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Looking for a safe-haven in a crisis-driven Venezuela

The Caracas stock exchange vs gold, oil and bitcoin

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Abstract

Purpose – This paper aims to find, which of the assets: gold, oil or bitcoin can be considered a safe-haven for investors in a crisis-driven Venezuela. The authors look also at the governmental change of approach towards the use and mining of cryptocurrencies being one of the assets and potential applications of bitcoin as (quasi) money.

Design/methodology/approach – The authors collected the daily data (a period from 01 May 2014 to 31 July 2018) on the development of the following magnitudes: Caracas Stock Exchange main index: *Índice Bursátil de Capitalisación* (IBC) index; gold price in US dollars, the oil price in US dollars and Bitcoin price in bolivar fuerte (VEF) (LocalBitcoins). The authors estimated a threshold VAR model between IBC and each of the possible safe-haven assets, where the trigger variable was the IBC; then the authors modelled the residuals from the TVAR model using MGARCH model with dynamic conditional correlation.

Findings – The results show that that gold is a better safe-haven than oil for Venezuelan investors, while bitcoin can be considered a weak safe haven. Still, bitcoin can perform (to a certain extent) money functions in a crisis-driven country.

Research limitations/implications – Further research after the change of local currency from VEF into bolivar soberano might be looked at on the later stage.

Practical implications – The authors provide evidence on which of analysed asset is the best safe-haven for the investors acting in the time of the crisis. The evidence goes in line with other authors' findings, thus, the results might bring implications for investors of more universal character. Additionally, the result might be helpful for governments and/or monetary authorities while projecting institutional frameworks and conducting monetary policy.

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Social implications – The unprecedented economic crisis in Venezuela was one of the factors that fuelled the mining and use of cryptocurrencies in the daily life of its citizens. Nowadays, the country is a leader in terms of the use of bitcoin and other cryptocurrencies in Latin America. The results show a potential application of bitcoin as a store of value or even means of payments in Venezuelan (or in other countries affected by the crisis).

Originality/value – The paper builds on the original data set collected by the authors and brings evidence from the models the authors constructed to verify, which asset is the best option for investors in hard times of the crisis. The authors add to the existing literature on financial assets, cryptocurrencies and behaviour of investors under different economic conditions.

Keywords Crisis, Bitcoin, Gold, Venezuela, Oil, Safe haven, TVAR model

Paper type Research paper

1. Introduction

Venezuela has been facing the effects of a crisis on an unprecedented scale. The country is trying to respond to the humanitarian crisis and also to mitigate the risks for investors present on the Caracas Stock Exchange (Bolsa de Valores de Caracas). These investors have several options for allocating their capital.

The aim of the article is to find, which assets, gold, oil or bitcoin, can be considered a safe haven for investors in a crisis-driven Venezuela. We look also at the governmental change of approach towards the use and mining of cryptocurrencies as one of the assets.

The study we apply is a threshold VAR model between the stock index and each of the possible safe-haven assets, where the trigger variable was the stock index. We allowed for three regimes, separating periods of extreme upward and downward movement of the index, as well as its "moderate" behaviour. In this way, we can analyse whether the relationships between the Caracas Stock Exchange main index (further, namely *Índice Bursátil de Capitalisación* (IBC) index) and the safe-haven candidates vary in different market conditions. A safe-haven asset should also have low volatility and no volatility spillovers between the assets should be observed. Therefore, to explore the interdependencies in volatility, we model the residuals with the cDCC-GARCH model. Our study covers daily data between 2014 and 2018, as in August 2018, Venezuela changed its currency from bolivar fuerte (VEF) to bolivar soberano (VES).

The results show that gold is still the best safe-haven asset. Moreover, they suggest that bitcoin – under certain specific conditions – could in fact have become an alternative store of value, used on an everyday basis. This evidence goes in line with other authors' findings (Johnson, 2019a, 2019b), who showed that bitcoin trading was used as a survival technique. This may, therefore, suggest implications that are more universal in character, i.e. that cryptocurrencies may play a very different role for investors from countries with worthless fiat currency (or those dealing with hyperinflation), than for investors from stable economies who mostly use it for speculation purposes. This concerns mainly the application of bitcoin (or other cryptocurrencies) to take on the functions of money.

We add to the existing literature on the effect of financial assets, cryptocurrencies and the use of big data and modern technologies such as blockchain on the behaviour of investors under different economic conditions (Sicilia and Visvizi, 2019; Park *et al.*, 2019). The paper is structured as follows. Section 2 analyses the economic situation in Venezuela. Section 3 provides a literature review. In the following Section 4, we describe the methodology used in the study and later on the results. In Section 5, we discuss our results. Section 6 concludes.

2. Economic situation in Venezuela

Venezuela is a South American country characterised by a non-market economy. According to the World Bank (2019), Venezuela has been facing the worst crisis in the history of the

Latin America region. According to estimates, the country will face a drop in the gross domestic product (GDP) of 25 per cent in 2019, following on from a drop of 17.7 per cent in 2018, which in total adds up to a 60 per cent fall in GDP since 2013.

Previously, Venezuela was one of the richest countries in Latin America, with the biggest oil reserves in the world, fertile land and mineral reserves (such as gold). Oil accounted for 96 per cent of Venezuelan GDP and fluctuations in oil prices have contributed to the huge drop in GDP since 2013 (IMF, Mu and Hu, 2018). However, it was income inequalities (as across the whole region) that were one of the main developmental problems (Musiałowska, 2016; Torres, 2019). In the 1980s and 1990s, the country had several *coups d'état*, but it was not until 1992 that Hugo Chavez and the army led the first successful *coup d'état*. This led to the fall of the government in 1993 and brought Mr Chavez's presidential election victory in 1998. As president, Mr Chavez re-introduced twenty-first-century socialism ("el chavismo"). The history behind the current and most severe Venezuelan crisis is, therefore, deeply rooted in the 1990s, when the country's economy started to transform into a socialist economic model. Up until 2014, 90 per cent of the country's export earnings had come from oil, while in 2015 over 60 per cent of government revenues depended on the oil industry (Mu and Hu, 2018) in Kliber and Ś wierczyńska (2019). Plummeting oil revenues and years of government mismanagement led to the country's economic situation worsening dramatically (in terms of the level of GDP, trade, the balance of payments and gross value added, see Table I), which, finally, led to a humanitarian crisis. The Government of Nicolás Maduro declared a state of

Main economic indices	2005	2010	2018
GDP: gross domestic product (million current US$)	145,514	393,806	291,376e
GDP growth rate (annual %, const. 2010 prices)	10.3	−1.5	−16.5[e]
GDP per capita (current US$)	5,433.0	13,566.0	9,230.0[e]
Economy: agriculture (% of gross value added)	4	5.7	5.6[e]
Economy: industry (% of gross value added)	56.9	51	39.2[e]
Economy: services and other activity (% of GVA)	39.2	43.4	55.3[e]
Employment in agriculture[f] (% of used)	9.8	9.1	10
Employment in industry[f] (% of used)	21	23.9	23.6
Employment in services[f] (% used)	69.3	67	66.4
Unemployment rate (% of labour force)	11.4	8.4	7.7f
Labour force participation rate[f] (female/male pop. %)	49.7/80.6	50.6/79.3	50.4/77.3
CPI: consumer price index[g] (2010 = 100)	. . .	100	772[b]
Agricultural production index (2004-2006 = 100)	101	111	109[e]
International trade: exports (million current US$)	55,413	66,963	11,563f'd
International trade: imports (million current US$)	21,848	32,343	6,771f'd
International trade: balance (million current US$)	33,565	34,620	4,792f'd
Balance of payments and current account (million US$)	25,447[h]	5,585	− 3,870e
Social, environment and infrastructure indicators			
	2005	2010	2018
Individuals using the internet (per 100 inhabitants)	12.6	37.4[f]	60[fe]
CO_2 emission estimates (million tons/tons per capita)	165.1/6.2	189.1/6.5	185.2/6.1p
Energy production and primary (Petajoules)	8,283	8,139	7,337b
Energy supply per capita (gigajoules)	103	111	79b

Notes: Legend [b]2015; [d]2017; [e]2016; [f]estimate, [h]break in time series and [p]2014 United Nations (2019), http://data.un.org/en/iso/ve.html Retrieved 04 April 2019

Table I. Main economic, social, environment and infrastructure indicators for Venezuela 2005-2018 emergency in 2016, a year when the inflation rate reached 800 per cent. By 2018, the inflation rate was an estimated 80,000 per cent (Carmody, 2019).

In response to the crisis, Venezuelans started to trade US dollars on the black market and to invest in cryptocurrencies, which was made possible by the extremely low cost of both electricity and access to the internet (Table I). About a year after oil production fell, with economic and social consequences this entailed, the crisis deepened due to, for example, US sanctions (such as difficult access to credit due to the drop in the value of the national currency) and the Venezuelan Government started to acquire gold from citizens and begin selling it abroad to Turkey or the UAE (Pons and Armas, 2019).

According to Kliber and Ś wierczyńska (2019), there were several factors, mostly state-driven, which created the conditions for the rise of the cryptocurrency market during the economic turmoil in Venezuela. The socialist regime of President Maduro subsidised electricity so heavily that it essentially became free (Chun, 2017), which resulted in bitcoin mining turning out to be an investment at almost no cost. In 2016, bitcoin and other cryptocurrency mining was banned; however, bitcoin trading was legal. With the launch in 2018 of the national cryptocurrency – Petro – backed by Venezuela's oil reserves, the mining of cryptocurrencies became legal again (Suberg, 2018). The extreme economic conditions, in particular hyperinflation, fuelled the emergence of electronic exchanges that enabled Venezuelans to use cryptocurrencies in everyday life, even to buy groceries (Helms, 2019) in Kliber and Ś wierczyńska (2019). Venezuela is nowadays the leader in cryptocurrency investment in Latin America.

3. Literature review

Looking from the investor perspective, the essential in creating a portfolio is to minimise risk by including various instruments, which are likely to react in a different way to changing market conditions. A safe haven is an asset, which is negatively correlated with the main asset during an economic downturn. The presence of such assets in a portfolio allows an investor to overcome possible losses in times of market turbulence.

In our study, we aim to look for such an asset – or group of assets – in crisis-driven Venezuela and try to answer, which one from among bitcoin, gold or oil performs the function of a safe haven asset the best.

Traditionally, gold is an asset, which considered a safe haven during periods of market crisis. Various authors have proved this using different modelling techniques. Baur and Lucey (2010) calculated a regression model for the returns of gold and concluded that gold can be treated as a safe haven asset. An analysis of the causality between gold and stock market returns in six countries, conducted by Anand and Madhogaria (2012), also confirmed that gold may serve as a safe-haven asset. Coudert and Raymond-Feingold (2011) applied a bivariate ARMA-GARCH-X model to estimate conditional covariances between gold and stock returns (based on date from France, Germany, the UK, the USA and the G7) and found that gold qualifies as a safe haven against all these stock indexes. Further, Mensi *et al.* (2018) suggested that gold can act as a safe-haven asset in the BRICS to counteract extreme market movements. El Hedi Arouri *et al.* (2015) claimed that past gold returns play a crucial role in explaining the dynamics of conditional returns and the volatility of the Chinese stock market and found that gold serves as a safe haven for stocks on Chinese stock markets. Liu *et al.* (2016) also claimed that when stock markets crash, gold can be used as a safe-haven asset in most countries.

The possibility of treating oil as a safe haven is not equally evident based on the literature. The results of Mensi *et al.* (2018) indicate that the BRICS index returns co-move with the WTI crude oil price at low frequencies (long horizons) and that a strong level of co-movement was particularly evident during the onset of the global financial crisis. Yang *et al.* (2018) investigated the dependence structures between six Chinese stock markets and the international financial market, including possible safe-haven assets and global economic factors under different market conditions and investment horizons. They found that not only is crude oil not a safe haven but also that it may damage Chinese stock markets as it increases in price over the long term, even in bull markets. Based on the Pakistani market experience in the global financial crisis of 2007-2009, Hanif *et al.* (2017) found a positive trend in correlations between oil-stock pairs, suggesting there was no portfolio diversification benefit to oil when this was added to a stock portfolio. Furthermore, due to the volatility of the international oil price, this is expected to have a direct effect on Venezuela's economic performance. Venezuela is a major oil producer, with the largest known oil resources in the world, therefore, we decided to conduct an empirical analysis of the investment properties of this commodity.

Many authors have analysed the problem of whether bitcoin can be considered a safe-haven asset. The opinion of different scholars on the investment properties of bitcoin varies, depending on the portfolio composition (stock indices, commodities, oil, etc.), data frequency (daily or weekly) and time span. Bouri *et al.* (2018) found that Bitcoin can act as a safe haven against global financial stress. Some researchers suggest that cryptocurrencies reduce risks if included in asset portfolios (Guesmi *et al.*, 2018; Symitsi and Chalvatzis, 2019). On the other hand, Symitsi and Chalvatzis (2019) note that the decrease in the overall portfolio risk due to the low correlation of bitcoin with other assets is not offset by its high volatility. Klein *et al.* (2018) or Baur *et al.* (2018) strongly reject the hypothesis that bitcoin can serve as a safe-haven asset and disagree that it is similar to gold. Smales (2019) points out liquidity problems, transaction costs and the time required to execute transactions, which disqualify bitcoin from being a safe haven asset. Kliber *et al.* (2019) and Kliber and Ś wierczyńska (2019) claim that bitcoin can act as a safe haven only in a crisis-driven country such as Venezuela when investment in local currency is analysed.

4. Data, model and methodology

4.1 Data

We collected data on changes to the following magnitudes:

- Caracas Stock Exchange main index: IBC index;
- gold price in US dollars;
- oil price in US dollars; and
- bitcoin price in VEF (LocalBitcoins).

The data was collected daily and covered the period 01 May 2014 to 31 July 2018. The reason for ending the sample in June 2018 was that on the 20th of August 2018 the official currency of Venezuela, the VEF was replaced by the VES.

The IBC index is the principal and most important index of the Caracas Stock Exchange. It lists the 11 largest companies by capitalisation and liquidity on the Venezuelan stock market (source: the webpage of the Caracas Stock Exchange). The companies included in the index are chosen based on their capitalisation and liquidity. Thus, the IBC includes companies from the banking and financial sector (Banco Nacional de Crédito, Banco Provincial, Mercantil Servicios Financieros A and Mercantil Servicios Financieros B), the real estate market (Fondo de Valores Inmobiliarios Clase B), chemical companies (Corimon A), a telephone service enterprise (CANTV), an energy company (Electricidad de Caracas), a steel producer (Sivensa) and manufacturers of tinplate cans and lids (envases Venezolanos and Manpa). When the IBC was first launched, it originally consisted of 15 Venezuelan companies. However, as then, four companies have been removed due to a variety of reasons including closure, bankruptcy and nationalisation (https://capital.com/ndice-burs-til-caracas-definition). Mavesa was acquired by Empresas Polar in 2001, Sudamtex went bankrupt in 2003 (Italiani and Omana, 2017), as did Venepal in 2004, while Vencemos was nationalised in 2008. None of these events happened during the period covered by our analysis.

In Figure 1 we present the dynamics of the IBC index – the prices and log returns. We can see that due to hyperinflation the prices exploded, starting from mid-2017. In nominal terms, the IBC index seemed to be the best performing index in the world – however, it was classified as 2018s worst stock market performer in dollar terms – Rapoza (2019). To re-calculate the actual price of the index, one would need to adjust for the drop in the bolivar. However, this is impossible due to the fact that the Venezuelan Government stopped publishing regular inflation data in 2017 (McKay, 2017). The IMF reported that the inflation rate for 2018 reached 929,790 per cent (Dube, 2019). Moreover, the Government of Venezuela controls the currency and the exchange rate of the bolivar to the US dollar has been officially fixed.

In Figures 2-4 the dynamics of the trading prices in the bolivar of gold, oil and bitcoin are presented, respectively. In the case of bitcoin, we also show the volume of trade, which had its peak in 2017. In Table II we present descriptive statistics of the data used in the study (stationary log returns). We note some similarities between the IBC and BTC series as follows: their mean exceeded the median, the maximum and minimum values were much higher when compared to the analogous measures of gold and oil and the highest in the case of bitcoin. Finally, we observe very high kurtosis in IBC and BTC. All the observations suggest the existence of extreme outliers in the data.

4.2 The model

A safe haven asset is an asset that holds its value in adverse market conditions, offering investors the opportunity to protect wealth. The way of testing safe-haven

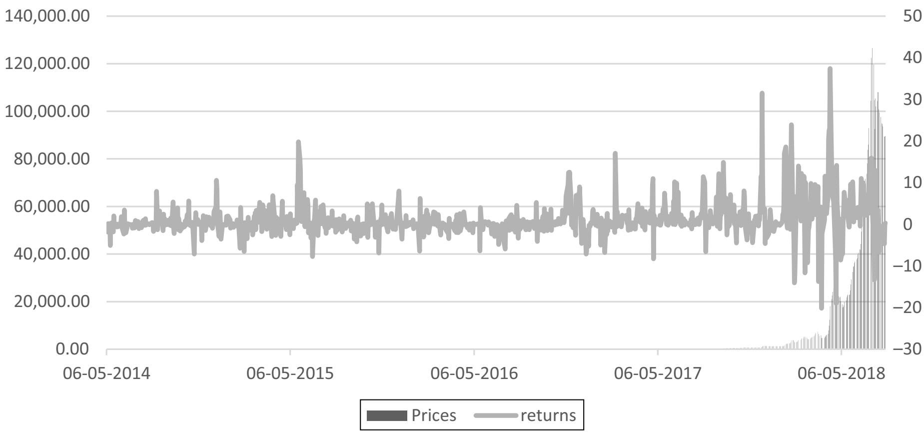
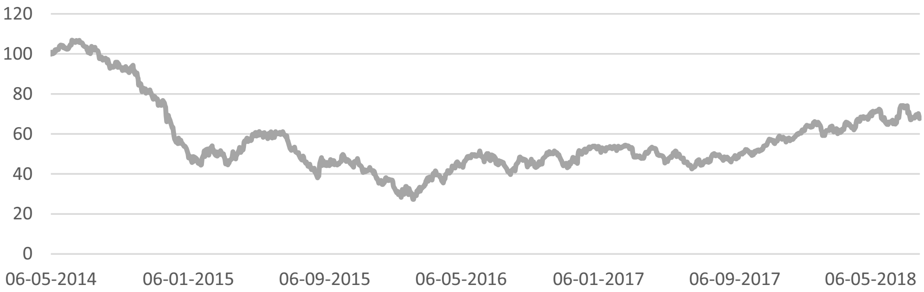


Figure 1.
Prices and returns of the IBC index

Source: CEIC Database

Source: Database stooq.pl

Figure 2. Evolution of gold prices in US dollars over 2014-2018



Source: Database stooq.pl

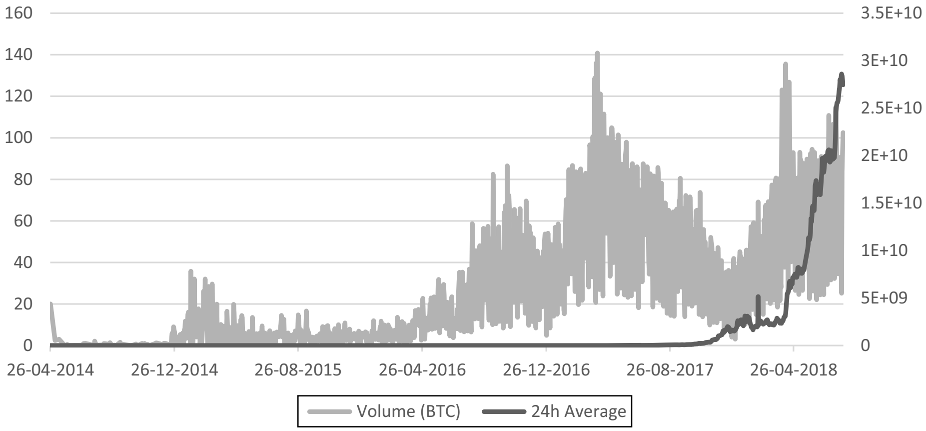
Figure 3. Evolution of oil prices in US dollars over 2014-2018

assets varies among scholars. Some researchers concentrate on the returns of the underlying asset and regress the returns of the possible safe-haven asset on the extreme returns of the stock exchange index while modelling the returns from such regression through GARCH-type models (Baur and Lucey, 2010). Others concentrate on modelling the conditional correlation between the stock exchange index and a possible safe-haven asset and check the direction of its changes when extreme returns in the investigating market occur (Bouri *et al.*, 2017b).

As many researchers stress, the fact that bitcoin cannot be treated as a safe haven asset is due to its volatility and low liquidity (Smales, 2019), therefore, in our approach we tested for two characteristics as follows:

(1) whether the dependencies in the conditional mean between the pair of assets change together with the change in the market conditions; and
(2) whether there exists any interrelationship in volatility between the assets.

To verify the first of the above-mentioned features, we estimated a threshold VAR model between IBC and each of the possible safe-haven assets, where the trigger variable was the IBC. We allowed for three regimes that were estimated in the model based on the dynamics



Source: localbitcoins

Figure 4. 24 h average price (right axis) and volume (left axis) of bitcoin trade in bolivars

Table II. Descriptive statistics of the data used in the study

	IBC	BTC	OIL	GOLD
Mean	1.06	1.43	−0.04	−0.01
Standard deviation	4.05	7.73	2.2	0.82
Minimum	−20.16	−86.05	−8.6	−3.3
Q1	−0.4	−1.57	−1.33	−0.46
Median	0.19	0.8	0	−0.01
Q3	1.91	3.79	1.21	0.41
Maximum	37.41	92.62	9.78	4.87
Skewness	2.12	1.23	0.11	0.32
Kurtosis	13.86	31.69	1.41	2.96

Notes: the statistics are computed for the log-returns of the data
Source: Authors

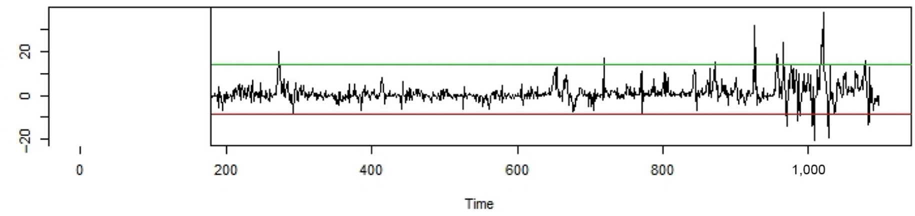
of the IBC. In this part, we could verify whether the estimated regimes corresponded to the extreme up and down movement of the IBC, as well as to its "moderate" behaviour and whether the relationship with the safe-haven candidate changed in the regimes. In the second part of the research, we modelled the residuals from the TVAR model using the MGARCH model with a dynamic conditional correlation.

4.3 Dependencies in the conditional mean in different market conditions

To verify, which asset could have served as a safe haven over the period 2014-2018 in Venezuela we estimated a TVAR – MSV model for each pair, namely, IBC and gold, IBC and oil and IBC and BTC. In each case, we allowed for three regimes that were estimated based upon the data. The threshold variable was IBD. In Figures 5-7 we present the values of the thresholds θ obtained for each data pair. In each case, we checked whether the nature of the relationships changed together with the change of the regime. The estimated TVAR model looks as follows:

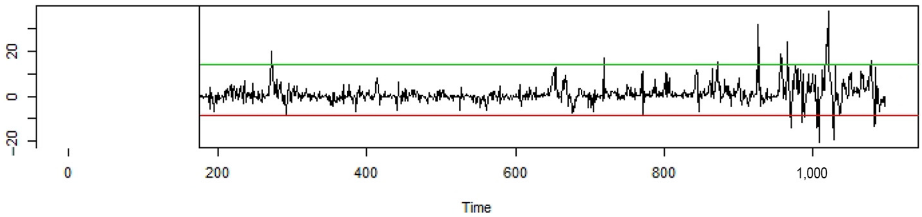
$$Y_t = \begin{cases} \alpha_1^1 + \alpha_2^1 Y_{t-1} + u_{1,t}, & \theta \le \theta_1 \\ \alpha_1^2 + \alpha_2^2 Y_{t-1} + u_{2,t}, & \theta_1 < \theta \le \theta_2 \\ \alpha_1^3 + \alpha_2^3 Y_{t-1} + u_{3,t}, & \theta > \theta_2 \end{cases}$$

where $Y_t = \begin{bmatrix} GOLD_t \\ IBC_t \end{bmatrix}$, $Y_t = \begin{bmatrix} OIL_t \\ IBC_t \end{bmatrix}$ or $Y_t = \begin{bmatrix} BTC_t \\ IBC_t \end{bmatrix}$ in the case of (1), (2), (3), respectively. To estimate the model, we used the package tsDyn of R. The model was estimated through maximizing the loglikelihood function and the optimal number of lags was chosen based on the BIC information criterion.



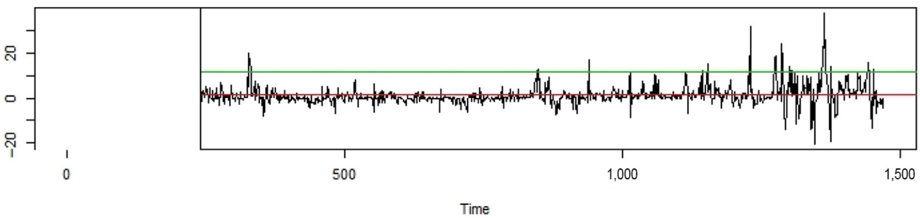
Source: Authors

Figure 5. Threshold values for the TVAR model between IBC and GOLD



Source: Authors

Figure 6. Threshold values for the TVAR model between IBC and OIL



Source: Authors

Figure 7. Threshold values for the TVAR model between IBC and VEF-BTC (LocalBitcoins)

4.4 Dependencies in conditional variance

Having estimated the model, we collected the residuals and estimated the models of conditional variance. In each case, we estimated the Aielli (2013) asymmetric dynamic conditional correlation model, cADCC. In the model, it is assumed that the residuals follow the so-called GARCH process, i.e. can be decomposed as:

$$u_{i,t} = \epsilon_{i,t}\sqrt{h_{i,t}},$$

where

$$\epsilon_{i,t} \sim iid(0,\ 1)$$

and

$$h_{i,t} = \ \omega_i + \alpha_i u_{i,t-1}^2 + \beta_i h_{i,t-1}$$

follow the GARCH (1, 1) equation (Bollerslev, 1986). In our study, apart from the GARCH (1, 1) specification, we also use the APARCH (1, 1) (Ding *et al.*, 1993) as follows:

$$h_{it} = \omega_i + \alpha_i\left(|u_{t-1}| - \gamma_i u_{t-1}\right)^{\delta} + \beta_i h_{t-1}^{\delta}$$

The cDCC correlation process is defined as follows:

$$\rho_{ij,t} = \frac{(1-a_{ij}-b_{ij})s_{ij,t-1} + a_{ij}\epsilon_{i,t-1}\epsilon_{j,t-1} + b_{ij}\rho_{ij,t-1}}{\sqrt{\left[(1-a_{ii}-b_{ii})s_{ii,t-1} + a_{ii}\epsilon_{i,t-1}^2 + b_{ii}\rho_{ii,t-1}\right]\cdot\left[(1-a_{jj}-b_{jj})s_{jj,t-1} + a_{jj}\epsilon_{i,t-1}^2 + b_{jj}\rho_{jj,t-1}\right]}},$$

$$s_{ij,t} = \frac{s_{ij}}{\sqrt{q_{it}q_{jt}}},$$

$$q_{it} = (1-a_{ii}-b_{ii}) + a_{ii}\epsilon_{i,t-1}^2 q_{i,t-1} + b_{ii}q_{i,t-1}.$$

For further details see Aielli (2013). The equation of conditional correlation can be modified so as to allow it to give an asymmetric reaction to positive and negative shocks – similar to the GJR model (Glosten *et al.*, 1993). The asymmetric model was estimated for the pairs of gold-IBC and oil-IBC.

We stored the values of correlation, even if the model suggested constant relationships (as in the case of gold and oil). Next, following Bouri *et al.* (2017b), we regressed the obtained conditional correlation on the binary variables – taking one in the case of the high regime and one for the low regime (separately).

We decide that an asset can be a safe haven if the regimes estimated in the first step clearly distinguish between the high and low IBC regime. Furthermore, the correlation between volatilities should be insignificantly different from zero, denoting no possibility of spillovers in conditional variance. Eventually, during the period of distress, we should observe a drop in the correlation.

5. Results

In Figures 5-7 we present the results of the threshold estimates. In the case of IBC and gold, as well as IBC and oil, we observe that the upper and lower thresholds indeed cover the extreme IBC movements – respectively, jumps and drops. The middle regime covers the "average" changes of the index. We observe that the most extreme upward and downward movements took place in the final part of the sample covering the years 2017 and 2018 (the hyperinflation period).

In contrast, the regimes estimated for the pair IBC-bitcoin are shifted when compared to the two previous cases. The "lower" and "middle" regimes contain a similar number of observations, while the "upper" one covers the highest jumps of the IBC. We can suppose that this model correctly identifies the period of hyperinflation.

In Tables III and IV, we present the estimates of the TVAR model. In the case of gold and oil, we can see that it is only changed to the IBC that depend on changes to the other asset, not the other way around – which is a sound conclusion. Moreover, in the lower and upper regime, the changes to the IBC were inversely correlated with the changes to gold (i.e. increases in gold were followed by declines in the IBC and declines in gold by increases in the IBC). As in the period of distress we observed not only declines but also increases in the IBC, this result supports the thesis that gold could have been a safe haven asset in Venezuela in the period analysed. What is interesting is that in the "normal" situation, no interrelations between the assets were observed.

Similar results were obtained for the pair as follows: IBC-oil, but only in the lower regime. In the upper one, the assets were positively correlated. The strength of relationships in the lower regime, measured by the p-value, was weaker in the case of the IBC-oil pair than in the analogous regime of the IBC-gold pair.

Finally, the results presented in Table V for the pair IBC-BTC are somewhat puzzling. First of all, the intercept in the upper regime is negative, while in the lower

Intercept	Intercept	Gold (−1)	IBC (−1)
Regime (1)			
(IBC ≤ − 8.583)			
Gold	0.8922	−0.0580	0.093
(t-stat)	(0.9132)	(0.2633)	(0.0679)
IBC	*−14.4641*	*−2.2891*	*−1.0326*
(t-stat)	(3.9640)***	(1.1431)*	(0.2947)***
Regime (2)			
(−8.583; 14.16)			
Gold	0.0141	−0.0297	−0.0158
(t-stat)	−0.0261	−0.0305	(0.0083).
IBC	*0.463*	−0.1319	*0.4367*
(t-stat)	(0.1132)***	(0.1325)	(0.0361)***
Regime (3)			
(IBC ≥ 14.16)			
Gold	−0.2202	−0.2805	0.0012
(t-stat)	(0.6960)	(−0.3168)	(0.0330)
IBC	*8.6207*	*−3.6737*	*0.2752*
(t-stat)	(3.0213)**	(1.3750)**	(0.1431)

Source: Authors

Table III. TVAR model estimates: Gold and IBC

	Intercept	Oil (−1)	IBC (−1)
Regime (1)			
(IBC < −8.583)			
OIL	0.3264	0.0893	0.0889
(*t*-stat)	(2.4685)	(0.3056)	(−0.1838)
IBC	−15.5453	−0.9449	−1.1372
(*t*-stat)	(3.9792)***	(0.4926)	(0.2962)***
Regime (2)			
(−8.583; 14.161)			
OIL	−0.0389	0.0484	0.0149
(*t*-stat)	(0.0703)	(0.0305)	(0.0224)
IBC	0.4633	0.0203	0.4381
(*t* stat)	(0.1134)***	(0.0492)	(0.0361)***
Regime (3)			
IBC > 14.161			
OIL	0.03252	0.2522	0.0317
(*t*-stat)	(1.8777)	(0.4110)	(0.0889)
IBC	8.649	1.42	0.2446
(*t*-stat)	(3.0269)**	(0.6625)*	(0.1433)

Source: Authors

Table IV. TVAR model estimates: Oil and IBC

Regime (1)		Intercept	BTC (−1)	IBC (−1)
low	BTC	*0.9764*	*0.4225*	0.1081
IBC ≤ 1.239	(*t*-stat)	*(0.2384)****	*(0.0307)****	(0.1090)
	IBC	0.042	0.0082	*0.2919*
	(*t*-stat)	(−0.1033)	(0.0133)	*(0.0473)****
Regime (2)	BTC	*1.6066*	0.0578	0.0089
middle	(*t*-stat)	*(0.6108)***	(0.0445)	(0.1294)
(1.24; 11.65)	IBC	0.3292	*0.0558*	*0.6592*
	(*t*-stat)	(0.2647)	*(0.0193)***	*(0.0561)****
Regime (3)	BTC	*−11.9503*	*−0.7367*	*0.7837*
high	(*t*-stat)	*(4.0275)***	*(0.0716)****	*(0.2126)****
IBC > 11.56	IBC	*−5.5108*	−0.0052	*1.0258*
	(*t*-stat)	*(1.7456)***	(0.0310)	*(0.0921)****

Source: Authors

Table V. TVAR model estimates: BTC (VEF) and IBC

one it is positive. As the threshold variable was lagged by one day, we can read this result as evidence of very high volatility in the upper regime, as the high values of IBC were immediately followed by deep declines. Moreover, in the lower regime, no dependence between the variables was identified. In the middle regime, the variables changed in the same direction, while in the upper (crisis) one – changes in bitcoin prices seemed to follow the changes to the IBC but also in the same direction. Thus, bitcoin (traded in bolivars) could have served as a diversifier and an additional means of generating earnings rather than as a safe haven asset.

5.1 Dynamic conditional correlation

In the following step of the research, we investigated the dependencies in the conditional variances of each pair. In each case, we estimated the asymmetric version of the Aielli (2013) cDCC model. Only in the case of the pair IBC-BTC were the coefficients of correlation significant, denoting that the relationships between the assets moved during the period of the research more than only in moments of extreme jumps.

In the case of gold and IBC (Table VI), we observe no dependencies in volatility during normal times. We performed two conditional correlation tests – one Tse (2000) test and one Engle and Sheppard (2001) test. As the two tests gave different conclusions, we decided to verify whether during short extreme market movements no changes in correlation could be observed. This was done by estimating the regression equation with the dummy variable of the IBC in the upper or lower regime Table VI and Figure 8.

In Table VII we present the estimates of the model for the pair oil-IBC. The situation was similar in that the results of the two CCC tests were ambiguous. The alpha parameter in the conditional correlation equation was insignificant. However, the gamma parameter indicating a stronger reaction to negative news was significant at 10 per cent with a p-value of 0.08 Figure 9.

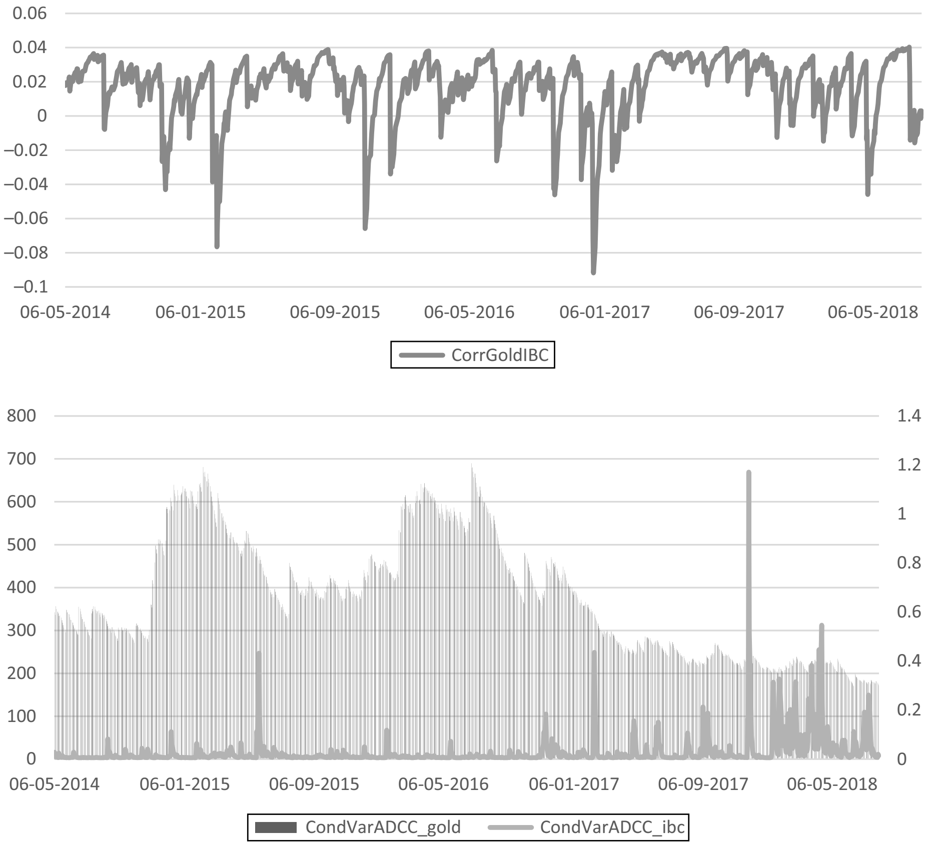
To finish with, in the case of the pair BTC-IBC (Table VIII), we can say that the correlation changed dynamically over the whole period of analysis. As parameter γ in the conditional correlation equation proved to be insignificant, we estimated a cDCC model without asymmetry. However, the asymmetry itself was present in the univariate GARCH models, indicating that the volatilities of both assets reacted more strongly to bad news.

To summarise, we can conclude that in the case of gold and oil we observe no significant dependencies in volatility with the IBC. Moreover, the volatilities of the assets were much smaller than the volatilities of the IBC (Figure 10). These characteristics qualify them to be good candidates for safe-haven assets. In contrast, during the whole period of analysis, there

Parameter	Coefficient	Std error	t-statistics	p-value
Unvariate GARCH equation for Gold				
ω	0.001	0.002	0.323	0.747
ARCH(α)	0.018	0.010	1.908	0.057
GARCH(β)	0.982	0.008	117.200	0.000
APARCH(γ)	0.143	0.241	0.593	0.553
APARCH(δ)	1.809	0.519	3.484	0.001
Univariate GARCH equation for IBC				
ω	2.226	1.358	1.639	0.101
ARCH(α)	0.553	0.211	2.621	0.009
GARCH(β)	0.379	0.125	3.036	0.003
APARCH(γ)	−0.189	0.086	−2.194	0.028
APARCH(δ)	2.178	0.583	3.734	0.000
Dynamic conditional correlation equation				
a	0.000	0.018	0.000	1.000
b	0.905	0.056	16.040	0.000
γ	−0.019	0.032	−0.589	0.556
df	4.360	0.275	15.870	0.000

Source: Authors

Table VI. Estimates of the cADCC model for the pair GOLD-IBC



Source: Authors

Figure 8. Volatility of IBC and gold (lower panel) and a conditional correlation between the assets (upper panel)Source: Authors.

was a significant risk of volatility transmission between the BTC and IBC, while their volatilities were of similar magnitudes.

5.2 Influence of the Índice Bursátil de Capitalisación regime on correlation behaviour

In the last step of the analysis, we regressed the obtained correlation coefficients on the dummy variables indicating the state of the IBC (high or low). The results are presented in Table IX. We observe that in all the cases when the IBC was in its low regime, the correlation with the second asset of the pair diminished. However, the *p*-value of the coefficient was the highest in the case of the BTC. No such dependencies were present in the high regime (the respective coefficients were positive and significant).

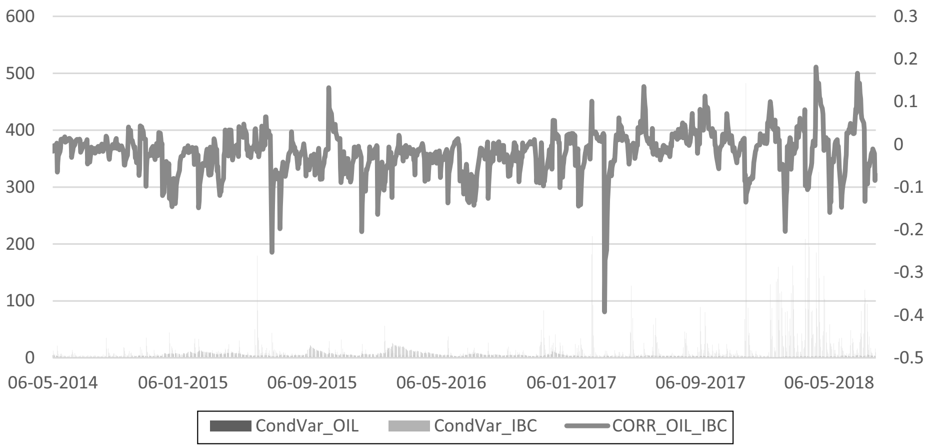
6. Conclusions

Due to hyperinflation, bolivars became practically useless. At the same time, the government encouraged investors to invest in gold (Alex, 2018). Moreover, the state started to pay a premium above international prices to make it worthwhile for those who could

Parameter	Coefficient	Std error	*t*-statistics	*p*-value
Unvariate GARCH equation for oil				
ω	0.065	0.031	2.111	0.035
ARCH(α)	0.084	0.016	5.084	0.000
GARCH(β)	0.904	0.018	49.820	0.000
Univariate GARCH equation for IBC				
ω	1.761	0.492	3.582	0.000
ARCH(α)	0.586	0.183	3.203	0.001
GARCH(β)	0.404	0.103	3.924	0.000
Dynamic conditional correlation equation				
a	0.028	0.038	0.727	0.468
b	0.821	0.199	4.125	0.000
γ	−0.074	0.042	−1.735	0.083
df	5.352	0.457	11.710	0.000

Source: Authors

Table VII. Estimates of the cADCC model for the pair Oil-IBC



Source: Authors

Figure 9. Volatility of IBC and oil (left axis) and a conditional correlation between the assets (right axis)

smuggle gold out of the country to exchange it for dollars (Business Today, 2019). Gradually, instead of using bolivars, Venezuelans started to pay in dollars, which in fact has two exchange rates – an official one and a black market one. Bitcoin also became an alternative. The popularity of bitcoin in Venezuela boomed when prices of energy were so low that the mining of cryptocurrencies became practically cost-free. After the ban on bitcoin mining, Venezuelans were still able to exchange it on electronic platforms. LocalBitcoins was the first to offer trade-in local currency and in the local language. We observe that the approach of the government towards the use of cryptocurrencies has changed over a period of time analysed. This change may also have been driven by fear of a further worsening of the country's reputation among investors.

Table VIII.
Estimates of the cADCC model for the pair BTC-IBC

Parameter	Coefficient	Std error	*t*-statistics	*p*-value
Unvariate GARCH equation for BTC				
ω	0.185	0.282	0.654	0.513
ARCH(α)	0.217	0.069	3.158	0.002
GARCH(β)	0.822	0.088	9.373	0.000
APARCH(γ)	−0.175	0.078	−2.247	0.025
APARCH(δ)	1.075	0.241	4.471	0.000
Univariate GARCH equation for IBC				
ω	1.217	0.545	2.235	0.026
ARCH(α)	0.800	0.290	2.764	0.006
GARCH(β)	0.217	0.114	1.894	0.058
APARCH(γ)	−0.177	0.089	−2.001	0.046
APARCH(δ)	1.397	0.706	1.980	0.048
Dynamic conditional correlation equation				
a	0.025	0.013	1.966	0.050
b	0.808	0.061	13.170	0.000
df	3.749	0.153	24.490	0.000

Source: Authors

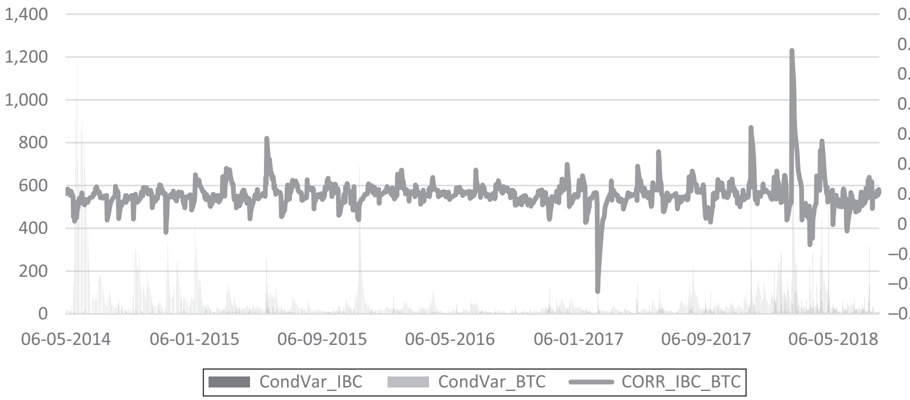


Figure 10. Volatility of IBC and BTC and a conditional correlation between the assets

Source: Authors

Thus, in our study, we investigated whether gold, oil or bitcoin could have been treated as a safe-haven asset in Venezuela in the period 2014-2018. We estimated a threshold vector autoregression model for the returns of gold, oil and bitcoin, where the threshold variable was the return of the Venezuelan Stock Exchange general index (IBC). We allowed for three regimes as follows: the extreme upward movements of the index (the hype), the moderate behaviour (normal) and the extreme downward changes (the crisis). We concluded that gold was a better safe haven than oil for Venezuelan investors, while bitcoin could have been considered merely a weak safe haven. Gold proved to be negatively correlated with the IBC only at moments of extreme upward and downward movement of the main stock index, while bitcoin moved in the same direction in the middle and high regimes.

Table IX. Dependencies of conditional correlation between IBC and potential safe-haven asset on IBC being in high or low regime

IBC and:	b_L	b_H
Gold		
Estimate	−0.015	0.009
p-value	0.023	0.004
Oil		
Estimate	−0.043	0.095
p-value	0.002	<0.001
BTC		
Estimate	−0.004	0.063
p-value	0.097	<0.001

Source: In the table, we present the estimates of two types of regression: $\rho = b_0 + b_L D(IBC_{regime} = L)$ and $\rho = b_0 + b_H D(IBC_{regime} = H)$, where ρ denotes the conditional correlation coefficient between IBC and one of the variables: gold, oil and bitcoin, L and H – respectively, low and high regime, while D – a dummy variable denoting the regime the IBC is in (estimated in the TVAR models). If an asset plays the role of a safe-haven, during the period of distress it should move in the opposite direction to IBC, resulting in the decline of the correlation.
Source: Authors

We also need to stress the fact that investing in bitcoin and gold can be done directly by both individual and institutional investors. Investment in oil in the case of the individual investor has, however, also become possible. This can be done through buying oil futures, contracts for difference or stocks of oil companies and investing in commodity-based exchange-traded funds or in crude-oil master-limited partnership – see for instance Pankratyeva (2019).

The results of our analysis suggest that bitcoin could, in fact, have become an alternative, *quasi money* asset, used in everyday life. It seems, however, that this might only be true for countries like Venezuela with an extremely weak currency and/or a high level of instability. Under such conditions, the problems that make it implausible to use bitcoin for these functions in developed and stable countries, appear to be of lesser importance. Therefore, with some reservations, bitcoin can fulfil some functions of money in crisis-driven countries. This is also a clear signal for the governments and monetary authorities of those countries. Namely, while designing institutional frameworks and conducting monetary policy, cryptocurrencies may be perceived and exploited by policymakers as a method for limiting the dollarisation process and for providing society with a more effective (even if only temporary) store of value and a means of payment other than a worthless and mistrusted national currency. However, this should preferably be an already existing unit or a brave new one, that is, not backed or linked in any way to the national unit of a given country.

This conclusion also implies consequences for domestic investors in such countries. They should be aware that bitcoin (or other cryptocurrencies) are not – as in developed countries – an almost purely speculative asset – but are also used as quasi money. Thus, a specific dichotomy arises here that should be taken into account when building investor portfolios.

From our analysis, it can also be concluded that gold still seems to be the asset of last resort, which is used only in the most extreme situations. This is consistent with the behaviour of many central banks and governments, as well as private investors. After the global financial crisis and the resulting problems many countries experienced, instability of financial and monetary systems worldwide, significant purchases of gold by these agents could be observed (with special attention to the activity of The People's Bank of China).

Finally, we must stress that our model for the pair BTS-IBC did not allow us to distinguish a regime of the most extreme downward changes, which could be explained by the fact that another type of dependency dominated. However, our previous findings, where the extreme-low regime was forced, also suggests that in the case of the most extreme downward movements of the IBC, negative relationships with the BTC were observed (Kliber *et al.*, 2019). What is interesting is that our results are in line with research by Johnson (2019a, 2019b), who noticed that bolivar to bitcoin trading was used mostly as a survival technique in a country with a worthless fiat currency.

Finally, and surprisingly, we found that the rise in oil prices could have had a negative effect on Venezuela because it could have accelerated the hyperinflation and deepened the crisis. The research opens avenues for further investigation on the economic situation after the change of the VEF into the VES and also poses also another set of questions on the potential development of e-government and e-services in Venezuela following the example of the use of bitcoin. However, this first requires normalisation of the situation and rebuilding of infrastructure, including IT infrastructure (Dahiya and Mathew, 2016).

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