

# COVID-19 Contaminations and Forex Market: A DCC-GARCH Graphical Approach

Hamza BOUHALI (*Author*)  
Morocco

Ahmed DAHBANI (*Author*)  
Brahim DINAR (*Author*)  
Research Laboratory in Economics, Management and  
Business Administration (LAREGMA),  
Hassan 1st University, Settat, Morocco

**Abstract:-** This study investigates the impact of COVID-19 contaminations and remediation plans implemented by authorities on forex market volatility using a comparative analysis of the DCC-GARCH dynamic correlations graphs. This article has two main findings: 1. The presence of strong correlations between COVID-19 contamination and forex market volatility. 2. The macro-economic policies and sanitary mitigation strategies yielded similar outcomes regardless of each country's financial market degree of development. These results can help authorities prepare better for the upcoming COVID-19 waves.

**Keywords:-** COVID-19, Exchange Rates, Graphical Analysis.

## I. INTRODUCTION

Following the initial outbreak in Wuhan last December 2019, the spectacular scale and spread of the new Coronavirus forced (and still do) authorities worldwide to implement rounds of economically damaging lockdowns and put global supply chains to a standstill mode. The high socio-economic costs associated with the COVID-19 impact triggered extreme risk aversion. They caused a sharp liquidity squeeze across the financial markets dragging down many asset class valuations to uncharted territory. Unsurprisingly, emerging and developing financial markets suffered the most disruptions in comparison to the developed markets, as shown by various studies such as (Boris Hofmann & Shin, 2020), (Topcu & Gulal, 2020) and (Sènea, Mbengue, & Allaya, 2020). Meanwhile, the unconventional fiscal and monetary plans in the United States and Western Europe to reduce the pandemic's havoc impact on their economies and populations led to an exuberant disconnection between financial markets performance and the state of the real economy in many countries. Due to this exceptional situation in financial markets, researchers turn toward the foreign exchange rates to investigate the pandemic's impacts on the market's volatility due to its higher efficiency and transparency. (Yilmazkuday, 2020) investigated the spillover effects of U.S. monetary policy on exchange rates of many developed and emerging markets. Using the SVAR approach, the researcher found that the U.S. monetary policy during the COVID-19 pandemic had increased volatility in most studied countries. However, those results seem tautological as USD volatility (measured generally using the dollar index's volatility. DXY) is automatically transmitted to the currency pairs against the USD.

A different research line is presented by (Villarreal-Samaniego, 2020) who analyzed the impact of the global development of the COVID-19 pandemic on five emerging and frontier market currencies. The author used an ARDL model and found significant relationships between the exchange rate movements against USD and the global COVID-19 situation in Brazil and South Africa. In the same vein, (Benzid & Chebbi, 2020) tried to investigate the impact of COVID-19 on the USD exchange rates against three major currencies using the GARCH model. Their main result was that COVID 19 new cases and deaths amplify conditional volatility of the currency pairs. Similar results are also found in the study of (Iyke, 2020) for the case of a larger sample encompassing developed and emerging markets countries. That said, all those studies adopted a macro approach, comparing the global evolution of the COVID-19 pandemic to exchange rate volatility as a proxy for the financial situation of different economies. However, since this pandemic, countries have adopted various sanitary measures, ranging from limited travel restrictions to total lockdown.

This article will adopt a different approach by investigating the impact of COVID-19 contaminations and remediation plans implemented by authorities on forex market volatility using a comparative study of the DCC-GARCH dynamic correlations graphs. We will use a large sample of countries from the entire Markets spectrum (developed, emerging and frontier), significantly impacted by the COVID-19 pandemic. The two significant findings of this article are: first, dynamic solid correlations between the COVID-19 contamination and the exchange rate volatility for all the studied countries. Second, comparable macro-economic policies and sanitary mitigation strategies yielded similar outcomes regardless of each country's financial market degree of development.

The article will be organized as follows: in section 2, we present the sample Data, we then expose the methods used in our study in section 3. We give the empirical findings of this research in section 4 and the concluding remarks in section 5.

**II. DATA AND METHODOLOGY**

COVID 19 health and staggering socio-economic tolls spread worldwide, but the impact varied across the countries depending on their specific economic and financial structures. Therefore, building up an appropriate sample of nations was the priority to avoid discrepancies or biases. We selected 17 countries representing all types of economies and exchange rate regimes in the world.

The second step was to select appropriate DATA for each country; we used the daily closing exchange rates against the USD and the daily new cases count for each country from their first COVID-19 confirmed case to 31/08/2020. For the particular case of the single currency, we created a "Euro index" representing the sum of daily cases in France, Spain, Italy and Germany, which are the European countries with the highest cases so far. Also, to investigate the effect of the United states' daily confirmed cases correlation to the exchange rate behavior, we used both closing EUR/USD rates and the CBOE Volatility Index (VIX), communally known on the markets as the fear index. Furthermore, we choose the Gold spot rate as a

proxy to assess the daily COVID-19 new cases' global effect on the market's behavior.

The selected countries, the chosen currency pairs, and the data sample for each country are listed in Table I. The plot of the used times series is presented in Figures 1 and 2. To ensure stationarity is needed for GARCH family models, we will use our data's 1st difference as we found it all to be stationary at the first difference with 5% significance.

We obtained forex closing rates from the different central banks' official websites, the daily data of the VIX index from the CBOE website, and the daily COVID 19 new cases data from the European Centre for Disease Prevention and Control (ECDC) database.

Our use of the DCC-GARCH model introduced by (Engle R. F., 2002) is motivated by its high flexibility and efficiency in modeling several variables with fewer elements to define. Furthermore, the graphs of dynamic correlation evolution over time give us more insight into the forex market's behavior during each period.

	Country	Currency Pair	First Case
Developed Markets	United States	VIX	21/01/2020 31/08/2020
	Euro Index (France, Spain, Italy, and Germany)	EUR/USD	25/01/2020 31/08/2020
	Switzerland	USD/CHF	26/02/2020 31/08/2020
	United Kingdom	GBP/USD	01/02/2020 31/08/2020
	South Korea	USD/KRW	20/01/2020 31/08/2020
	Japan	USD/JPY	15/01/2020 31/08/2020
Emerging Markets	Russia	USD/RUB	01/02/2020 31/08/2020
	South Africa	USD/ZAR	06/03/2020 31/08/2020
	Brazil	USD/BRL	26/02/2020 31/08/2020
	India	USD/INR	30/01/2020 31/08/2020
	Turkey	USD/TRY	12/03/2020 31/08/2020
Frontier Markets	Morocco	USD/MAD	03/03/2020 31/08/2020
	Tunisia	USD/TND	03/03/2020 31/08/2020
	Kuwait	USD/KWD	24/02/2020 31/08/2020
	Worldwide	GOLD/USD	31/12/2019 31/08/2020

Table I Countries, currency pairs, and time samples selected for our study

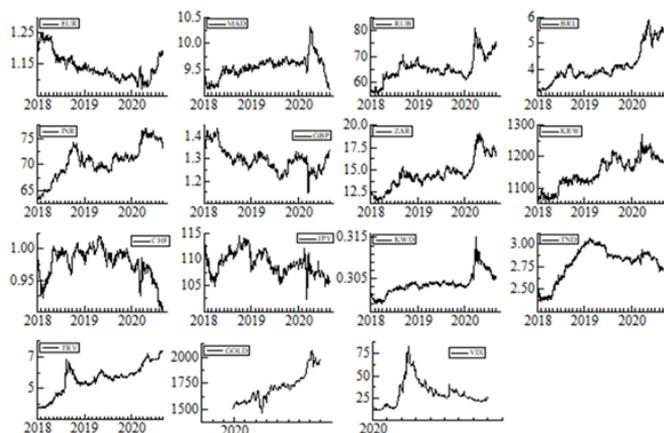


Fig 1 Daily Closing Rates for the studied countries

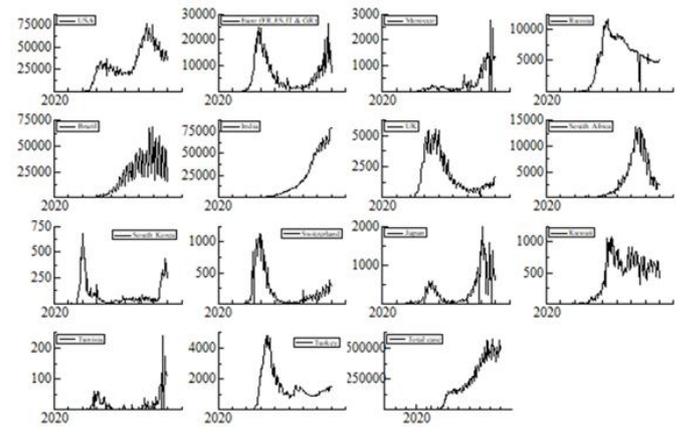


Fig 2 Daily new COVID-19 case for the studied countries

III. RESULTS

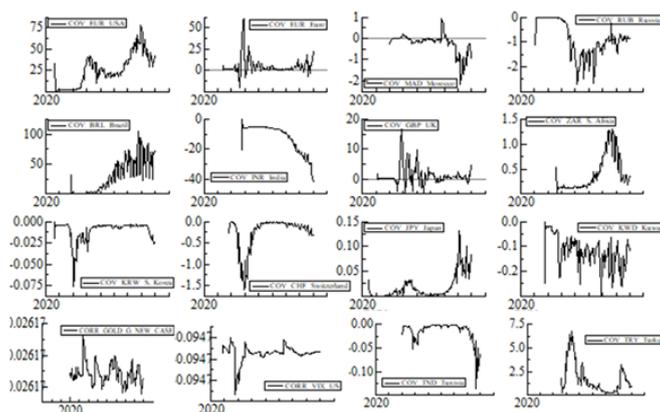


Fig 3 Dynamic correlations between daily exchange rates and daily new COVID-19 cases volatilities in the studied countries

		Index		$\beta_{dcc}$	Log-likelihood
	World cases	GOLD/USD	Value	0.81774	420.878
			Prob	0.00010	
Developed Markets	United States	EUR/USD	Value	0.82042	1135.73
			Prob	0.02450	
	VIX Index	Value	0.84735	1034.09	
		Prob	0.00090		
	Euro Index <sup>1</sup>	EUR/USD	Value	0.48825	925.404
			Prob	0.04091	
	Switzerland	USD/CHF	Value	0.75482	313.115
			Prob	0.00450	
	United Kingdom	GBP/USD	Value	0.88297	728.555
			Prob	0.00190	
South Korea	USD/KRW	Value	0.75499	296.617	
		Prob	0.00210		
Japan	USD/JPY	Value	0.78557	373.339	
		Prob	0.00000		
Emerging Markets	Russia	USD/RUB	Value	0.82753	832.053
			Prob	0.01082	
	South Africa	USD/ZAR	Value	0.80722	718.747
			Prob	0.03697	
	Brazil	USD/BRL	Value	0.77194	1042.15
Prob			0.04062		
India	USD/INR	Value	0.83186	784.209	
		Prob	0.00001		
Turkey	USD/TRY	Value	0.81555	588.39	
		Prob	0.0164		
Frontier Markets	Kuwait	USD/KWD	Value	0.82503	297.318
			Prob	0.01670	
	Tunisia	USD/TND	Value	0.84112	370.929
			Prob	0.01806	
	Morocco	USD/MAD	Value	0.76379	334.894
			Prob	0.00000	

Table 2 Results of DCC-GARCH Model for the different countries

<sup>1</sup> FR, ES, IT & GR

The DCC GARCH model results presented in Table 2 exhibit a strong dynamic correlation between the exchange rates volatilities and the new contaminations in each studied country. However, we observe different patterns on the dynamic correlations graphs plotted in Figure 3 regardless of the market segmentations. This disparity may result from the various mitigation strategies implemented by the authorities to stop the spread of COVID-19 and the heterogeneity in reactions, whether fiscal or monetary, across the countries. To further investigate these disparities in dynamic correlation reactions, we proceeded to a graphical comparison of the above-indicated correlations with the Coronavirus's contaminations patterns for the different countries regardless of their financial markets' sophistication. This analysis produced a new classification of four categories for the sample countries we will present in the following paragraphs. We will also discuss the similarities and discrepancies in each category regarding the COVID-19 contaminations trends and the policies implemented by the local authorities to face the pandemic.

#### **1<sup>st</sup> Category: Morocco & Tunisia**

Both countries recorded their first COVID-19 confirmed case on the same day: March 2, 2020, and took pre-emptive and drastic sanitary steps to halt the virus spreading. The two North African countries kept the contaminations record meager until June 2020, easing many confinement measures. This change was in response to the lockdowns' economic and social burden and led to new confirmed cases upsurge.

Both countries display a similar dynamic correlation and COVID-19 case trajectory pattern as they share identical exchange regimes and capital movement restrictions. These common characteristics allowed their respective central banks to monitor capital outflows and volatility-induced foreign exchange rates closely. Also, the two countries' fiscal and monetary policies were supportive and helped reduce the initial impact of the pandemic on their economies and populations. The central banks decreased their crucial interest rates in powerful ways, and even Moroccan monetary authorities quickly widened the foreign exchange rates band from 2,5% to 5%.

#### **2<sup>nd</sup> Category: South Korea, Switzerland, Turkey, South Africa**

This category is particular as it gathers a mix of developed and emerging countries. This diversity shows that while the coronavirus shock has not been homogenous across these countries, the outcome was similar to the dynamic correlations between exchange rate volatility and the evolution of the new confirmed cases in each country of this group.

These countries successfully monitored the course of the COVID-19 cases spreading. They deployed considerable efforts such as introducing mobile technology in tracking and tracing the infected population, systematic testing of individuals further to various containment measures implemented earlier. The dynamics that shaped the group configuration are identical across the board. Massive fiscal support to the hard-hit economic sectors and population

combined with pro-active monetary policies helped stabilize financial markets.

#### **3<sup>rd</sup> Category: Russia, India, Brazil, Kuwait**

This cluster gathered countries with large exporting capacities of commodities or services, representing the early casualties of COVID-19 economic impact. However, Kuwait is a striking case study, as the country's testing performance per capita is responsible for many Coronavirus confirmed cases when reported to its total population.

On the macro-economic front, this group has reacted similarly to ease the pandemic's socio-economic impact through the monetary policy by reducing key interest rates, relaxing macro-prudential banking rules, and easing inflow controls. The central banks pursuing managed float regimes intervened massively to support their currencies' external value, triggering large swings in forex volatilities in contrast to the second category countries, which refrained from any forex intervention.

#### **4<sup>th</sup> Category: USA, U.K., Japan, Euro area (Germany, France, Spain, Italy)**

The single category where the mismatch is undisputedly visible between the dynamic correlation patterns and the COVID-19 new cases evolution path.

Even within the same Block (Euro area) or the same country (USA), the appraisal of the COVID-19 situation is very contrasted as infection peaks were recorded in April/May 2020 in most European countries, including the U.K., where the outbreak took a relatively long time. Meanwhile, the USA, the hardest-hit country globally, represents the most problematic instance as the states' eruption was rather slow. Domestic political issues largely impacted the progress of reopening the economy.

Against this background, countries of the category instead proactively bold fiscal stimulus packages to tackle the pandemic's evolving health and economic challenges; they implemented a full range of measures to help preserve employment, businesses and support households. Their central banks embarked on unprecedented ultra-accommodative policies by aggressively slashing key interest rates, providing massive liquidity to the financial markets, and relaxing temporarily prudential rules on banks. These interventions contribute to boosting market confidence and stabilizing trading conditions.

## **IV. CONCLUDING REMARKS**

This article investigated the impact of COVID-19 contaminations and remediation plans on forex market volatility. We used an original comparative method based on a graphical analysis of the dynamic correlations graphs generated by the DCC-GARCH model.

As it's the case for many previous studies such as (Iyke, 2020), (Benzid & Chebbi, 2020) and (Villarreal-Samaniego, 2020), we found a robust dynamic correlation between the COVID-19 contamination and the exchange rate volatility for

all the studied countries. Furthermore, we proceed to graphical analysis of COVID-19 contaminations and dynamic correlations patterns to find similarities in our sample. This investigation resulted in detecting four distinct groups composed of countries with different levels of economic development. This result shows that comparable macro-economic policies and sanitary mitigation strategies yielded similar outcomes regardless of each country's financial market degree of development.

This research has an essential value for market actors and authorities worldwide. It shows that monetary and sanitary measures that proven their efficiency in developed countries have a great chance of being effective in countries with different economic structures.

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