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CRYPTOCURRENCY MARKET AS AN ASYMMETRIC DUOPOLY: COMPLEMENTARITY AND COMPETITION BETWEEN BITCOIN AND ETHEREUM

Despite an extensive body of research on cryptocurrency price forecasting and volatility assessment, the nature of market interaction between Bitcoin and Ethereum in terms of market organization theory remains largely unexplored. The article is devoted to verifying the hypothesis of an asymmetric duopoly structure between Bitcoin and Ethereum. Three hypotheses are proposed: Bitcoin price leadership (H1), Cournot quantity equilibrium (H2), and partial asset complementarity (H3). The methodological framework comprises correlation analysis of logarithmic price levels and returns, market share analysis using both price-based and volume-based metrics, and regression estimation of three Bertrand models and a Cournot model with lagged BTC market share. The empirical base consists of daily Yahoo Finance data for 2017–2026, aggregated to monthly averages. The results confirm the price leadership hypothesis (H1); the asymmetry of 0.402 quantitatively confirms Bitcoin's dominance. The Cournot hypothesis (H2) in its classical formulation is rejected, and a capital rotation mechanism from BTC to ETH with a one-month lag is established. The complementarity hypothesis (H3) is confirmed by both analytical blocks. It is concluded that the cryptocurrency market operates as an asymmetric duopoly in which price competition follows the Bertrand model with Bitcoin as the leader, while complementary demand dominates at the level of market shares.

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КРИПТОРИНОК ЯК АСИМЕТРИЧНА ДУОПОЛІЯ: КОМПЛЕМЕНТАРНІСТЬ І КОНКУРЕНЦІЯ МІЖ BITCOIN І ETHEREUM

Попри широкий масив досліджень із прогнозування цін й оцінки волатильності криптоактивів, питання характеру ринкової взаємодії між Bitcoin і Ethereum в термінах теорії ринкової організації залишається практично недослідженим. Проаналізовано верифікацію гіпотези про існування асиметричної дуопольної структури між Bitcoin і Ethereum. Висунуто три гіпотези: цінового лідерства Bitcoin (H1), кількісної рівноваги Курно (H2) та часткової комплементарності активів (H3). Методологічну основу дослідження становлять кореляційний аналіз логарифмічних рядів цін і доходностей, аналіз ринкових часток за ціновою та торговельними метриками, а також регресійне оцінювання трьох моделей Бертрана і моделі Курно з лаговою часткою BTC. Емпіричною базою стали щоденні дані Yahoo Finance за 2017–2026 рр., агреговані до місячних середніх. Результати підтверджують гіпотезу цінового лідерства (H1), асиметрія у 0.402 кількісно підтверджує домінування Bitcoin. Гіпотезу Курно (H2) у класичному формулюванні відхилено і констатовано механізм ротації капіталу від BTC до ETH з місячним лагом. Гіпотеза комплементарності (H3) підтверджена за обома аналітичними блоками. Зроблено висновок, що крипториннок функціонує як асиметрична дуополія, де цінова конкуренція реалізується за моделлю Бертрана з лідером Bitcoin, а на рівні ринкових часток домінує комплементарний попит.



Keywords: Bitcoin, Ethereum, duopoly, Bertrand model, Cournot model, price leadership, market shares, complementarity, cryptocurrency market.

Ключові слова: Bitcoin, Ethereum, дуополія, модель Бертрана, модель Курно, цінове лідерство, ринкові частки, комплементарність, криптовалютний ринок.

JEL Classification: G10, L13, C58.

Introduction

The cryptocurrency market is one of the most dynamic and analytically under-researched segments of the modern digital economy. A substantial share of global crypto-market capitalization is consistently concentrated in two assets – Bitcoin (BTC) and Ethereum (ETH) – which form a duopolistic structure atypical of traditional financial markets. At the same time, the dichotomy between competition and complementarity of Bitcoin and Ethereum cannot be described by the standard duopoly model in its classical sense, for three reasons.

First, although these digital assets compete for investment demand, they serve qualitatively different investment functions: store of value (Bitcoin is primarily positioned as a digital savings vehicle and a hedging instrument) and programmable infrastructure (Ethereum is the base infrastructure for decentralized finance, smart contracts, and tokenomics), which rules out pure substitution.

Second, the supply of both assets is determined algorithmically rather than by the strategic decisions of players, which eliminates the key mechanism of Cournot quantity competition, in which each player deliberately chooses its output in response to a competitor's decision. In Bitcoin and Ethereum, supply is algorithmically deterministic: Bitcoin issuance is set by the protocol (a halving every four years, with a fixed cap), while Ethereum issuance is governed by the Proof-of-Stake mechanism and by burning under EIP-1559. Neither player makes strategic decisions about quantity; the protocols do so automatically. The relevance of the study is heightened by current structural shifts in the market: Ethereum's transition to Proof-of-Stake in 2022 and the active growth of the Layer-2 solutions market since 2021, which increases complementarity between the assets. On the other hand, the approval of Bitcoin ETFs in 2024 is a structural break that reinforces the asymmetry of the duopoly, since Bitcoin has acquired the characteristics of a self-standing institutional asset class, consistent with the concept of a "digital value reserve" and deepening its functional differentiation from Ethereum (Li et al., 2026). These developments alter the parameters of the duopoly and make a quantitative assessment of the market characteristics of both digital assets timely and necessary.

Third, empirical data (Yahoo Finance, n. d.) show a synchronous rather than competitive growth in market shares, which contradicts the logic of mutual displacement.

Therefore, the analysis of BTC and ETH requires an adapted version of the duopoly model in which functional differentiation replaces product

differentiation. Thus, the dichotomy between competition and complementarity of Bitcoin and Ethereum calls for the development and application of adapted theoretical and methodological provisions.

Turning to contemporary scholarly work, one can state that most of it focuses on price forecasting or on volatility assessment of individual assets, whereas the market structure and the nature of interaction among the leading crypto assets remain largely unexplored.

Thus, in the contemporary scientific literature, cryptocurrencies are treated as a multidimensional phenomenon that combines financial, technological, and institutional aspects. The Johansen cointegration tests in the study by Saka Ilgin (2024) show no cointegration between BTC/ETH and traditional asset classes. The Granger causality test revealed unidirectional causal relationships running from Bitcoin and Ethereum prices to the Dow Jones commodity index, especially after 2021–2022. Kraus and Rosokhatska (2022) emphasize the speculative nature of cryptocurrencies, while at the same time acknowledging their potential as an alternative asset with store-of-value properties.

Mazaraki and Volosovich (2022) focus on the institutional and technological aspects of mining, stressing its transformation under the influence of energy, regulatory, and geopolitical factors that determine the economic viability and sustainability of the crypto industry. Melnyk and Klym (2022) examine cryptocurrencies in the context of cybersecurity, pointing to their dual nature: both as a tool for enhancing transaction security and, at the same time, as a means of cybercrime, which creates new challenges for public policy. Meanwhile, Fomina and Semenova (2022) analyze problems in the accounting of crypto assets, emphasizing the absence of unified standards in the European Union and Ukraine, as well as the need to adapt accounting approaches to the specifics of digital assets.

In addition, contemporary studies are devoted to applying machine learning methods to the analysis of the cryptocurrency market. The sources and quality of input data for forecasting models are systematized by Sitailo (2024), who distinguishes three categories of analysis (technical, fundamental, and socio-economic) and describes practical methods of collecting data from crypto exchanges, blockchains, and social networks. Attention is also paid to hybrid artificial intelligence architectures and neural networks (Dobrolyubova et al., 2025; Kozenkova & Movsesyants, 2025) and to WGAN combinations for generating synthetic time series (Babych, 2025). Chyzhevska et al. (2025) apply an FNN model to medium-term Bitcoin price forecasting and show that integrating technical indicators (SMA, RSI, MACD) substantially improves forecast accuracy.

In parallel, a line of research on causal relationships between events in the crypto market is developing. Troyan (2024) studies the internal market dynamics over 2017–2024 using Granger causality tests and finds that platform tokens are the most influential category, while the market itself is characterized by rapid propagation of price impulses across assets.

Iyer and Popescu (2023) investigate the transmission of returns and volatility between crypto assets and global financial markets in 2014–2022 and confirm an asymmetric structure of price-signal transmission. However, the authors treat ETH and BTC symmetrically, without identifying a hierarchy between them.

Korkusuz (2025) concludes that Ethereum acts as the most influential driver of volatility, reflecting the asset's key role in DeFi and decentralized finance. At the same time, Joshi (2025) maintains that in the volatile regime, BTC consistently acts as the principal source of shocks, while ETH is a secondary transmitter and XMR is mainly a recipient. The Granger causality test reveals more stable and statistically significant causal relationships in the stable regime.

The line of comparative analysis of investment assets is represented by Hutsul (2025), who examines how investment priorities shift between gold and cryptocurrencies and finds that Bitcoin is gradually assuming the function of a "digital value reserve," while traditional assets retain the role of a portfolio stabilizer. Polyansky and Litvinenko (2025) evaluate the effectiveness of a countertrend trading strategy for BTC and ETH and show that BTC demonstrates considerably higher stability than ETH, which indirectly indicates a different nature of the market behavior of the two assets and confirms their functional differentiation.

The above works treat Bitcoin and Ethereum as separate assets or as elements of a diversified portfolio, but none of them examines these two assets as a structural pair of participants in a stable market duopoly with its own logic of price leadership and distribution of market shares. Yet precisely such a framing corresponds to reality: throughout 2017–2026, BTC and ETH together have consistently held dominant positions in the capitalization structure of digital assets, forming a distinct market configuration. Thus, the scientific problem lies in the absence of a theoretically grounded and empirically verified description of the structure of interaction between Bitcoin and Ethereum in terms of market organization. Filling this gap requires adapting microeconomic duopoly models to the specifics of the cryptocurrency market and testing the nature of competitive relations between the two leading digital assets.

The purpose of the article is to verify the hypothesis of an asymmetric duopoly structure between Bitcoin and Ethereum by empirically testing the implications of the Bertrand price competition and Cournot quantity competition models. In line with this purpose, the following hypotheses are formulated:

price leadership hypothesis H1 assumes that *Bitcoin* is the price leader in the duopoly and that *BTC* price changes are transmitted to *ETH* asymmetrically, which indicates a hierarchical structure of price leadership;

quantity equilibrium hypothesis H2 proceeds from the assumption that the market shares of Bitcoin and Ethereum form a stable Cournot equilibrium,

i.e., an increase in the market share of BTC is statistically significantly and inversely related to the change in the share of ETH in the next period;

complementarity hypothesis H3 assumes that common market factors dominate the substitution effect, which manifests itself in a positive correlation of returns and indicates partial complementarity of the assets in portfolio demand.

The data source comprises daily closing prices and trading volumes of Bitcoin (BTC–USD) and Ethereum (ETH–USD) for the period from January 1, 2017 to March 20, 2026 (Yahoo Finance, n.d.). For comparative analysis, prices are aggregated to monthly averages and rebased to a common base (index = 100 at the beginning of 2017). In addition, in order to correctly represent the multiplicative growth of digital asset prices and to mitigate the non-stationary distribution of the price time series, a logarithmic transformation was applied.

To distinguish short-term co-movement of prices from long-term cointegration, correlation analysis is applied in two directions: the correlation of log price levels and the correlation of first differences of logarithms (log returns).

The subsequent analysis of the market shares of digital assets is likewise conducted in two directions: price share and share in trading volumes. Comparing these indicators and analysing the difference between the shares makes it possible to identify discrepancies between price and trading dominance and to test the stability of the duopoly structure in recent years.

Given the specifics of crypto assets, where supply is determined algorithmically, and demand is shaped by reflexive expectations, marginal costs for the end investor are effectively absent. Under these conditions, an empirical test of the implications of the Bertrand and Cournot models for BTC and ETH makes it possible to assess whether the cryptocurrency market can be interpreted in terms of a classical duopoly or to delineate the limits of applicability of such models.

To test the implications of the Bertrand model, three regression models in logarithmic first differences are constructed:

levels model:

$$\ln(\text{ETH}_t) = \alpha + \beta \cdot \ln(\text{BTC}_t) + \varepsilon_t, \quad (1)$$

elasticity of ETH with respect to BTC:

$$\Delta \ln(\text{ETH}_t) = \alpha + \beta_1 \cdot \Delta \ln(\text{BTC}_t) + \varepsilon_t, \quad (2)$$

elasticity of BTC with respect to ETH:

$$\Delta \ln(\text{BTC}_t) = \alpha + \beta_2 \cdot \Delta \ln(\text{ETH}_t) + \varepsilon_t. \quad (3)$$

The asymmetry of the coefficients β_1 and β_2 is the key test of price leadership.

To test the implications of the Cournot model, a regression of the change in the market share of *ETH* on the lagged value of the *BTC* share is constructed:

$$\Delta S_{ETH,t} = \alpha + \beta \cdot S_{BTC,t-1} + \varepsilon_t. \quad (4)$$

A statistically significant value of the coefficient β can be interpreted as confirmation of Cournot equilibrium dynamics. The estimation is carried out using the *feols* function from the *fixest* package in the R software environment.

Thus, the empirical study is built as a sequence of interrelated analytical blocks that reflect the logic of testing the proposed hypotheses regarding the duopoly structure of the cryptocurrency market. The first section analyses the dynamics of the Bitcoin and Ethereum price series, including their transformation (logarithmization, aggregation) and an assessment of the co-movement of prices through correlation analysis in levels and returns, which allows short- and long-term relationships to be distinguished. The second section is devoted to analysing the market shares of *BTC* and *ETH* in both price and trading terms, which makes it possible to assess the structure of dominance and its stability over time. The third section examines price leadership within the Bertrand model by constructing regressions in logarithmic increments and comparing sensitivity coefficients, which reveals the asymmetry in the transmission of price impulses between the assets. The fourth section is devoted to testing the implications of the Cournot model by estimating the dynamic dependence between market shares, which allows the interaction of digital assets to be interpreted in terms of quantity competition. Taken together, these stages of the study form a coherent empirical framework that makes it possible not only to test hypotheses about the nature of the interaction between Bitcoin and Ethereum, but also to assess the applicability of classical models of oligopolistic competition to the cryptocurrency market.

1. Correlation analysis of logarithmic price series of Bitcoin and Ethereum

The correlation analysis of the logarithmic price series of Bitcoin and Ethereum revealed two distinct levels of interdependence.

The correlation of log levels made it possible to establish a long-term common trend of the two assets: Bitcoin and Ethereum experienced synchronous cycles of growth and decline throughout the studied period of 2017–2026 (*Figure 1*). The high value of the correlation coefficient ($r =$

0.922) indicates the presence of a common trend component, which may be driven by shared macroeconomic and market demand factors. At the same time, such a correlation may be partly due to the non-stationarity of the series and reflect a common trend rather than a direct structural link between the assets.

The correlation of *log* returns is a considerably more informative indicator, since first differences of logarithms are free of the trend component and close to stationary. The value of $r = 0.795$ indicates a strong but incomplete synchronicity of short-term (daily) price movements. This means that a substantial part of the variation in Ethereum returns is associated with Bitcoin dynamics ($R^2 \approx 0.632$), whereas the rest is attributable to Ethereum-specific factors: protocol updates, *DeFi* market dynamics, smart-contract activity, etc.

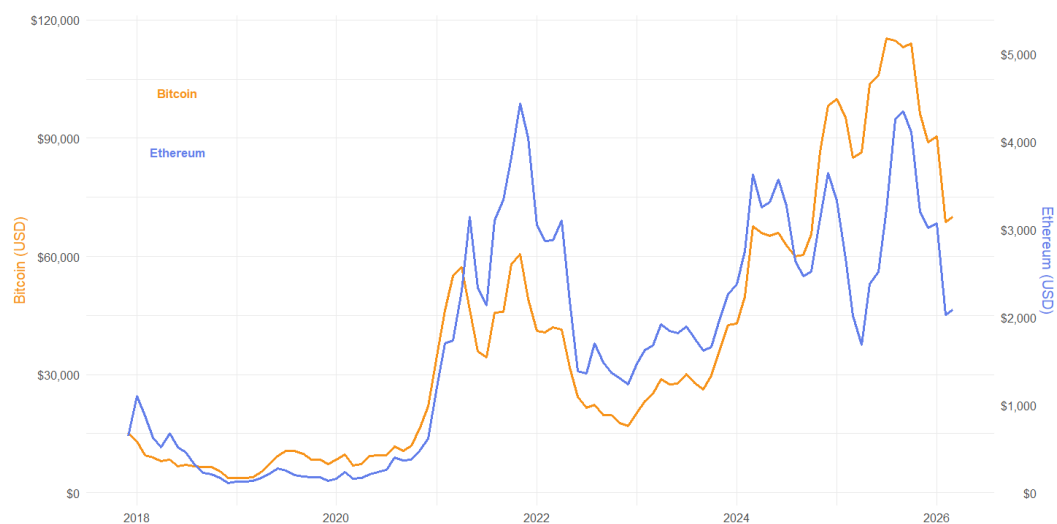


Figure 1. Synchronous movement of *Bitcoin* and *Ethereum* prices in 2017–2026

Source: constructed by the author in *R* based on Yahoo Finance data (n. d.).

The gap between the correlation values in levels (0.922) and in returns (0.795) reflects the presence of a common long-term trend alongside the preserved short-term autonomy of dynamics. This supports the hypothesis of partial complementarity (H3), since crypto assets function as elements of a single asset class in the long run but are not perfect substitutes in short-term dynamics.

From the standpoint of the duopoly market structure, the obtained value of the *log*-return correlation is compatible with different interaction mechanisms, including both price leadership (the Bertrand model) and a response to changes in market positions (the Cournot model). At the same time, correlation analysis does not allow causal relationships to be identified, which necessitates further regression analysis to disentangle these effects.

2. Analysis of the market shares of Bitcoin and Ethereum

The calculated annual average shares (*Table 1*) demonstrate the key structural characteristic of the duopoly under study, namely its deep and persistent asymmetry, which has not weakened over the past nine years of observation. It should be noted that the calculated shares reflect the relative ratio between BTC and ETH within a two-asset system, which is a deliberate choice in line with the logic of a two-player model, but it limits the extrapolation of the results to the broader crypto market.

Table 1

Dynamics of the market shares of Bitcoin and Ethereum

Year	Price share of Bitcoin	Price share of Ethereum	Trading share of Bitcoin	Trading share of Ethereum	Gap between the price and trading shares of BTC
2017	0.958	0.042	0.827	0.173	0.131
2018	0.945	0.055	0.728	0.272	0.217
2019	0.974	0.026	0.698	0.302	0.276
2020	0.974	0.026	0.698	0.302	0.276
2021	0.945	0.055	0.629	0.371	0.316
2022	0.934	0.066	0.667	0.333	0.268
2023	0.941	0.059	0.702	0.298	0.238
2024	0.955	0.045	0.662	0.338	0.293
2025	0.971	0.029	0.654	0.346	0.317
January–March 2026	0.970	0.030	0.645	0.355	0.325

Source: calculated by the author in R based on Yahoo Finance data (n. d.).

The price dominance of Bitcoin remains almost unchanged throughout the period: the share of *BTC* in the total capitalization of the two assets fluctuates within a narrow range of 0.934–0.974, whereas the share of Ethereum never exceeded 0.066. Despite the fact that ETH has reached technological maturity, moved to Proof-of-Stake, and become the base infrastructure of the DeFi ecosystem, its price weight in the system remains structurally limited. This indicates that, in price terms, the duopoly is a quasi-monopolistic structure rather than a balanced competition.

Trading activity shows a substantially different picture. The share of ETH in trading volumes rose from 0.173 in 2017 to 0.302–0.371 in 2019–2021 and stabilized at 0.338–0.355 in 2024–2026. That is, by the trading metric, Ethereum controls a third of the two-asset market, which is fundamentally different from its 3–6% price share. This divergence indicates that ETH is a much more actively traded instrument relative to its price weight and is used mainly as a liquid trading asset.

The data in *Table 1* clearly demonstrate the structural transformation of the trading weight of the two assets over 2017–2026 and constitute one of the key arguments in favour of the concept of an asymmetric duopoly.

Market formation phase (2017–2018). Ethereum entered the duopoly with a relatively low trading weight of about 17–27% of the combined trading volume of the two assets. Bitcoin dominated as the only widely recognized crypto asset, and most market activity was concentrated around it.

ETH growth phase (2019–2021). The share of Ethereum in trading volumes rose rapidly to 30–37%, peaking in 2021 amid the boom in DeFi, NFTs, and the overall growth of the smart-contract ecosystem. This is the only period when ETH approached a third of the market, which indicates the formation of a full-fledged second pole of the duopoly.

Stabilization phase (2022–2026). After Ethereum transitioned to Proof-of-Stake and the market turmoil of 2022, the share of ETH stabilized in the range of 33–36% and has not changed significantly since. This indicates that a structural equilibrium in trading activity has been reached: the duopoly has settled at a proportion of roughly 65/35 in favour of Bitcoin.

From the standpoint of duopoly models, *Table 1* confirms the validity of applying an asymmetric Cournot model: the players have different market power, and their shares are relatively stable over time rather than converging to a symmetric equilibrium. The stability of the shares over 2019–2026, despite radical changes in the technological and regulatory environment, is in itself consistent with the logic of a stable equilibrium, which is a key prerequisite for testing hypothesis *H2*.

The gap between the price and trading shares of BTC rose from 0.131 in 2017 to 0.317–0.325 in 2025–2026, i.e., by more than a factor of 2. This means that Bitcoin increasingly performs the function of a digital value reserve, that is, an asset that is held rather than traded, whereas Ethereum is shifting toward a liquid functional token. Such functional differentiation is direct empirical evidence of complementarity between the assets: they do not merely compete for the same demand but satisfy qualitatively different investor needs.

Consequently, the divergence between price and trading shares is empirical confirmation of functional differentiation between the assets. Bitcoin dominates as a store-of-value asset, whereas Ethereum holds a much stronger position as an instrument of circulation and use. It is precisely this differentiation that explains why the duopoly remains simultaneously asymmetric and stable: each asset dominates its own functional niche, which reduces the direct substitution effect and supports equilibrium.

3. Implications of the Bertrand model

The estimation results of the regression models (*Table 2*), which reflect the implications of Bertrand price competition, indicate a pronounced asymmetry in the interaction between Bitcoin and Ethereum.

Table 2

Estimation results of the models of price interaction between Bitcoin and Ethereum (Bertrand model)

Variables / indicators	Levels model (1)	Elasticity of ETH with respect to BTC (2)	Elasticity of BTC with respect to ETH (3)
Constant	−3.784*** (0.4579)	−0.0045 (0.0149)	0.0120 (0.0114)
ln(BTC)	1.063*** (0.0450)		
Δln(BTC)		0.9839*** (0.0859)	
Δln(ETH)			0.5820*** (0.0508)
Number of observations	100	100	100
R ²	0.850	0.573	0.573
Adjusted R ²	0.849	0.568	0.568

Note: standard errors are given in parentheses; *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$.

Source: calculated by the author in R based on Yahoo Finance data (n.d.).

The constructed levels model (1) shows an extremely close long-term relationship between the logarithms of the two assets' prices: the coefficient on ln(BTC) is 1.063 ($p < 0.001$), and $R^2 = 0.850$. This means that a 1% increase in the price of Bitcoin is associated with a 1.063% increase in the price of Ethereum in the long run. A coefficient above one indicates that Ethereum shows somewhat higher-than-proportional price sensitivity to changes in Bitcoin; that is, it amplifies the leader's impulses. The negative constant reflects a structural level discount of ETH relative to BTC, attributable to the difference in absolute prices.

The key results are obtained in the models of short-term dynamics. The elasticities are the central result of testing the Bertrand model and directly verify hypothesis *H1* on asymmetric price leadership.

The elasticity of ETH with respect to BTC is 0.984 ($SE = 0.086$, $p < 0.001$), i.e., a 1% change in the monthly *log* return of *Bitcoin* is accompanied by a 0.984% change in the return of Ethereum in the same direction (Figure 2). The coefficient on Δln(BTC), close to one, means that ETH responds proportionally to a change in the price of BTC, which is behaviour characteristic of a market in which one player is the unrivalled price benchmark.

The elasticity of BTC with respect to ETH is 0.582 ($SE = 0.051$, $p < 0.001$), i.e., the symmetric dynamic is almost twice as weak as in model (2) (Figure 3). Thus, Bitcoin responds to price changes of *Ethereum* only partially, retaining considerable independence in forming its own price.

The values of the coefficients of determination ($R^2 \approx 0.57$) for both models (2) and (3) in first differences indicate that about half of the variation in short-term returns is explained by the interaction between the assets, whereas the other part is due to idiosyncratic factors. This is consistent with the earlier conclusions about the partial complementarity of the assets: despite the strong interrelation, Ethereum retains a degree of autonomy in short-term dynamics.

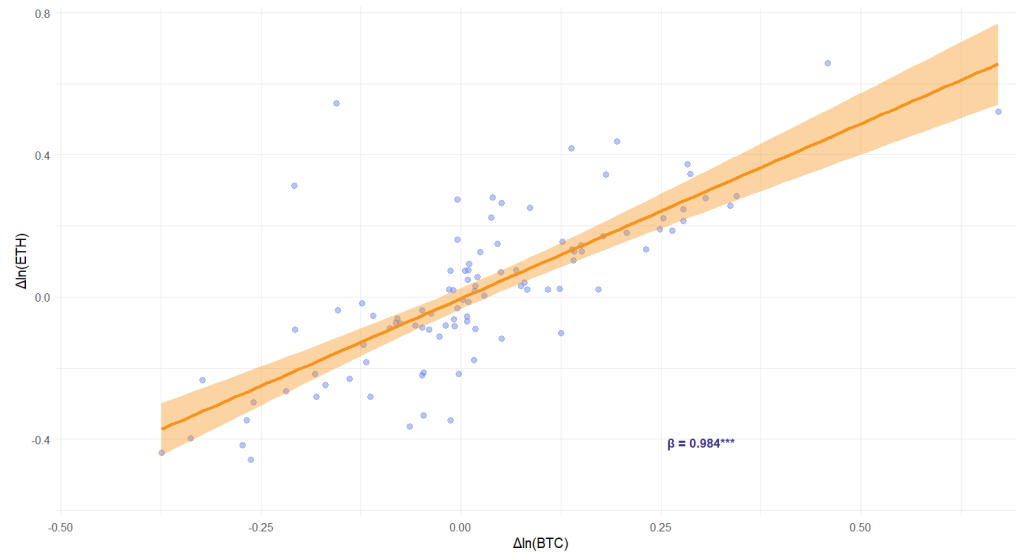


Figure 2. Elasticity model of *ETH* with respect to *BTC*

Source: constructed by the author in R based on Yahoo Finance data (n.d.).

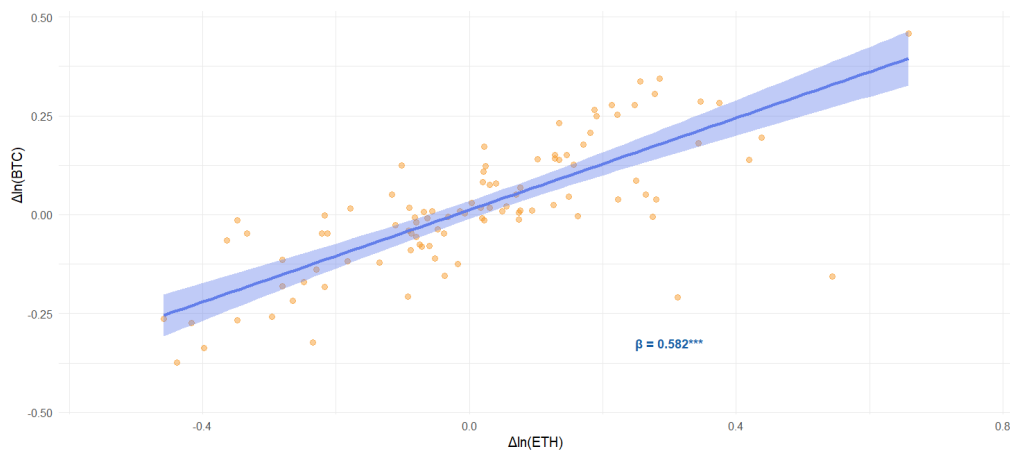


Figure 3. Elasticity model of *BTC* with respect to *ETH*

Source: constructed by the author in R based on Yahoo Finance data (n.d.).

The asymmetry of the elasticities (the difference between these coefficients is 0.402) is a quantitative measure of the asymmetry of price transmission and serves as direct empirical confirmation of the hypothesis of Bitcoin price leadership (H1) in the duopoly. The results obtained mean that price impulses generated in the Bitcoin market are almost fully transmitted to Ethereum, whereas the reverse effect is substantially weaker. From an economic standpoint, this corresponds to a hierarchical duopoly structure in which Bitcoin plays the role of the dominant player (leader) that sets market dynamics, while Ethereum acts as an adaptive follower. Such a configuration is consistent with an asymmetric interpretation of the Bertrand model, in which one of the players has greater market power and shapes the price expectations of the other participants.

Thus, the results of the empirical analysis confirm the presence of an asymmetric price transmission mechanism between Bitcoin and Ethereum and allow their interaction to be interpreted in terms of the Bertrand model with Bitcoin as the dominant price leader (confirmation of hypothesis H1), while Ethereum is a reactive follower with substantially lower price autonomy.

4. Implications of the Cournot model

The regression of the change in the market share of Ethereum on the lagged share of Bitcoin (model 4) yielded a statistically significant result ($p < 0.001$); however, the coefficient on $SBTC_{t-1}$ deserves attention. It is $+0.302$ ($SE = 0.068$, $p < 0.001$); the constant is -0.205 ($p < 0.001$), $Adj. R^2 = 0.157$ (Table 3). The model explains 15.7% of the variation in changes in the *ETH* share, which is a low but significant result for monthly financial data.

Table 3

Estimation results of the Cournot model
(dynamics of the market shares of Bitcoin and Ethereum)

Variables / indicators	Δ_{SETH} (dependent variable)
Constant	-0.2046^{***} (0.0468)
$SBTC_{t-1}$	0.3018^{***} (0.0685)
Number of observations	100
RMSE	0.0328
Adjusted R^2	0.157

Note: standard errors are given in parentheses; *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$.

Source: calculated by the author in R based on Yahoo Finance data (n. d.).

The classical Cournot equilibrium implies a negative coefficient β , i.e., if the *BTC* share in the previous period rises, the *ETH* share in the next period should decline as the competitor's reaction to the loss of its position. The positive coefficient obtained ($+0.302$) means the opposite: an increase in the *BTC* share precedes an increase in the *ETH* share in the following month. This directly contradicts the mechanism of quantity displacement and does not confirm hypothesis H2 in its classical formulation. However, this result has a meaningful explanation in the context of crypto assets. Thus, an increase in the market share of *Bitcoin* generally occurs in a phase of overall market upswing, when capital flows into the entire asset class. During such periods, *Ethereum* also receives an inflow of investment with a one-month delay, which allows us to identify a rotation of capital from Bitcoin to altcoins, well documented in the crypto-finance literature (Kammoun, 2026; Zhang et al., 2024; Kumah & Baafi, 2025). Thus, the positive coefficient reflects not competitive displacement but complementary demand: *BTC* and *ETH* are mutually complementary elements of a single investment class, in which the growth of one asset stimulates interest in the other.

The result obtained also indicates that the standard Cournot model with a trading-volume share is an insufficiently adequate specification for

crypto assets. The trading-volume share reflects not the production decisions of players, as in the classical model, but trader behaviour, which is determined by market sentiment rather than strategic planning.

Therefore, the Cournot equilibrium hypothesis H2 in its standard formulation is rejected. Instead, the result supports the complementarity hypothesis H3: the dynamics of the digital assets' shares point to a synchronous rather than competitive movement. This does not contradict the general concept of an asymmetric duopoly but refines it, since competition between BTC and ETH is realized mainly through the mechanism of price leadership, whereas at the level of market shares the effect of a common asset class dominates.

Conclusions

The conducted study is an attempt to systematically verify the hypothesis of an asymmetric duopoly structure of the cryptocurrency market by empirically testing the implications of the Bertrand and Cournot models on Bitcoin and Ethereum data for 2017–2026. The results obtained allow the following conclusions to be formulated.

First, the correlation analysis of the logarithmic price series confirmed the presence of two qualitatively different levels of interdependence between the assets. The high correlation of *log* levels ($r = 0.922$) reflects a common long-term trend component, whereas the correlation of *log* returns ($r = 0.795$) indicates a strong but incomplete short-term synchronicity. The gap between these indicators (0.127) quantitatively captures the degree of Ethereum's specific autonomy, driven by factors of the *DeFi* ecosystem and protocol updates, and serves as the first empirical argument in favour of the partial complementarity hypothesis (H3).

Second, the analysis of market shares revealed a persistent structural asymmetry over nine years of observation. The gap between the price and trading shares of *BTC* more than doubled (from 0.131 in 2017 to 0.317–0.325 in 2025–2026), which indicates a deepening of functional differentiation: Bitcoin increasingly plays the role of a digital value reserve, whereas Ethereum is establishing itself as a liquid functional token. This differentiation is the key mechanism sustaining a stable equilibrium in the asymmetric duopoly: each asset dominates its own functional niche, which reduces the direct substitution effect.

Third, the results of testing the implications of the Bertrand model confirmed the hypothesis of Bitcoin price leadership (H1). The elasticity of ETH with respect to BTC is 0.984 ($p < 0.001$), whereas the reverse elasticity of BTC with respect to ETH is only 0.582 ($p < 0.001$). The asymmetry of 0.402 is a quantitative measure of BTC's dominance in setting price benchmarks: price impulses from Bitcoin are almost fully transmitted to Ethereum, while the reverse effect is twice as weak. The levels model ($R^2 = 0.850$) confirms a close long-term relationship with a coefficient of 1.063, which indicates that the follower amplifies the leader's impulses.

Fourth, testing the implications of the Cournot model revealed a statistically significant positive coefficient (+0.302, $p < 0.001$) on the lagged BTC share, which directly contradicts the classical mechanism of quantity displacement and refutes hypothesis *H2* in its standard formulation. Instead, the positive sign is interpreted as a manifestation of a mechanism of capital rotation from Bitcoin to Ethereum with a one-month lag: an increase in the BTC share is a harbinger of a bullish market phase, during which capital spreads to Ethereum as well. This result is an independent empirical contribution consistent with the altcoin-season phenomenon and confirms the complementarity hypothesis (*H3*).

Thus, the cryptocurrency market in the BTC–ETH segment functions as an asymmetric duopoly in which competition is realized mainly through the mechanism of price leadership, whereas at the level of market shares the effect of complementary demand dominates. The practical significance of the results lies in three aspects. For portfolio managers, the identified lag of capital rotation from BTC to ETH is an instrumentally significant signal when rebalancing crypto portfolios. For regulators, the persistent asymmetry of market shares and the price leadership of Bitcoin indicate a concentration of systemic risk in a single asset, which must be taken into account in approaches to the prudential regulation of digital assets. For researchers, the rejection of the Cournot model is evidence that classical industrial organization models require modification in order to describe cryptocurrency markets correctly.

Prospects for further research lie in extending the analysis and applying regime-dependent models to identify structural breaks, in particular those related to the approval of Bitcoin ETFs in 2024, as well as in constructing a dynamic version of the Cournot test to verify the stability of the identified capital rotation effects under different market conditions.

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