Cryptocurrency comovements and crypto exchange movement: The relocation of Binance

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ABSTRACT

Binance, the largest cryptocurrency exchange by traded value, relocated from Hong Kong (origin market) to Malta (destination market). This study exploits this relocation event by examining the comovement of Binance's native token with the native tokens of other cryptocurrency exchanges in the origin and destination markets. Using multivariate regression analysis, our results show that Binance experienced a significant decline in comovement with its origin market after moving to Malta. The results are less evident for the destination market; however, an increase in comovement immediately after the relocation of Binance is notable.

1. Introduction

Since the emergence of Bitcoin, cryptocurrencies have grown in popularity as an innovative payment mechanism and a potential alternative for traditional fiat currencies. Blockchain-based cryptocurrencies, unlike fiat money, have no borders and function independently of centralized financial systems. However, despite a rise in recognition of cryptocurrencies, the lack of regulations compatible with their rapid evolution creates many barriers hampering their development. The exchanges where virtual currencies are traded provide an opportunity to transcend these obstacles. Although cryptocurrency exchanges seek to improve economic freedom and gain independence from traditional financial systems, they are subject to regulatory oversight in the jurisdictions where they are registered. As regulations might ban or permit certain exchange activities, they may influence the decision on where exchanges should establish their headquarters.

Binance, which is the world's largest cryptocurrency exchange in terms of daily trading volume while having its own cryptocurrency (CoinMarketCap, 2021a), initially founded in Hong Kong (i.e., the origin market), moved its headquarters out of China following the government's crackdown on domestic cryptocurrency exchanges and initial coin offering (ICO) in September 2017 (Rapoza, 2017). Months later, Binance announced its relocation to Malta (i.e., the destination market) after the Maltese Parliament enacted legislation establishing a regulatory framework for cryptocurrencies and blockchain technology (Aitken, 2018). Binance was not the only exchange to make such a decision. Numerous blockchain companies were attracted by the regulatory framework and

made the strategic move to Malta. Regulatory threats may hinder the development of cryptocurrency exchanges, while a crypto-friendly atmosphere could positively impact their operations. In addition, the presence of a framework in a particular market might reduce the uncertainties that market participants are facing. The habitat-based comovement proposed by the study of Barberis et al. (2002) suggests that when there are international trading restrictions or a lack of information, many investors restrict their trading to a subset of available assets. Therefore, we expect exchanges relocation due to regulatory changes to be an important determinant of comovement in the cryptocurrency market. This study exploits this relocation event by examining its influence on the comovement of Binance's native token with the native tokens from other cryptocurrency exchanges in the origin and destination markets.

Several studies investigated how a shift in corporates' headquarters location affects stock return dynamics. Our findings are consistent with those of Pirinsky and Wang (2006), who documented a positive comovement in monthly stock returns of corporate headquarters located within the same geographic location. Moreover, they demonstrated that when corporates relocate their head-quarters, their stocks experience a drop in comovement with stocks from the former location and an increase in comovement with stocks from the new location. They suggested that this alteration in comovement patterns is unlikely to be related to fundamentals. Similarly, Kumar et al. (2013) examined the dynamics of trading correlations around firms' headquarters relocation. They detected a decrease in trading correlation with stocks at the previous location as well as an increase in trading correlation with stocks at the new location. Meanwhile, there is a paucity of literature on cryptocurrency comovement (Caporale and Kang, 2020). Considering that the Bitcoin's market capitalization exceeds the market capitalizations of all other cryptocurrencies (CoinMarketCap, 2021b), the bulk of papers examining comovements in the crypto market focused solely on Bitcoin as a market-dominant. Ciaian et al. (2018) showed that Bitcoin and Altcoins (alternative coins) prices are highly interdependent in the short run. According to a similar research of Kumar and Ajaz (2019), Altcoin prices are mainly influenced by Bitcoin price fluctuation. Blau et al. (2020) found that six of the 16 most active Altcoins have a perfect comovement with Bitcoin. Nonetheless, Siddiqui (2020) investigated the short-term and long-term linkages between ten major cryptocurrencies and discovered multiple comovements between various Altcoins. This indicates the presence of comovements among several other cryptocurrencies rather than comovements only with Bitcoin. However, none of these studies examined whether a relocation of cryptocurrency exchanges affects the comovement of cryptocurrencies.

The findings of the current study contribute to the literature on cryptocurrency comovement by providing empirical evidence that the relocation of a cryptocurrency exchange influences market comovement. Further, to account for fluctuations in the supply of cryptocurrency tokens, this study analyses comovements using market capitalization returns rather than price-based returns. To the best of our knowledge, this is the first work that adjusts for these changes. Our results from multivariate regression analysis show that Binance has experienced a significant drop in comovement with its origin market after relocating to Malta. The results for the destination market are less evident, although there was an increase in comovement immediately after the relocation. Our findings corroborate the results of Siddiqui (2020) that different Altcoins move together; thus, Altcoins do not only co-move with Bitcoin. These findings enable investors to make better-informed investment decisions. Furthermore, it is also helpful for policymakers interested in supporting careful regulations rather than imposing restrictions on the cryptocurrency industry.

This paper is structured as follows. In Section 2, we present the data and empirical methodology. Section 3 discusses the empirical findings. Section 4 provides the conclusions.

2. Data and empirical methodology

The data utilized in this study consist of daily market capitalization returns for native cryptocurrency tokens on five exchanges, namely Binance, Kucoin, OAX, XPA, and Komodo,[1] as well as Bitcoin, collected from CoinMarketCap[2] website over the period 3rd November 2017 till 10th August 2018[3] (CoinMarketCap, 2021c). The cryptocurrency exchanges were chosen based on three criteria: exchanges with their own native tokens in the cryptocurrency market, exchange headquarter location, and data availability. Binance shifted its headquarter from Hong Kong to Malta on the 23rd March 2018; therefore, Hong Kong will be denoted by OM (the origin market), while Malta will be marked as DM (the destination market). The origin market exchanges analyzed in this study are OAX, XPA, and Kucoin. However, Komodo is the only exchange located in the destination market that matches the selection criteria; thus, the destination market exchange analyzed is Komodo.

To account for variations in supply, this study employs returns based on the daily market capitalization rather than cryptocurrency prices. When a cryptocurrency is created, it often has a maximum supply of coins, which means the maximum number of coins or tokens that can be issued. For instance, Bitcoin has a fixed upper limit of 21 million coins; adopting this strategy makes it more valuable over time as compared to the unlimited supply of fiat currencies (Grinberg, 2012). For this reason, developers may choose to buyback and burn their tokens out of circulation to reduce the supply and stabilize token value (Cong et al., 2022). Binance (2017) and Kucoin (2017) both use a share of their profits to buy back and burn tokens until supply is reduced to 100 million tokens. To ensure that the comovement analysis is valid, we use the daily market capitalization to account for changes in token supply, which equals the circulating quantity times the token's value. Since there are three exchanges in the OM and only one exchange in the DM, we equally weighted the market capitalization returns of the three exchanges, OAX, XPA, and Kucoin, to compare the outcomes of the Binance comovement with OM and DM.

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[1] BNB is the native token of Binance. KCS, OAX, XPA and KMD are the native tokens of Kucoin, OAX, XPA, and Komodo respectively.

[2] A website that tracks cryptocurrencies market capitalizations, pricing, and information.

[3] KCS token did not exist before 24th October 2017, thus a comovement analysis with Binance was not possible before this date.

To address the question of whether there is a change in comovement after the relocation of Binance with its OM and DM, in line with the studies of Blau et al. (2020) and Green and Hwang (2009), we undertake a multivariate analysis using ordinary least square (OLS) regression. Note that the variables employed in the study are returns measured as logarithmic differences of market capitalization/prices, hence they are stationary at the level form and OLS is appropriate for the estimation of our models.

We begin our investigation by estimating the following regression equation to examine the correlation between Binance's daily market capitalization returns and the OM and DM returns.

$$R_{bin,t} = a_0 + a_1 R_{om,t} + a_2 R_{om,t} * D + a_3 R_{dm,t} + a_4 R_{dm,t} * D + \varepsilon_t \tag{1}$$

Where the dependent variable $R_{Bin,t}$ represents the market capitalization returns of Binance on day t. The vectors of independent variables include: $R_{om,t}$ is the market capitalization returns of the OM at day t. $R_{om,t}*D$ captures the market capitalization returns of the OM after the relocation of Binance at day t, where D is a dummy variable with zeros before 23rd March 2018, the day Binance moved to Malta, and ones afterward. $R_{dm,t}$ and $R_{dm,t}*D$ are analogous to $R_{om,t}$, and $R_{om,t}*D$ for the destination market. A positive estimate of a_1 and a_3 is interpreted as evidence of comovement between Binance and the respective origin and destination markets. The interaction terms (a_2 and a_4) enable us to estimate whether the relocation reduces or improves the comovement. Specifically, negative estimates of the a_2 (a_4) coefficient suggest that the relocation reduces the comovement between Binance and origin (destination) market, since the absolute value of a_1+a_2 (a_3+a_4) becomes smaller, indicating a reduced comovement between Binance and origin (destination) markets. On the other hand, positive estimates of the a_2 (a_4) coefficient suggest that the relocation increases the comovement between Binance and origin (destination) market.

Eq. (1) is estimated considering different widths of regression windows around the relocation date: $(-7, +7)$, $(-14, +14)$, $(-28, +28)$, $(-56, +56)$, $(-84, +84)$, $(-112, +112)$, and $(-140, +140)$ days. We leave out the 23rd March, which is the day of relocation.

3. Empirical results

Before presenting the estimation results, we provide the simple correlations along with their level of significance between returns of Binance and each of the markets (OM or DM) across different windows lengths. More specifically, we provide the correlations for both before and after the relocation decision during the first and second half of the window, respectively. For the sake of completeness, we also provide the correlations between Binance and Bitcoin returns.

Table 1 highlights that the correlation level between Binance and the destination market in general increased after the relocation, while we observe a decrease in correlation between Binance and origin market and this especially for longer window lengths. For the window $(-56, +56)$, we observe that before the relocation the correlation between Binance and OM is lower than the correlation between Binance and DM. One reason for this observation is that in the first half of the $(-56,+56)$ window, i.e., before relocation, the returns of Binance and returns of DM are both more driven by the returns of Bitcoin.[4]

Table 2 reports the estimates of the comovement coefficients. The estimates of a_1 show that Binance's comovement with the OM was positive in general before the relocation; a highly significant comovement was identified at 84, 112, 140-day windows. However, this comovement dissipated after the relocation. The coefficient a_2, which captures the change in comovement with the OM after the relocation of Binance, displays negative coefficients. This negative change in comovement is significant at 84, 112, 140-day windows. Combining the coefficients a_1 and a_2 helps us to determine if Binance's comovement with the OM still exists after migration to Malta. The results reveal that a_1+a_2 are not statistically different from zero for all time windows. These findings imply that the previously discovered statistically significant comovements with the OM ceased upon the relocation of Binance. Our findings are consistent with the stock market trends identified by Pirinsky and Wang (2006).

On the other hand, Binance's comovement with DM exhibits positive coefficients even before the relocation, as represented by the coefficient estimate of a_3. This positive comovement was significant starting from 56 to 140-day windows. Compared with coefficient estimates of a_1, we observe that the magnitude of the coefficient estimates of a_3 is smaller except for the $(-56,+56)$ window. These findings indicate that geographical diversification across different native tokens results in lower return comovement for cryptocurrency exchanges.[5] The non-significant coefficient estimates of a_3 indicate that this comovement disappeared closer to the day of the relocation. Following Binance's relocation, the estimates of a_4 show that the change in comovement with the DM is positive for all time frames and statistically significant for the 112 and 140-day windows. Furthermore, the combination of a_3 and a_4 indicates that a greater comovement with the DM exists after the Binance's relocation. The estimates are positive and significant for all time frames; with the exception of the 56-day window, the comovement more than doubled following the relocation. According to the results reported in Table 2, the first window has a very high coefficient of determination R^2 with 77% variation of the dependent variable $R_{Bin,t}$ explained by the independent variables. However, considering that there are only 14 observations for this window, the limited sample size may have resulted in a greater R^2 (Cramer, 1987). For other time windows, R^2 varies between 24 and 45%.

Since Bitcoin dominates the market, as previously stated, we extend regression Eq. (1) by including the daily market capitalization returns of Bitcoin; this variable will help us determine whether or not a general market comovement causes these changes.

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[4] To conserve on space, the return correlations of Bitcoin-OM and Bitcoin-DM are not reported, but are available upon request.

[5] As discussed above, the coefficient estimate of a_3 for the $(-56,+56)$ window may occur because of the exclusion of Bitcoin returns from the equation. The estimation of Eq. (2), i.e., when Bitcoin returns are incorporated in the model, indeed shows that the coefficient estimates of a_3 lose their significance.

Table 1
Correlations before and after the Binance relocation.

		(-7,+7)	(-14,+14)	(-28,+28)	(-56,+56)	(-84,+84)	(-112,+112)	(-140,+140)
Binance-OM	Before	0.146	0.238	0.368*	0.433***	0.497***	0.543***	0.546***
	After	0.054	0.330	0.305	0.351***	0.386***	0.414***	0.355***
Binance-DM	Before	0.363	0.136	0.259	0.625***	0.463***	0.350***	0.373***
	After	0.723*	0.598**	0.434**	0.563***	0.564***	0.557***	0.535***
Binance-Bitcoin	Before	0.072	0.472*	0.560***	0.777***	0.608***	0.564***	0.555***
	After	0.639	0.683***	0.482***	0.586***	0.603***	0.597***	0.5301***

Simple correlations between returns of Binance and origin market (OM), returns of Binance and destination market (DM), and returns of Binance and Bitcoin. The correlations before the relocation are calculated using the first half of the windows, while the correlations after the relocation are calculated using the second half of the windows. ***, **, and * denote significance at the 1%, 5% and 10% levels, respectively.

Table 2
Comovement around the relocation of Binance without Bitcoin in the model.

Window	a_0	a_1	a_2	a_1+a_2	a_3	a_4	a_3+a_4	Obs.	R^2
(-7,+7)	0.014	-0.075	0.046	-0.029	0.201	0.995	1.196***	14	0.77
	(0.010)	(0.316)	(0.357)	(0.171)	(0.447)	(0.496)	(0.220)		
(-14,+14)	0.022	0.375	-0.343	0.032	-0.213	1.074	0.861**	28	0.32
	(0.015)	(0.601)	(0.666)	(0.279)	(0.878)	(0.932)	(0.308)		
(-28,+28)	0.006	0.307	-0.313	-0.006	0.071	0.523	0.594***	56	0.24
	(0.008)	(0.208)	(0.268)	(0.168)	(0.252)	(0.324)	(0.203)		
(-56,+56)	0.006	0.096	-0.098	-0.002	0.620***	0.012	0.633***	112	0.45
	(0.005)	(0.096)	(0.159)	(0.126)	(0.101)	(0.178)	(0.146)		
(-84,+84)	0.007	0.420***	-0.424**	-0.005	0.237**	0.353	0.590***	168	0.28
	(0.007)	(0.096)	(0.199)	(0.176)	(0.117)	(0.233)	(0.202)		
(-112,+112)	0.007	0.523***	-0.487***	0.037	0.156**	0.370**	0.526***	224	0.32
	(0.005)	(0.064)	(0.147)	(0.133)	(0.070)	(0.170)	(0.155)		
(-140,+140)	0.007	0.529***	-0.443***	0.086	0.162**	0.253*	0.415**	280	0.31
	(0.005)	(0.063)	(0.128)	(0.112)	(0.068)	(0.145)	(0.128)		

Notes: This table shows the outcomes of estimating the following equation to examine the comovement between Binance's daily market capitalization returns and the returns of both the origin and destination markets: $R_{bin,t} = a_0 + a_1 R_{om,t} + a_2 R_{om,t}*D + a_3 R_{dm,t} + a_4 R_{dm,t}*D + \varepsilon_t$. The dependent variable $RBin,t$ is the market capitalization returns of Binance on day t. The vectors of independent variables include: $R_{om,t}$ is the market capitalization returns of the origin market at day t. $R_{om,t}*D$ represents the market capitalization returns of the OM after the relocation of Binance at day t, where D is a dummy variable with zeros before 23rd March 2018, the day Binance moved to Malta, and ones afterward. $R_{dm,t}$ and $R_{dm,t}*D$ are analogous to $R_{om,t}$ and $R_{om,t}*D$ for the destination market. Standard errors are given in parentheses below the coefficients. *, **, and *** indicate significance at 10%, 5%, and 1%, respectively.

$$R_{bin,t} = a_0 + a_1 R_{om,t} + a_2 R_{om,t} * D + a_3 R_{dm,t} + a_4 R_{dm,t} * D + a_5 R_{btc,t} + \varepsilon_t \qquad (2)$$

Here the dependent and independent variables are identical to those in the preceding Eq. (1); the only difference is in incorporating $R_{btc,t}$, which is the market capitalization returns of Bitcoin at day t. Table 3 reports the results for regression Eq. (2).

The coefficients of the constant term a_0 show that Binance had a significantly greater average market capitalization returns at 14- and 140-day windows if all explanatory variables in the model are set to zero. The overall comovement with the OM was positive before the relocation of Binance and reliably significant at 84, 112, 140-day windows. However, after Binance moved to Malta, the change in comovement with the OM, as captured by the coefficient a_2, has been negative; this drop in comovement became statistically significant for the 84 to 140-day intervals. Once again, the combination of a_1+a_2 yields estimates that are not statistically different from zero for all time windows. These results follow the same pattern that was observed earlier in Table 2 on Binance's comovement with the OM, which confirms our findings that there is a shift in comovement between Binance and OM after its relocation, i.e., a significant decrease in comovement is evident at 84, 112, 140-day windows. The combined effects (a_1+a_2) confirms that the pre-existing comovement disappears after the event.

For the DM, the results are inconspicuous. In contrast to results from Table 2, the coefficients of a_3 have negative values; only two coefficients are positive, and only one negative coefficient is statistically significant. These results invalidate the previously discovered comovement with DM prior to Binance's relocation. The coefficients of a_4 show that after moving to Malta, the change in comovement with DM remains positive for all time windows; however, only the 7-day window is significant. More importantly, the results reflected under the combination of a_3 and a_4 coefficients have changed to a great extent. Interestingly, the pre-existing comovement with DM vanished after integrating Bitcoin into the regression model; nevertheless, a significant positive comovement is observed in the first 7-day window. The coefficient a_5 that captures Binance's comovement with Bitcoin yields statistically significant coefficients for all except the first time-window. Although the relocation had an impact on the Binance-DM comovement, our findings reveal that the Binance-Bitcoin comovement is more prevalent. Our findings are consistent with the general comovement with Bitcoin discovered by Blau et al. (2020). Furthermore, R^2 displays higher values in Table 3, yet follows the same pattern as in Table 2, a high R^2 is noticeable on the first window and equals 77.7%; for other time windows, R^2 varies between 31 and 52%.

Table 3

Comovement around the relocation of Binance after including Bitcoin in the model.

Window	a_0	a_1	a_2	a_1+a_2	a_3	a_4	a_3+a_4	a_5	Obs.	R^2
(-7,+7)	0.014	-0.095	0.016	-0.080	0.338	0.976*	1.314***	-0.230	14	0.78
	(0.010)	(0.332)	(0.377)	(0.203)	(0.534)	(0.519)	(0.322)	(0.440)		
(-14,+14)	0.030**	0.514	-0.379	0.140	-1.101	1.384	0.282	1.119*	28	0.42
	(0.014)	(0.567)	(0.624)	(0.267)	(0.931)	(0.887)	(0.404)	(0.548)		
(-28,+28)	0.007	0.218	-0.203	0.015	-0.226	0.468	0.242	0.636**	56	0.31
	(0.008)	(0.204)	(0.263)	(0.162)	(0.276)	(0.312)	(0.250)	(0.282)		
(-56,+56)	0.006	0.042	-0.044	-0.002	0.218	0.046	0.264	0.722***	112	0.52
	(0.005)	(0.091)	(0.150)	(0.119)	(0.142)	(0.167)	(0.168)	(0.188)		
(-84,+84)	0.009	0.293***	-0.307*	-0.014	-0.237*	0.270	0.033	1.108***	168	0.41
	(0.006)	(0.090)	(0.183)	(0.134)	(0.134)	(0.213)	(0.208)	(0.190)		
(-112,+112)	0.007	0.417***	-0.406***	0.011	-0.005	0.220	0.215	0.661***	224	0.41
	(0.005)	(0.063)	(0.138)	(0.124)	(0.070)	(0.160)	(0.153)	(0.107)		
(-140,+140)	0.007*	0.416***	-0.378***	0.038	-0.009	0.149	0.141	0.685***	280	0.41
	(0.004)	(0.061)	(0.119)	(0.104)	(0.068)	(0.135)	(0.125)	(0.102)		

Notes: This table reports the outcomes of estimating the following equation to examine the comovement between Binance's daily market capitalization returns and the returns of both the origin and destination markets and Bitcoin: $R_{bin,t} = a_0 + a_1R_{om,t} + a_2R_{om,t}*D + a_3R_{dm,t} + a_4R_{dm,t}*D + a_5R_{btc,t} + \varepsilon_t$. The dependent variable $RBin,t$ is the market capitalization returns of Binance on day t. The vectors of independent variables include the following: $R_{om,t}$ is the market capitalization returns of the origin market at day t. $R_{om,t}*D$ captures the market capitalization returns of the OM after the relocation of Binance at day t, where D is a dummy variable with zeros before 23rd March 2018, the day Binance moved to Malta, and ones afterward. $R_{dm,t}$ and $R_{dm,t}*D$ are analogous to $R_{om,t}$, and $R_{om,t}*D$ for the destination market. $R_{btc,t}$, is the market capitalization returns of Bitcoin at day t. Standard errors are given in parentheses under coefficients. *, **, and *** indicate significance at 10%, 5%, and 1%, respectively.

Our overall findings indicate that when Binance relocated its headquarter, its native token experienced a decline in comovement with tokens of other cryptocurrency exchanges in the origin market. Furthermore, the pre-existing comovement with its origin market vanished after the relocation. According to Aysan et al. (2021), Binance disassociated itself from the cryptocurrency exchanges of the origin market after moving to Malta. After the relocation, investors were provided more protection and flexibility to manage their digital assets, making it the survival of the fittest in the cryptocurrency market. Despite the fact that Blau et al. (2020) discovered that 6 out of 16 Altcoins had perfect comovement with Bitcoin, our findings show that Binance's comovement with the origin market was significant over multiple time windows prior to the relocation event. Furthermore, comovement with the destination market was significant in the 84-day window before the relocation and in the first window after this moment, indicating that there are linkages not only with Bitcoin but also amongst Altcoins.

When we reestimate Eqs. (1) and (2) using daily price returns rather than capitalization returns, we observe similar results. In models with and without Bitcoin, especially for larger window sizes, the comovement between Binance and OM disappears after the relocation. In models without Bitcoin, Binance and DM comovement becomes stronger across estimation windows after the relocation, whereas in models with Bitcoin, this strengthening is only observed in the shorter estimation windows. The findings of these robustness analyses are reported in Table A1 (without Bitcoin) and Table A2 (with Bitcoin) in the Appendix.

We further verify whether or not this change in comovement results from changes in the underlying fundamentals of the cryptocurrency exchanges. For this purpose, we detected if any of the exchanges had implemented a fork, which is a permanent upgrade in the underlying blockchain protocol. However, it was verified via the websites of the cryptocurrency exchanges and www.coindar.org[6] that none of them implemented a fork during the sample period; hence, it can be said that changes in fundamentals do not explain the observed changes in comovement. Hence, the most compelling rationale for the changes in comovement is a positive regulatory shift. Once Malta introduced a regulatory framework for cryptocurrencies and blockchain, it attracted numerous blockchain companies, including Binance and Bitbay (Håland, 2018).

4. Conclusions

This study examines using multivariate OLS whether the relocation of the cryptocurrency exchange Binance affects the comovement of Binance's native token with the native tokens from other cryptocurrency exchanges in the origin and destination market. Our findings indicate that when Binance relocated its headquarter, its native token witnessed a drop in comovement with tokens from other cryptocurrency exchanges in the origin market. Furthermore, the previously existent comovement with its origin market vanished after the migration. Even after the inclusion of Bitcoin into the model, there is a rise in comovement in the destination market. Cryptocurrency exchanges are the gateway that facilitates the trading of digital assets. However, governments need to set up a constructive regulatory framework for licensing cryptocurrency exchanges to promote innovation and the future development of digital currencies. A policy implication of this study directly results from our conclusion that regulations influence where exchanges locate their headquarters and thus impact comovement in the market. Tight regulations will drive cryptocurrency market participants to migrate offshore to avoid legal complications. In addition, our findings suggest that, in general, increasing geographical diversification across

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[6] A website that gives an overview of all cryptocurrencies events.

Table A1
Comovement around the relocation of Binance without Bitcoin in the model (**price returns**).

Window	a_0	a_1	a_2	a_1+a_2	a_3	a_4	a_3+a_4	Obs.	R^2
(-7,+7)	0.0134	-0.0631	0.0811	0.0180	0.1776	1.0432*	1.221***	14	0.77
	(0.010)	(0.288)	(0.302)	(0.093)	(0.419)	(0.477)	(0.229)		
(-14,+14)	0.0168	0.2736	-0.2768	-0.0032	-0.1144	1.0219	0.907***	28	0.38
	(0.013)	(0.429)	(0.450)	(0.128)	(0.667)	(0.715)	(0.258)		
(-28,+28)	0.0031	0.2270	-0.2430	-0.0161	0.1225	0.5176*	0.6400***	56	0.28
	(0.008)	(0.186)	(0.203)	(0.079)	(0.226)	(0.283)	(0.168)		
(-56,+56)	0.0052	0.0637	-0.0936	-0.0299	0.6357***	0.0324	0.668***	112	0.48
	(0.005)	(0.095)	(0.116)	(0.066)	(0.099)	(0.155)	(0.120)		
(-84,+84)	0.0078	0.3624***	-0.4135***	-0.0511	0.2780**	0.3589*	0.6370***	168	0.27
	(0.007)	(0.092)	(0.134)	(0.0974)	(0.115)	(0.201)	(0.166)		
(-112,+112)	0.0084	0.4594***	-0.4882***	-0.0287	0.1738**	0.4092**	0.5830***	224	0.29
	(0.006)	(0.065)	(0.112)	(0.091)	(0.076)	(0.167)	(0.149)		
(-140,+140)	0.0084*	0.4648***	-0.4585***	0.0064	0.1934***	0.2825**	0.4760***	280	0.29
	(0.005)	(0.060)	(0.097)	(0.076)	(0.067)	(0.133)	(0.115)		

Notes: This table shows the outcomes of estimating the following equation to examine the comovement between Binance's daily price returns and the returns of both the origin and destination markets: $R_{bin,t} = a_0 + a_1 R_{om,t} + a_2 R_{om,t}*D + a_3 R_{dm,t} + a_4 R_{dm,t}*D + \varepsilon_t$. The dependent variable $RBin,t$ is the price returns of Binance on day t. The vectors of independent variables include: $R_{om,t}$ is the price returns of the origin market at day t. $R_{om,t}*D$ represents the price returns of the OM after the relocation of Binance at day t, where D is a dummy variable with zeros before 23rd March 2018, the day Binance moved to Malta, and ones afterwards. $R_{dm,t}$ and $R_{dm,t}*D$ are analogous to $R_{om,t}$, and $R_{om,t}*D$ for the destination market. Standard errors are given in parentheses below the coefficients. *, **, and *** indicate significance at 10%, 5%, and 1%, respectively.

Table A2
Comovement around the relocation of Binance after including Bitcoin in the model (price returns).

Window	a_0	a_1	a_2	a_1+a_2	a_3	a_4	a_3+a_4	a_5	Obs.	R^2
(-7,+7)	0.0128	-0.0813	0.0790	-0.0023	0.2822	1.0160*	1.298***	-0.1681	14	0.78
	(0.010)	(0.307)	(0.317)	(0.112)	(0.523)	(0.507)	(0.318)	(0.451)		
(-14,+14)	0.0249*	0.4669	-0.3958	0.0711	-1.1403	1.4287**	0.288	1.2204**	28	0.52
	(0.012)	(0.392)	(0.406)	(0.118)	(0.719)	(0.661)	(0.334)	(0.475)		
(-28,+28)	0.0044	0.1869	-0.1669	0.0200	-0.2668	0.4942*	0.2270	0.7257***	56	0.39
	(0.007)	(0.174)	(0.192)	(0.0751)	(0.250)	(0.264)	(0.212)	(0.250)		
(-56,+56)	0.0046	0.0507	-0.0619	-0.0111	0.1753	0.0850	0.2600*	0.7742***	112	0.56
	(0.005)	(0.088)	(0.107)	(0.061)	(0.138)	(0.144)	(0.144)	(0.174)		
(-84,+84)	0.0089	0.2749***	-0.2945**	-0.0196	-0.2652**	0.2747	0.0095	1.1827***	168	0.42
	(0.006)	(0.083)	(0.121)	(0.0873)	(0.133)	(0.180)	(0.177)	(0.184)		
(-112,+112)	0.0098*	0.3500***	-0.3664***	-0.0164	-0.0232	0.2052	0.1820	0.7800***	224	0.42
	(0.005)	(0.061)	(0.103)	(0.087)	(0.074)	(0.155)	(0.147)	(0.113)		
(-140,+140)	0.0084**	0.3641***	-0.3696***	-0.0055	0.0014	0.1576	0.1590	0.7318***	280	0.41
	(0.004)	(0.056)	(0.089)	(0.069)	(0.066)	(0.123)	(0.114)	(0.099)		

Notes: This table reports the outcomes of estimating the following equation to examine the comovement between Binance's daily price returns and the returns of both the origin and destination markets and Bitcoin: $R_{bin,t} = a_0 + a_1 R_{om,t} + a_2 R_{om,t}*D + a_3 R_{dm,t} + a_4 R_{dm,t}*D + a_5 R_{btc,t} + \varepsilon_t$. The dependent variable $RBin,t$ is the price returns of Binance on day t. The vectors of independent variables include the following: $R_{om,t}$ is the price returns of the origin market at day t. $R_{om,t}*D$ captures the price returns of the OM after the relocation of Binance at day t, where D is a dummy variable with zeros before 23rd March 2018, the day Binance moved to Malta, and ones afterward. $R_{dm,t}$ and $R_{dm,t}*D$ are analogous to $R_{om,t}$, and $R_{om,t}*D$ for the destination market. $R_{btc,t}$, is the price returns of Bitcoin at day t. Standard errors are given in parentheses under coefficients. *, **, and *** indicate significance at 10%, 5%, and 1%, respectively.

different native tokens of cryptocurrency exchanges could result in a significant decrease in returns comovement. Therefore, investors are advised to take into account the shift in comovement after a cryptocurrency exchange relocation to make optimal portfolio decisions. However, the limitation of this study is related to cryptocurrency exchanges selection, which can ignore some of the relevant exchanges that do not fulfill the selection criteria. Obtaining a larger sample size can provide a better understanding of how the relocation of cryptocurrency exchanges influences comovement in the market. As far as we know, this is the first paper to use market capitalization returns rather than price-based returns to account for fluctuations in the supply of cryptocurrency tokens. Future studies could adjust for the fundamental changes in the underlying blockchain protocol and control for different protocols, such as the consensus mechanism, to gain more insight on what causes comovement in the cryptocurrency markets.

CRediT authorship contribution statement

Mustafa Disli: Conceptualization, Methodology, Software, Validation, Formal analysis, Investigation, Resources, Data curation, Writing – original draft, Writing – review & editing, Visualization, Supervision, Project administration. **Fatima Abd Rabbo:** Validation, Investigation, Data curation, Writing – original draft, Visualization. **Thibault Leneeuw:** Methodology, Software, Validation, Formal analysis, Data curation, Writing – original draft. **Ruslan Nagayev:** Software, Validation, Formal analysis, Investigation, Data

curation, Writing – review & editing, Visualization.

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Appendix

Tables A1 and A2.

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