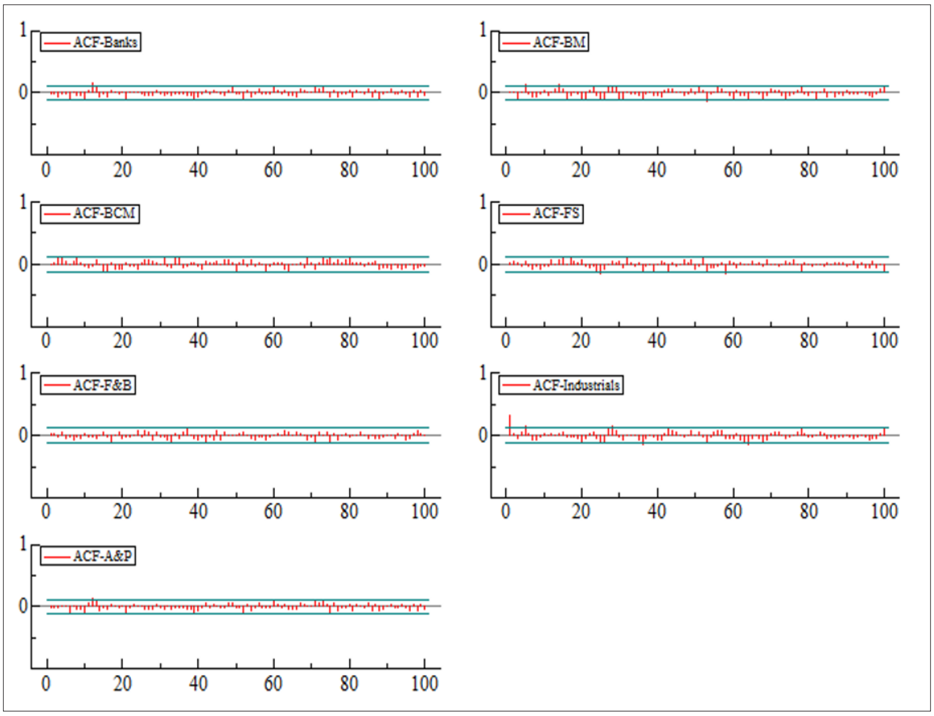

Figure 2: The ACF-plots for the residual's series

But the lags that fall outside the limits in the ACF of the srrs in Figure 3 do make a pattern. We see that the first lags are greatest, and then the ACF decreases. Because the number of lags that fall outside is large and the lags that fall outside make a pattern, squared series are not uncorrelated. If a is serially independent, a squared should be uncorrelated, but it is not, which means that a is dependent. Hence a GARCH model is a good choice of modelling the volatility.

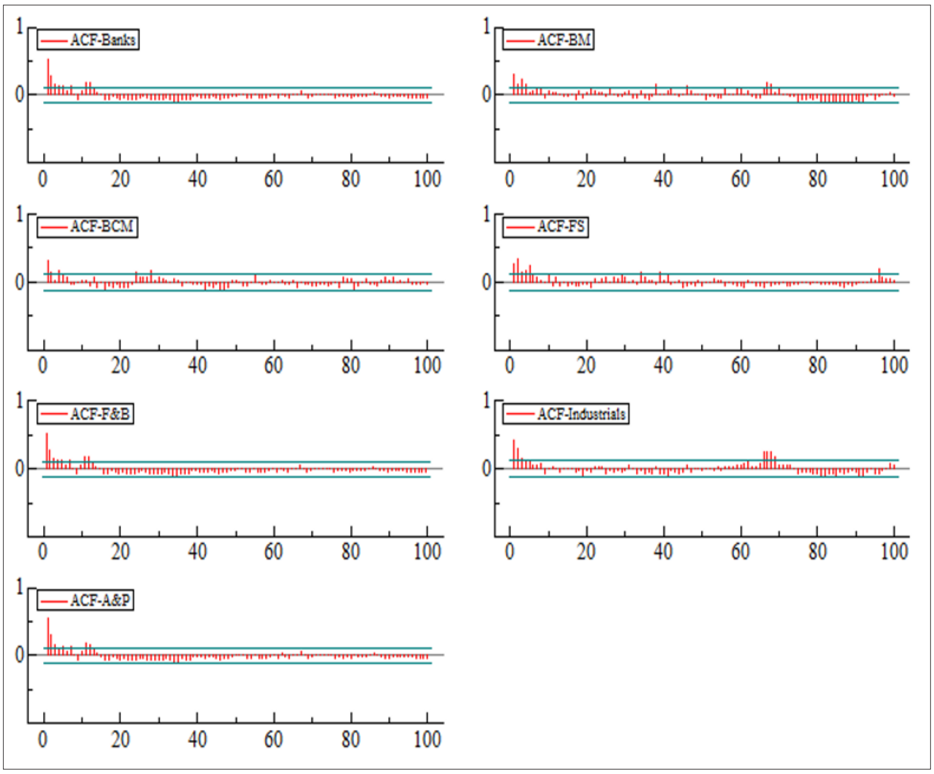

Figure 3: The ACF-plots for the squared residuals series

Methodology

Tunisian Economy has experienced unprecedented levels of volatility in January 2011, since the outbreak of the revolution, due to several political events. This volatility has been worsened in February 2020 since the outbreak of COVID-19 global pandemic. To study the effects of political instability and COVID-19 pandemic on Tunisian sector stock price returns, we use a model of GARCH family. According to the correlation matrix (table 2), the returns series are correlated. But Pearson correlation is an average correlation which does not show the variations in the correction over the period. We performed more detailed correlation with DCC-GARCH model.

We use the DCC, multivariate GARCH (DCC M-GARCH) approach to measure the impact of COVID-19 pandemic crisis and political instability on conditional mean and volatility of sectorial stock price returns. It is a two steps process; the first step is DCC M-GARCH estimation which involves conditional correlation estimates, The second step is to introduce variables of COVID-19 (new cases and/or new deaths) and dummy variables political instability (PI) in conditional mean and conditional volatility of return series equations to view their effects on sectorial stock price returns and on their volatility [43].

We start our empirical work by searching the mean equation of return series. We estimate a different ARIMA series and the appropriate model gives the high value of maximum likelihood and the low values of Akaike and BIC criterion. According to previous section analysis the residuals present a clustering volatility and the DCC-GARCH model is a good choice of modelling the volatility.

The DCC- GARCH model is given below:

$$\mathrm{H_t} = \mathrm{D_t R_t D_t}$$

Where H_t is conditional variance matrix, D_t is a $k \times k$ diagonal matrix having conditional variance $\sqrt{\mathrm{H_t}}$

On it's diagonal and R_t is time- varying correlation matrix. The conditional variance h_{it} for return series are estimated using univariate GARCH.

$$h_{it} = a_i + \sum_{j=1}^{q_i} \alpha_{ij} e_{it-j}^2 + \sum_{k=1}^{p_i} \beta_{ik} h_{it-k} \ , for\ i = 1,2, \dots, m$$

Where, a_i, α_{ij} and β_{ik} are non-negative and

$\sum_{j=1}^{qi} \alpha_{ij} + \sum_{k=1}^{pi} \beta_{ik} < 1$, and m is the number of selected sectors.

If, the residual (e_t) and the conditional standard deviation ($\sqrt{h_{it}}$) are obtained, the conditional standard deviation is expressed by diagonal matrix D_t, which consists ($\sqrt{h_{it}}$) elements on its diagonals as shown as follow.

$$D_t = \begin{bmatrix} \sqrt{h_{11t}} & 0 & \cdots & 0 \\ 0 & \sqrt{h_{22t}} & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \cdots & \sqrt{h_{mm,t}} \end{bmatrix}$$

The standardized residuals ϵ_t are used for estimating the symmetric and dynamic correlation matrix R_t.

$$R_t = \begin{bmatrix} 1 & \rho_{12,t} & \rho_{13,t} & \cdots & \rho_{1m,t} \\ \rho_{12,t} & 1 & \rho_{23,t} & \cdots & \rho_{2m,t} \\ \rho_{13,t} & \rho_{23,t} & 1 & \ddots & \vdots \\ \vdots & \vdots & \ddots & \ddots & \rho_{m-1,m,t} \\ \rho_{1m,t} & \rho_{2m,t} & \cdots & \rho_{m-1,m,t} & 1 \end{bmatrix}$$

The element of $H_t = D_t R_t D_t$ is $[H_t]_{ij} = \sqrt{h_{it} h_{jt}}\, \rho_{ij}$,

where ρ_{11}=1 According to [43, 44]. $R_t = Q_t^{*-1} Q_t Q_t^{*-1}$

Where $$Q_t^{*-1} = \begin{bmatrix} \sqrt{q_{11}} & 0 & \cdots & 0 \\ 0 & \sqrt{q_{22}} & \cdots & \vdots \\ \vdots & \ddots & \ddots & 0 \\ 0 & \cdots & 0 & \sqrt{q_{mm}} \end{bmatrix}$$

Where $Q_t = (1 - a - b)\overline{Q_t} + a\epsilon_{t-1}\, \epsilon'_{t-1} + bQ_{t-1}$

Where Q_t^* is the diagonal matrix of its diagonal elements, and Q_t is a symetric postive definite conditional correlation matrix, and $\overline{Q_t} = E(\epsilon_t \epsilon'_t)$ is unconditional covariance of the standadized residual of univariate GARCH model.

The likelihood of the DCC estimator [45].

$$L = -0.5 \sum_{t=1}^{T} (Klog(2\pi) + 2\log(|D_t|) + \log(|R_t|) + \epsilon'_t R_t \epsilon_t)$$

The volatility (D_t) and the correlation (R_t) components may vary, thus the estimation process achieved in two steps. Firstly the volatility (L_v) is maximized :

$$L_v = -0.5 \sum_{t=1}^{T} (Klog(2\pi) + 2\log(|D_t|) + r'_t D_t^{-2} r_t)$$

Then the correlation (L_c) is maximized

$$L_c = -0.5 \sum_{t=1}^{T} (Klog(R_t) +) + \epsilon'_t R_t^{-1} \epsilon_t - \epsilon_t' \epsilon_t)$$

Empirical Results

In this section we start our empirical work by detrminating the adequate model for mean and variance equations of time series of returns. We modeled means of each time series with an ARIMA(p,d,q) model and volatility with one of GARCH family (GARCH, GJR-GARCH, EGARCH…).

Table 2 presents the log likelihood (LL) of the univariate GARCH models estimated for stock price returns of Tunisian listed sectors.

Table 4: Log Likelihood of the Estimated Models

	DCC GARCH(1,1)		DCC EGARCH(1,1)		DCC GJR-GARCH(1,1)	
	AR(1)	ARMA(1,1)	AR(1)	ARMA(1,1)	AR(1)	ARMA(1,1)
Banks	994.281	994.98	918.784	919.238	994.914	995.589
BM	843.174	843.833	841.562	788.84	843.295	844.033
BCM	785.951	786.086	735.093	782.621	786.607	786.721
FS	971.847	971.301	879.068	886.026	972.356	969.361
A&P	1018.78	1019.57	941.936	942.916	1019.12	1019.93
F&B	899.057	901.113	844.222	849.509	899.124	901.184
Industrial	839.752	839.765	792.291	792.292	839.88	839.892

We estimate six different models as shown in table 4. We try to estimate a different other Models, but they show not significant results. We see that ARMA (1, 1)- GJR-GARCH(1,1) estimated with Normal distribution looks the appropriate one.

The comparison based on the Maximum Likelihood values between the gaussian distribution and the Student-distribution shows that the maximized log-likelihood value of the t-DCC model is little higher than Gaussian DCC model. Henceforth, we follow the results of the t-DCC model.

Table 5 presents the appropriate following DCC ARMA (1,1)- GJR-GARCH(1,1) model:

$$\begin{cases} PR_t = c_0 + \varphi PR_{t-1} + \theta\varepsilon_{t-1} + \varepsilon_t \\ h_t^2 = \omega_0 + a\varepsilon_{t-1}^2 + b\sigma_{t-1}^2 + \delta D_{t-1}\varepsilon_{t-1}^2 \end{cases} \quad \text{and } t = 1, \dots, 270$$

Where PR_t is a sector price returns, and D_{t-1} is a dummy variable which take 1 if the shock is negative ($\varepsilon_t < 0$,cases of bad news) and 0 if the shock is positive ($\varepsilon_t > 0$,cases of good news).

Table 5: DCC MGARCH Estimates

	Banks	BM	BCM	FS	A&P	F&B	Industrials
c_0	0.05500*	-0.0066	0.0889*	0.0020	0.0046	0.0055	0.0065
φ	0.28290**	0.2357**	0.2146**	0.5542***	0.5504***	0.282**	0.3009**
θ	-0.49479**	-0.3366**	-0.3811**	0.01811	-0.4876**	-0.4947**	-0.0273**
ω_0	0.09808 *	0.2222*	0.15216*	0.8521**	0.5506**	0.0980*	0.1193**
a	0.11404**	0.1176**	0.1505**	0.1285**	0.1415**	0.2140**	0.2099**
b	0.667625***	0.6701***	0.8575***	0.8263***	0.6896***	0.6676***	0.7229***
δ	0.22816***	0.1589**	0.1630**	0.1450**	0.1828**	0.1428**	0.1421**
DCC(*α*)	0.143001***						
DCC(*β*)	0.758280***						
Df	8.757280***						
Log likelihood	6515.6025						
AIC	-48.413						
SC	-48.392						
Wald test (Khi.sq(2))	67,07***						

Notes: Superscripts***, **and * indicate significance at 1%, 5% and 10% levels. AIC and SC stand for Akaike and Schwarz Bayesian information criteria.

Table 5 shows the model estimation results. In all cases the ARCH and GARCH coefficients are significant at 5% level. Results show that our appropriate model is asymmetric due to the significance and positive sign of the coefficientsδ. So, the negative shocks more influence the Tunisian sector return prices that the positive shocks. In addition, the Khi-squared statistic of Wald test is equal to 67.07 indicating that the adjustment parameters that govern the dynamic correlation process are significantly different to zero.

Table 6 shows the conditional correlation of the sector pairs which describe the co-movements between the sectorial stock price returns. We focused the correlation between Tunisian stock market. Most of the conditional correlations of the pairs Stock price returns are positive and significant. The results highlight that Automobile & Parts sector has the highest correlation with Banks (0.424) and the lowest conditional correlation is between Financial services and Basic materials (-0.0134) which is negative but not significant. It can be inferred that the changes in one of the sector stock prices will affect more to the most other sectors stock market prices. All values of conditional correlations are less than 0.5, but the low level of correlation is considered good for portfolio diversification.

Table 6: DCC Estimated unconditional Correlation

	Banks	BM	BCM	FS	A&P	F&B
BM	0.286***					
BCM	0.253***	0.252***				
FS	0.124*	0.0134	0.142**			
A&P	0.424***	0.280***	0.262***	0.191***		
F&B	0.325***	0.169**	0.162**	0.038	0.321***	
Industrials	0.292***	0.320***	0,412***	0.141**	0.302***	0.226***

Notes: Superscripts***, **and * indicate significance at 1%, 5% and 10% levels

Figure 4 presents the conditional correlation between the stock markets Tunisian sector stock market prices. The lines representing the correlation of pairs Tunisian sector stock markets are mostly in the positive parts of the graph showing more correlation. Stock market returns of Banks sector shows less correlation with Financials service sector which is the main direct competitor. Other Tunisian sectors are more correlated with sector of Banks. The figure shows the similarity in the results of conditional and unconditional correlation between Tunisian sectors returns price. Stock market returns price Basic Materials and Financial service sectors present smallest correlation. The line representing this previous correlation is mostly in the bottom touching with line crossing the zero showing less correlation. The same movements of the correlation lines such as during the February and March months can be attributed to the political instability in Tunisia which coincides of high level of uncertainty such us the fall of the government of Mr Hbib Jemli and the appointment of the new President of the Government Elyes ELfakfakh. It can be attributed to first case of COVID19 in Tunisia. During these periods, Sector markets become more integrated, and the diversification benefits are reduced. It is riskier for the investors to invest during periods of high integration between stock markets.

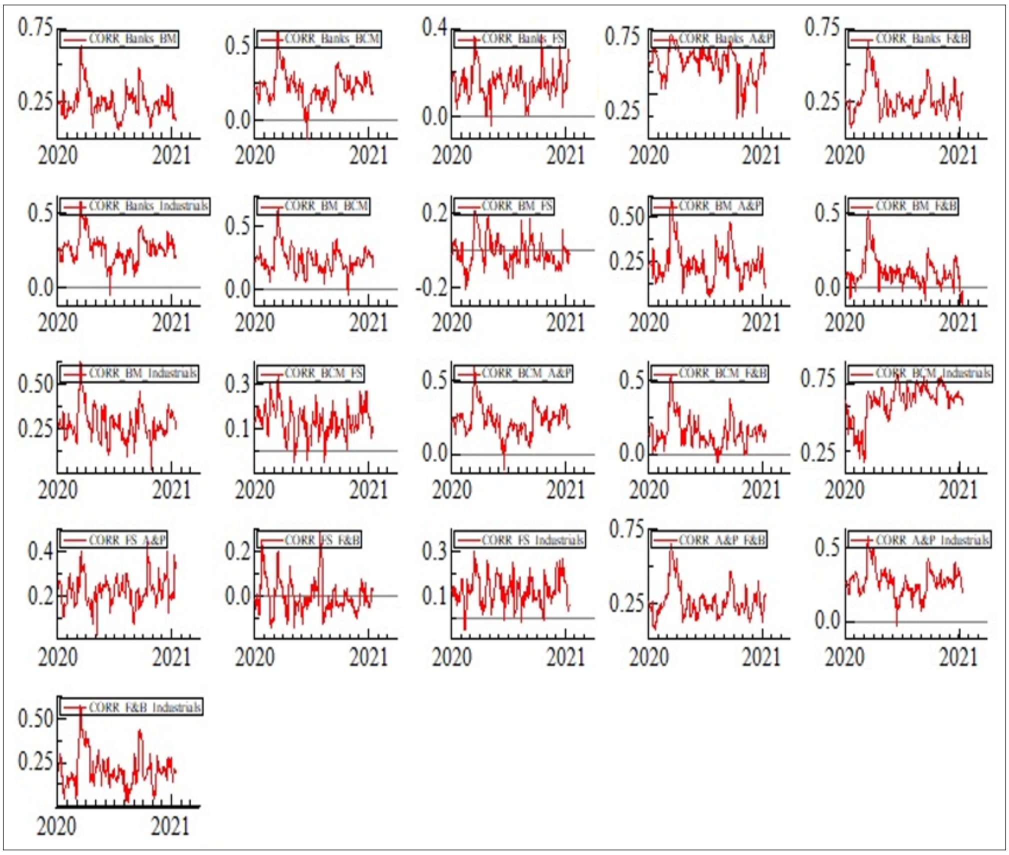

Figure 4: Conditional Correlation of DCC under Multivariate GJR-GARCH Student- Distribution.

Political Instability Effect on Tunisian Sectorial Stock Market Returns

To present the political instability impacts on stock market returns of the main Tunisian sectors, we enter the dummy variable PI, which presents the political instability events, firstly in mean and secondly in the variance.

$$\begin{cases} PR_t = c_0 + c_p PI_{t-1} + \varphi PR_{t-1} + \theta \varepsilon_{t-1} + \varepsilon_t \\ h_t^2 = \omega_0 + \omega_p PI_{t-1} + a\varepsilon_{t-1}^2 + b\sigma_{t-1}^2 + \delta D_{t-1}\varepsilon_{t-1}^2 \end{cases} \quad and\ t = 1, \dots, 270$$

Where c_p and ω_p are the coefficients of political instability dummy variable respectively in mean and variance equations. The estimation results shown in table 7, indicate that the coefficient c_1 is negative but not significant implying that Tunisian sectorial stock market returns are not significantly affected by the political events.

Table 7: Effect of Political Instability on Sectorial Stock Market Returns and on Volatility

	Banks	BM	BCM	FS	A&P	F&B	Industrials
c_0	-0.0004929	-0.000923	0.0005652	0.0005027	-.0004114	0.000890	0.0002394
c_p	-0.002709	-0.001674	-0.007657	-0.002559	-0.000282	-0.000533	-0.001171
φ	0.3656***	0.3801***	0.3377***	0.3257***	0.3482***	0.3789***	0.3452***
θ	-0.41339**	-0.1425*	-0.3128**	0.4035**	-0.4356**	0.4684***	-0.4230**
ω_0	0.33015 **	-0.2452**	0.35200**	0.5918**	-0.5486**	0.1241**	0.1868**
ω_p	0.023381***	0.02876***	0.0299***	0.02406***	0.01849**	0.0188**	0.0375***
a	0.22361***	0.1566**	0.2922***	0.2575***	0.1952**	0.2056**	0.2810***
b	0.58951***	0.7805***	0.7551***	0.8132***	0.7761***	0.6861***	0.7921***
δ	0.2715***	0.2612***	0.1806**	0.2693***	0.1658**	0.1436**	0.2194***
DCC(α)	0.251775 ***						
DCC(β)	0.670751 ***						
Df	31.42549 **						
Log likelihood	7376.655						
AIC	-55.750						
SC	-54.137						
Wald test (Khi.sq(2))	61.66 ****						

Notes: Superscripts***, **and * indicate significance at 1%, 5% and 10% levels. AIC and SC stand for Akaike and Schwarz Bayesian information criteria.

Our results confirm those of previous studies (Ben Moussa and Talbi (2019), Jribi et al (2015) which demonstrated that Tunisian stock market volatility increases when the political environment presents instability, attack, unrests Volatility [35, 42].

These results are supported by figure 5. This figure shows that the volatilities of Tunisian sectorial stock market returns are significantly and positively influenced by the political events. The volatility increases especially in the periods which present a significant political event such as period of rejection of government of Hbib Jemli followed by the investiture of Elyess Fakhfakh government. Figure 5 indicates also, period (July 2020) of resignation of Prime Minister Fakhfakh influences positively the sectorial stock markets returns volatilities.

Although the year 2020 began and ended with several political and social unrests, we note that the stock market in the banks, BC, BMC, A&P, and industrial sectors ended this year with a drop or stationary level of volatility. This can be explained by the stability of the government in this period, or explained by the adaptation of citizens and investors of the political environment which has become the main problem of the Tunisian economy.

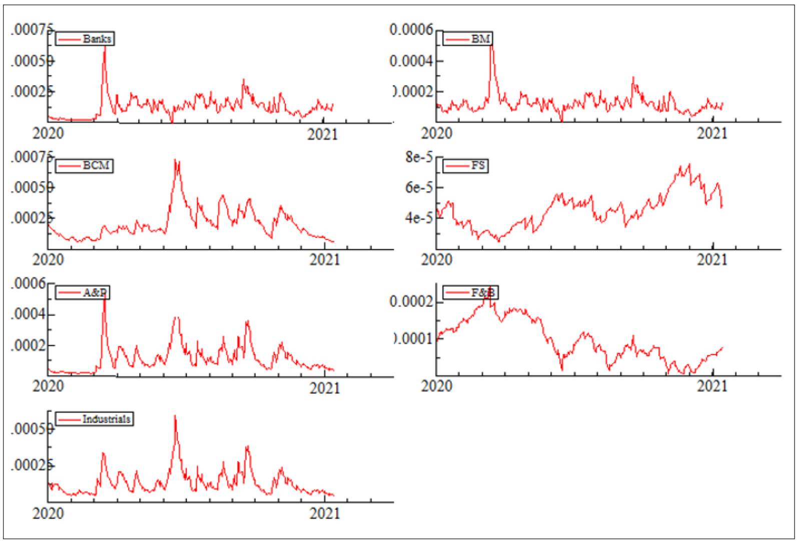

Figure 5: volatility of sectorial stock market returns with PI as independent variable

Covid19 Pandemic Crisis Effect on Tunisian Sectorial Stock Market Returns

To show the effect of COVID19 pandemic crisis on Tunisian sectorial stock market returns, we introduce a variable of the death rate (DR) which is calculated as the total of deaths due to COVID 19 divided by total of cases infected by Corona virus. In first step we introduce this variable in its one lagged gorm in mean of our appropriate model, and in the second step in the variance. We examine the sign and the significance of the coefficients of DR.

Table 8 illustrates the empirical results of the following model:

$$\begin{cases} PR_t = c_0 + c_c DR_{t-1} + \varphi PR_{t-1} + \theta \varepsilon_{t-1} + \varepsilon_t \\ h_t^2 = \omega_0 + \omega_c DR_{t-1} \quad + a\varepsilon_{t-1}^2 + b\sigma_{t-1}^2 + \delta D_{t-1}\varepsilon_{t-1}^2 \end{cases} \quad and\ t = 1, \ldots, 270$$

In case of introducing DR in mean of our model. Estimation as shown in row 3 gives a negative non-significant coefficient (c_1) of the DR variable. This output indicates that COVID 19 pandemic is not a mean determinate factor of Tunisian sectorial stock returns. For the second step, except row 3 of c_1, the estimation result is presented in table 10.

Table 8: effects of DR due to Covid-19 on Sectorial stock market returns and on volatility

	Banks	BM	BCM	FS	A&P	F&B	Industrials
c_0	0.05300*	-0.0056	0.0029	0.0041	0.0056	0.00485	0.0059
c_c	-.01604	-0.0255	-0.0798	-.00204	-0.03010	-.00792	-0.0065
φ	0.26230**	0.2731**	0.2366**	0.3343***	0.3494***	0.381**	0.3525**
θ	-0.46919**	-0.4455**	-0.3988**	-0.4117**	-0.4996**	-0.4714**	-0.3231**
ω_0	0.13701 *	0.2452**	0.25289*	0.7925**	0.5486**	0.1060*	0.1263**
ω_c	0.013381**	0.01876**	0.0268***	0.01456**	0.01149**	0.0158**	0.0340***
a	0.12361**	0.1190**	0.1932**	0.1575**	0.1495**	0.2251**	0.2166**
b	0.67895***	0.6821***	0.8555***	0.8413***	0.6773***	0.6586***	0.7492***
δ	0.21716***	0.1612**	0.1680**	0.1693**	0.1588**	0.1743**	0.1489**
DCC(α)	0.1171***						
DCC(β)	0.8511***						
Df	24.587***						
Log likelihood	7321.785						
AIC	-54.259						
SC	-53.938						
Wald test (Khi.sq(2))	71.45****						

Notes: Superscripts***, **and * indicate significance at 1%, 5% and 10% levels. AIC and SC stand for Akaike and Schwarz Bayesian information criteria.

Results presented in table 8 show that our model is Multivariate DCC-GJR-GARCH due to significance of the Wald test. Our appropriate model is asymmetric, and it reacts mostly in cases of negative shocks. The coefficient ω_1 of the DR due to COVID 19 pandemic is significant and positive at 5% level. This finding indicates that COVID-19 death rate (DR) increases the Tunisian stock market returns volatilities. Indeed, there is a positive link between volatility of stock market returns and investor's fear sentiment. These results confirm the findings of previous studies, which demonstrated that stock market falls when the change in volatility indices rises [39, 17, 40].

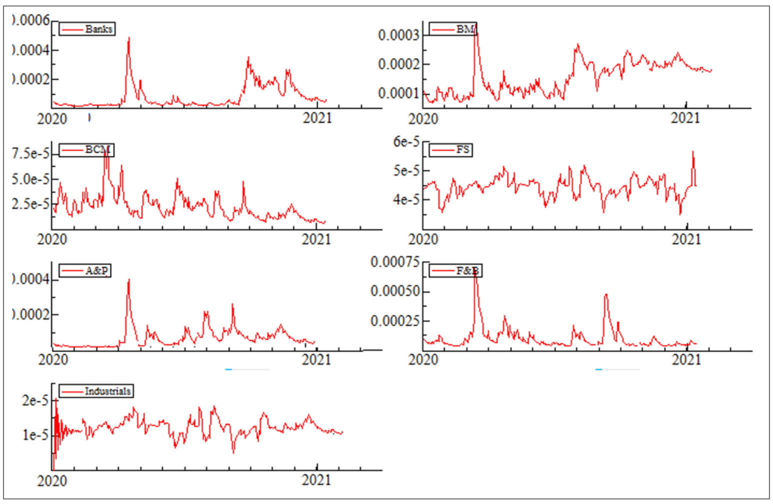

Figure 6: volatility of sectorial stock market returns with DR as independent variable

Figure 6 confirms our findings which show that the volatility of all Tunisian sector stock market returns increased especially in periods Mars and September 2020. These two periods represent the first and the second the first and second wave of Covid-19 pandemic in Tunisia.

As a small recap of our work, we notice the effect of political instability has a more significant effect than covid-19 pandemic. This is confirmed that the level of volatility, for all sectors, influenced by political instability is higher than that influenced by the Covid19 pandemic crisis.

Estimation Results with Interaction of Dr and Ip

In this subsection we estimate the main two models by adding respectively (DR_{t-1}*PI_{t-1}) in the following first model:

$$\begin{cases} PR_t = c_0 + c_c DR_{t-1} + \gamma_c (DR_{t-1} * PI_{t-1}) + \varphi PR_{t-1} + \theta \varepsilon_{t-1} + \varepsilon_t \\ h_t^2 = \omega_0 + \omega_c DR_{t-1} + \beta_c (DR_{t-1} * PI_{t-1}) + a\varepsilon_{t-1}^2 + b\sigma_{t-1}^2 + \delta D_{t-1}\varepsilon_{t-1}^2 \end{cases} \quad and\ t = 1, \dots, 270$$

And in the second step, we estimate the following model with adding the interaction (PI_{t-1}* DR_{t-1})

$$\begin{cases} PR_t = c_0 + c_p PI_{t-1} + \gamma_p (PI_{t-1} * DR_{t-1}) + \varphi PR_{t-1} + \theta \varepsilon_{t-1} + \varepsilon_t \\ h_t^2 = \omega_0 + \omega_p PI_{t-1} + \beta_p (PI_{t-1} * DR_{t-1}) + a\varepsilon_{t-1}^2 + b\sigma_{t-1}^2 + \delta D_{t-1}\varepsilon_{t-1}^2 \end{cases} \quad and\ t = 1, \dots, 270$$

Results presented in table 9 show that our models are always Multivariate DCC-GJR-GARCH due to significance of the Wald test. Our models are also asymmetric, and they react mostly in cases of negative shocks. The coefficient c_p and c_c of respectively PI and DR still not significant. But, the novel coefficients γ_p and γ_c , of (DR_{t-1} * PI_{t-1}) in the of COVID 19 pandemic model and in Political Instability one, present some significant value at 10%. The most important finding in these cases, is the negative sign of γ_p and γ_c . These results imply that Covid -19 pandemic crisis increases the negative effect of political instability on stock market returns in different. Moreover, the political instability increases the negatively impacts of negative effect of Covid-19 pandemic crisis on sectorial Stock markets returns in Tunisia.

Table 9: Estimation results with interaction of DR and IP

	Banks	BM	BCM	FS	A&P	F&B	Industrials
c_p	-0.001938	-0.0018731	-0.009511	-0.003944	-0.001673	-0.001396	-0.001723
γ_p	-0.0038*	-0.003331*	-0.00556**	-0.003035*	-0.001130	-0.00438*	-0.00662**
c_c	-.01604	-0.0255	-0.0798	-.00204	-0.03010	-.00792	-0.0065
γ_c	-.01123*	-0.0164**	-0.02832**	-.00183*	-0.02341	-.00527**	-0.0153**
ω_c	0.015618**	0.02553**	0.02996***	0.01961**	0.01445**	0.01823**	0.03651***
β_c	0.11182***	0.09873***	0.12546***	0.08982**	0.10375**	0.1138***	0.13012***
ω_p	0.025480***	0.02761***	0.0212***	0.0278***	0.02286**	0.0208**	0.0392***
β_p	0.12223***	0.07619**	0.12009***	0.10954***	0.09985**	0.1204***	0.11765***
COVID-19 Model	*DCC(α)*	0.2130***		Political Instability Model	*DCC(α)*	0.227543 ***	
	DCC(β)	0.7816***			*DCC(β)*	0.716811 ***	
	Df	26.8997***			Df	30.12098 **	
	Log likelihood	7781.143			Log likelihood	7911.622	
	AIC	-58.204			AIC	-59.550	
	SC	-57.187			SC	-61.124	
	Wald test (Khi.sq(2))	69.997***			Wald test (Khi.sq(2))	63.765 ***	

The coefficients ω_c and ω_p are significant and positive at 5% and 1% level. The coefficients β_c and β_p of interaction variables (DR_{t-1}* PI_{t-1} are positive and significant at 5% and 1% level. these findings indicate that political instability PI and COVID-19 death rate (DR) increases the Tunisian stock market returns volatilities in our two models. Indeed, the volatility of stock market returns is influenced positively by occurring only the COVID-19 or occurring political instability. But the sectorial stock market returns volatilities become higher in cases of occurring together (COVID-19 pandemic crisis and political instability). In these cases, all kind of uncertainty level become higher, and the economic conditions turn out to be unbearable which increases the fear of investors. This situation makes the decision-making task of politicians more difficult, and all economic indexes fall.

All these finding are supported by Figure 7and figure 8.

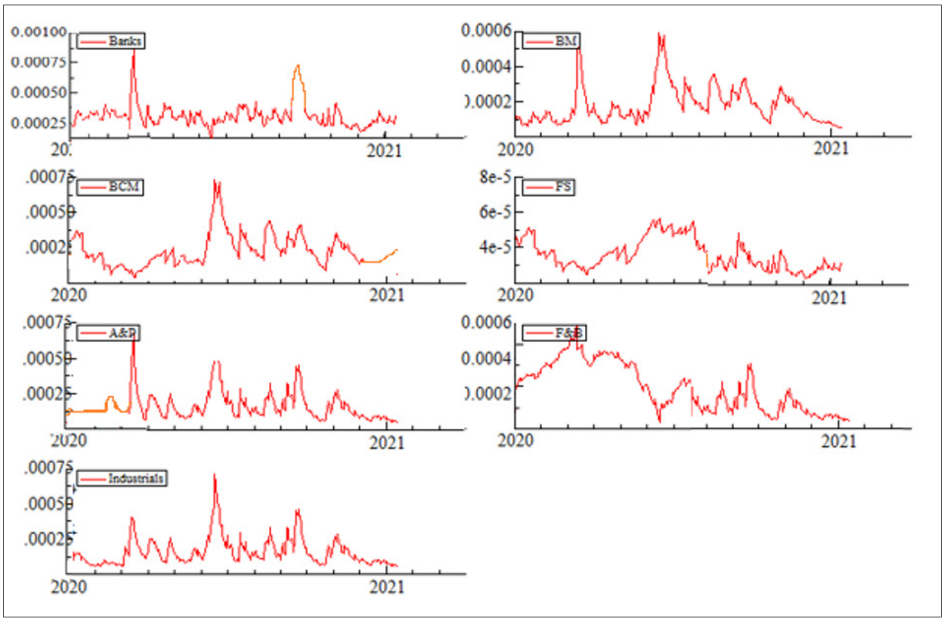

Figure 7: volatility of sectorial stock market returns with (DR*IP) interaction in Political instability model.

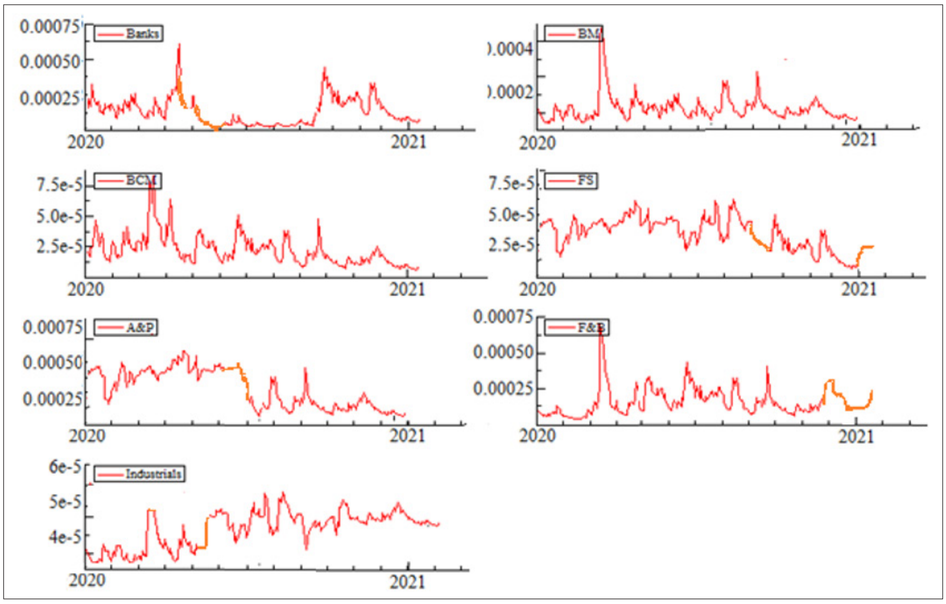

Figure 8: volatility of sectorial stock market returns with (DR*IP) interaction in COVID-19 model

Which show that the volatility of all Tunisian sector stock market returns increased all in periods? The level of volatility in all Tunisian sectors is become higher. Indeed, the high level of banks stock market returns increases from 0,0007 to 0,001, , the high level of volatility in cases of A&P , BC, BCM ,FS, F&B and Industrial take respectively 0,00075, 0,0006, 0,00075,8.10^{-5}, 0,00075, 0,00075.

With these findings we can conclude that, to reduce the uncertainty, the Tunisian policy makers must succeed in coming to an agreement at the political level or succeed in combating the New Corona virus better. Finally, it will be excellent to overcome these two big problems to renovate the economy and encourage investors [46-50] .

Conclusion

This paper is motivated firstly, by several different results of the studies which examined the influence of political instability on stock markets returns and secondly by a lack studies which examined the effect COVID-19 pandemic crisis on stock markets volatilities. The article contributes to financial literature by examining the effects of Death Rate (DR) due to novel coronavirus and significant political events on sectorial stock market returns in Tunisian. This country, since 2011, presents several social unrests and political instability due terrorist attacks, disagreement of political parties, etc. we use stock prices of seven main Tunisian sectors: Banks, Basic Materials (BM), Building Construct Materials (BCM), Financial services (FS), Automobile and Parts (A&P), Food and Beverage (F&B) and Industrials. Moreover, we estimate the DDC multivariate GJR-GARCH and we show the unconditional correlation between the different sectorial stock market returns and the level of their volatility in case of introducing PI and DR variables.

The main findings are that the political instability COVID-19 coefficients are negative and not significant in mean equation, but positive and significant in the variance equation. These results indicate that novel coronavirus and political instability variables positively influence the stock market returns volatility of the Tunisian sectors. Indeed, there is a positive link between volatility and investor's fear sentiment. Our results show that both of political instability and COVID-19 increase the stock market returns' volatility on the Tunisian sectorial stock market. However, the impact political instability on the volatility is stronger than that of the DR COVID-19 for all sectors. These findings are confirmed by the conditional volatility of different sectorial stock market returns which are higher in case of introducing PI.

Our findings are of great value for understanding how political uncertainty and pandemic crisis affect the stability of the Tunisian stock market. They are also important for both individual investors and market regulators. Results help the policy makers to understand how to improve their political performance by reducing the disagreement between parts and between different executive authorities. It can help government and private investors to improve the sanitary conditions to fight a sudden epidemic. Our findings also can help the investor how to reduce portfolio risk and increase returns.

This research can be extended by including a political stability variable (good political events). We can present this variable perhaps and hoping for the near future because sine Since 2014, the good political events are very rare. With this variable we can show how the political stability is better to reduce stock market returns volatility and reduce the investor's fear sentiments.

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