U.PORTO
FEP FACULDADE DE ECONOMIA
UNIVERSIDADE DO PORTO

MASTER IN

FINANCE

Cross-Border Cryptocurrency Premium: An In-Depth Analysis of Speculative Bubbles and Arbitrage Opportunities

João Francisco Araújo Barbosa

Supervised by

Fábio Dias Duarte

Co-Supervised by

Ana Isabel Coelho Borges

M

2024

FACULDADE DE **ECONOMIA**

Acknowledgments

This dissertation marks the culmination of a significant journey. I am deeply grateful for everyone who stood by my side during hard times, as their encouragement and support was fundamental. It would not have been possible without every single one of them.

First and foremost, I wish to express my profound gratitude to the most important people in my life: family and friends. Their endless patience, guidance, and unwavering belief in my abilities have been a constant source of strength and motivation throughout this endeavor. Words cannot express my appreciation for all you have done.

I am also immensely thankful for my professors, Fábio Dias Duarte and Ana Isabel Coelho Borges. The supervision, wisdom, and constructive criticism provided were invaluable in shaping my research direction to what I proudly present today.

Additionally, I would like to extend my heartfelt thanks to the University of Porto, particularly the Faculdade de Economia da Universidade do Porto. The rigorous academic environment allowed me to acquire the knowledge and skills necessary for future professional endeavors, contributing to my professional growth.

Thank you all for being an integral part of this period of my life.

Abstract

In an era marked by rapid technological advancements and innovation in the financial ecosystem, the interest in cryptocurrencies as a means of investment diversification has significantly intensified. Cryptocurrencies have emerged into the limelight due to their high risk-adjusted returns. Such growth has led researchers to uncover intricate market dynamics within the crypto sector. We conducted a rigorous exploration into the "*Cross-Border Cryptocurrency Premium*" (CBCP) phenomenon. The CBCP emerges from the presence of imbalances in cryptocurrency prices across exchange markets, which might provide arbitrage opportunities for savvy investors. We examine the presence of the CBCP and its determinants for two decentralized cryptocurrencies widely regarded as premier digital assets (i.e., Bitcoin and Ethereum) traded in five developed markets with the highest levels of economic freedom. (i.e., the United States, Germany, Japan, Australia, Canada, and the United Kingdom).

When analyzing the CBCP on a country-by-country basis, we found that each country's heterogeneous microenvironment is crucial for understanding the scale of the CBCP. Our findings contribute to understanding the uniqueness of decentralized markets and the determinants of crypto price divergences. They shed light on the factors driving cross-border cryptocurrency premiums and identify arbitrage opportunities for risk-seeking investors.

Keywords: Bitcoin, Ethereum, Cross-Border Cryptocurrency Premium, Speculative Bubbles, Arbitrage Opportunities

JEL Codes: C58, G12, G15, O33

Table of Contents

List of Figures

List of Tables

List of Acronyms

AML – Anti-Money Laundering

AUD – Australian Dollar

BTC – Bitcoin

CAD – Canadian Dollar

CbC – Country-by-Country

CBCP – Cross-Border Cryptocurrency Premium

CEX – Centralized Exchanges

DApps – Decentralized Applications

EMH – Efficient Market Hypothesis

ETH – Ethereum

ETF – Exchange Traded Fund

EUR – Euro

GBP – Pound Sterling

ICO – Initial Coin Offering

JPY – Japanese Yen

KRW – Korean Won

KYC – Know-Your-Customer

PoS – Proof of Stake

PoW – Proof of Work

ROI – Return on Investment

SEC – Securities Exchange Commission

USD – United States Dollar

1. Introduction

In 2023 half of the citizens in the United States (U.S.) own or previously owned cryptocurrencies, and 43% plan to invest in these digital assets by the end of 2024 (ConsenSys.io). In January 2024, the global value of the crypto market cap achieved $1.59T, according to data available on *CoinMarketCap.com*. Cryptocurrencies such as Bitcoin (BTC) and Ethereum (ETH) are set as the main value drivers of this market, accounting for more than 68% of the global market capitalization with a large BTC dominance (49.8%).

Digital currencies have emerged as novel financial instruments with unique characteristics, capturing the interest of various market players. The growth of the crypto market has not only sparked the interest of retail investors but also financial institutions, who are increasingly eager to engage. One of the clearest indications of this interest was demonstrated in June 2023, when BlackRock, the world's largest asset manager, and Fidelity submitted applications to the Securities and Exchange Commission (SEC) for a spot Exchange Traded Fund (ETF) tracking Bitcoin. Another significant development was the approval of these applications by SEC Chairman Gary Gensler approximately six months later.

Some governments and citizens have shown continuous interest in digital currencies as a response to the collapse of traditional financial systems and low economic growth, as seen in the cases of many Latin American countries. Particularly, BTC is considered to be a hedge against the inflation of currencies, due to its characteristics as a store of value. A study conducted by Chainalysis.com found that many Venezuelans have begun using cryptocurrencies, especially stablecoins, to protect their savings and preserve their wealth from the effects of hyperinflation. However, despite this wave of market engagement, the concept and functioning of the cryptocurrency market remain ambiguous and unfamiliar to a large portion of the world's population. According to the survey conducted by ConsenSys.io, only 50% of respondents in the U.S. claimed to understand what cryptocurrencies are, and 42% assumed to have an unclear understanding. Regulatory oversight is also lacking when applied to the mechanisms driving the cryptocurrency markets, and how they can relate with traditional ones.

"Regulatory systems are burgeoning, with myriad approaches being taken by various governments. Current regulatory measures are in their infancy and continue to evolve with the rapidly expanding industry" (Farell, 2015, p.12).

Alongside the growing economic significance and enthusiasm surrounding the potential of cryptocurrencies, concerns from retail investors, financial institutions, and regulators have fueled academic research into various aspects of cryptocurrencies and the functioning of this decentralized market. One of the key concerns and subjects of research are the dramatic price fluctuations observed in crypto exchange markets. Bitcoin often described as "digital gold" exemplifies this volatility. Gkillas et al. (2019) argue that the inclusion of Bitcoin and gold in portfolios significantly enhances equity performance, particularly under conditions of tail risk. This suggests that Bitcoin may serve as a contemporary alternative to gold in portfolio management strategies.

According to a report published by Deutsche Bank[1], Bitcoin remains highly volatile and is expected to maintain this level of volatility in the foreseeable future despite its perceived value as a digital asset. Consequently, one of the most pressing matters for academic research is understanding how a cryptocurrency is intrinsically valued. The imbalances between the price of cryptocurrencies in international cryptocurrency markets and the influence of foreign exchange rates emerge as a topic in this research line.

As demonstrated by Choi et al. (2018), in January 2018, the price of Bitcoin traded on South Korean exchanges (dealt in local currency) was nearly 55% higher than the price of Bitcoin traded in the United States in USD on the same day. This discrepancy, known as the *Kimchi Premium*, illustrates a market disequilibrium where Bitcoin consistently trades at higher prices on South Korean exchanges compared to international markets, specifically in the United States, when accounting for the prevailing foreign exchange rates for fiat currencies (Choi et al., 2018; Eom, 2021). Arbitrageurs can capitalize on such disequilibrium. For example, they can purchase Bitcoin in the US crypto market at a lower price and then transfer the Bitcoin to a Korean exchange where it can be sold for a higher price in Korean won (KRW). The arbitrageurs would then exchange the KRW

[1] "*Bitcoin could potentially become the 21st century gold. (n.d.)." Deutsche Bank.* *https://www.db.com/what-next/digital-disruption/dossier-payments/i-could-potentially-see-bitcoin-to-become-the-21st-century-gold*

for US dollars, completing the arbitrage cycle and potentially securing risk-free returns[2]. Choi et al. (2018) and Eom (2021) acknowledge that arbitrage opportunities for Bitcoin are not exclusive to Korea. The divergence in Bitcoin prices is a phenomenon that verifies at the international level, and such differences can be high and persist over long periods, potentially impacting market stability even in financially stable countries with robust asset markets. The US-local countries' price imbalances, particularly evident in Bitcoin, raise critical concerns about the intrinsic value of these digital assets and the potential for market manipulation. Nonetheless, the literature on the Cross-Border Cryptocurrency Premium (hereafter, CBCP[3]) is scant and pretty much limited to US-Korean markets. The lack of research on CBCP in established markets creates a critical research gap in our understanding of the factors influencing asset prices, creating discrepancies across different economic environments. Our study extends the research conducted by Eom (2021) by promoting a deeper exploration of the phenomenon occurring in financially stable nations with high levels of economic freedom.

We examined the CBCP emerging from price imbalances in cryptocurrencies traded on multiple international crypto exchanges, taking into account various foreign exchange rates across a pool of countries and currencies. Moreover, we extend our study to Ethereum CBCP. By analyzing the influence of crypto-specific indicators, country-specific metrics, and control variables, this research aims to expand our knowledge of how the CBCP manifests in different economic contexts, namely in the USA, Germany, Japan, Australia, Canada, and the United Kingdom for BTC and ETH markets.

In brief, our results reveal that the premium is not confined to the South Korean market but extends to major global economies, highlighting the widespread presence of arbitrage opportunities. We also identified the key indicators that influence the premium, both positively and negatively, enhancing the public understanding of the primary drivers affecting market behavior. Additionally, these findings assist in predicting future trends,

---

[2] Arbitrageurs are unable to maintain global parity in Bitcoin prices in Korea due to institutional frictions. However, it's also worthied to reference the fact that the South Korean won (KRW) is regulated, making arbitrage strategies difficult for international investors/arbitrageurs. Nonetheless, the violation of the one-price rule should call our attention.

[3] The term "Cross-Border Cryptocurrency Premium (CBCP) is a concept we developed, inspired by the traditional "Kimchi Premium".

providing valuable insights for arbitrageurs seeking to capitalize on market inefficiencies. Furthermore, by adopting a country-by-country approach, we demonstrate that the impact of key CBCP indicators varies across different markets. This underscores the importance of considering country-specific factors to fully understand the dynamics of CBCP.

2. The Market and Cryptocurrency Giants: Background

According to Giudici et al. (2020 p.1), "cryptocurrencies are digital financial assets, for which ownership and transfers of ownership are guaranteed by a cryptographic decentralized technology". Their potential applications as mediums of monetary exchange, investment avenues, and catalysts for fintech advancements constitute significant areas of interest.

2.1. Bitcoin

Satoshi Nakamoto is the founding father of the first decentralized digital asset, known as Bitcoin, which was created in 2009. According to Nakamoto (2008, p.1), "a purely peer-to-peer version of electronic cash would allow online payments to be sent directly from one party to another without going through a financial institution". Since Bitcoin possesses a decentralized nature, meaning that no central bank has established control, it is perceived as resistant to government intervention and other aspects of the conventional monetary system, thereby disrupting established financial norms (Bunjaku, 2017). Li and Wang (2017) state that Bitcoin serves as a payment medium and value storage, possessing similar characteristics to gold.

With its launch in 2009, the technology has moved beyond its use as a cryptocurrency verification system and is now being applied to a greater range of commercial and economic uses. Data compiled by Tasca et al. (2018, p.1) revealed that the number of transactions on the Bitcoin blockchain increased at a dramatic pace from approximately 1,000 per day in 2011 to about 300,000 per day at the moment that the paper was written. According to the author, this allowed Bitcoin to progress from the "prototype and shadow economy phases" to the third stage of acceptance as a legal means of conducting business.

Bitcoin's market capitalization has grown significantly attracting both retail and institutional investors due to continuous worldwide acceptance. Smales (2022, p.1) found that "increases in investor attention are associated with higher returns, more volatility, and greater illiquidity in cryptocurrency markets". According to Eross et al. (2019), the primary participants in Bitcoin trading are traders from Europe and North America, and the volume of trades peaks in the morning and during the day, in line with other currency markets.

2.2. Ethereum

Launched by Vitalik Buterin in 2015, Ethereum can be classified as a blockchain-based decentralized platform capable of supporting the creation of smart contracts and the development of decentralized applications (DApps). Its token ether (ETH) is the second largest cryptocurrency in the market, holding significant relevance in the industry. According to Buterin (2014, p.34) “the Ethereum protocol provides for a platform with unique potential, rather than being a closed-ended, single-purpose protocol”.

Ethereum blockchain technology plays singular functions in smart contracts; it allows individuals and companies worldwide to automatically enforce complex financial agreements, which are executed only when specific conditions are met (Tikhomirov et al., 2018). While “earlier blockchain protocols could be categorized as single-function tools (e.g. Bitcoin), like pocket calculators, or at best multi-function tools like Swiss army knives, Ethereum can be considered the smartphone of blockchains” (Buterin, 2016, p.2). Most recently, due to the rapid development of blockchain technology and the introduction of disruptive cryptocurrency projects, a new crypto-economy has emerged, impacting the financial industry (Khan et al., 2021). The Ethereum project is at the heart of such disruption.

Unlike Bitcoin, which primarily focuses on being a decentralized form of money for transactions and value storage, Ethereum encompasses these features but also has different capabilities[4] and long-term objectives. Its most important use case is as a platform for building "DApps" across various sectors, including decentralized finance (DeFi), digital identity, and social networks, among others. These applications leverage blockchain technology to offer more secure, transparent, and equitable services.

2.3. Key Challenges in the Cryptocurrency Industry

Cryptocurrency industry faces a multitude of challenges that could significantly impact its future viability. These challenges encompass a broad spectrum of issues from regulatory problems, governance, public perception, and the management of the inherent

[4] Ethereum, contrary to Bitcoin uses a PoS (Proof-of-Stake) consensus mechanism instead of PoW (Proof-of-Work), as it aims to improve scalability and energy efficiency.

volatility of cryptocurrencies, among others. Additionally, concerns related to illicit activities such as money laundering and terrorism financing must be addressed to enhance the industry's reputation as a safer space.

Navigating the regulatory landscape is a complex process due to evolving governmental regulations and the absence of universally accepted frameworks. In the United States, the SEC classifies most cryptocurrencies as securities, particularly ICOs (Initial Coin Offerings), except Bitcoin, which is treated as a commodity due to the fact its creation did not involve its offering through an ICO, and its main purpose is to be used as a means of payment instead of an investment contract. According to Treiblmaier (2022, p.9) “whether Bitcoin will turn out to be an unsubstantiated hype, a speculative commodity, a currency, or even official money will ultimately depend on its evaluation from a regulatory perspective, namely, legislation”. In contrast to the US, there is disagreement when classifying cryptocurrencies as securities particularly in the European Union, as well as in nations like Australia and Japan. International organizations like the Financial Action Task Force (FATF) are working to standardize regulatory frameworks, but significant disparities remain.

Governance within blockchain networks also poses a significant challenge for the industry. Although blockchain networks are meant to be decentralized, complex governance frameworks are sometimes needed for protocol updates and network modifications. Conflicts between stakeholders, such as developers, miners, users, and investors, can result in difficult hard forks and make reaching an agreement difficult. The solution to this problem according to Trump et al. (2018, p.4), might involve “governing the ungovernable”. However, the fact that the decision-making process may involve a central authority may inadvertently lead to centralization, a critical concern within the industry that needs to be “avoided at all costs”.

Despite the numerous challenges the cryptocurrency industry faces, overcoming public perception is crucial for incentivizing mass adoption. However, frequent illegal activities undermine trust, creating insecurity among investors. The pseudonymous nature of cryptocurrencies makes them attractive for money laundering and terrorism financing. Foley et al. (2019) estimate that "$76 billion of illegal activity per year is financed through payments in bitcoin." Enhanced regulatory measures, such as know-your-customer (KYC) and anti-money laundering (AML) laws, are essential to mitigate these risks and improve public trust.

3. Literature Review

3.1. Market Inefficiencies

There is still a lot of debate in financial research regarding the efficiency of cryptocurrency markets. Market efficiency, in its traditional sense, is characterized by the fact that market prices reflect all available, relevant information, which is universally accessible to all participants (Beaver, 1981). Under these conditions, arbitrage opportunities are typically very minimal. According to the Efficient Market Hypothesis (EMH) proposed by Fama (1970), an investor cannot consistently outperform the market, and anomalies should not exist because they will immediately be arbitraged away. If they do exist, it can be an indication of market inefficiency, and profitable opportunities could arise (Schwert, 2003). EMH is categorized into three forms efficiency: weak, semi-strong, and strong. Each form differs based on the types of information considered, being historical, public, and private, respectively.

Cryptocurrency markets, particularly those involving Bitcoin and Ethereum, have started to attract academic attention in terms of efficiency valuation. Studies suggest that Bitcoin initially exhibited "weak efficiency," where prices reflected all historical information, but has evolved towards greater efficiency over time. According to Noda (2021, p.1), “the degree of market efficiency varies with time in the markets, and Bitcoin’s market efficiency level is higher than that of Ethereum over most periods”. Wei (2018) emphasized the role of liquidity in enhancing market efficiency and reducing volatility, stating that in liquid markets, active traders are more likely to eliminate return predictability through arbitrage, thereby enhancing market efficiency. Contrary to previous findings, some researchers argue that cryptocurrency markets remain inefficient in certain aspects. Vidal-Tomás and Ibáñez (2018) highlighted that while Bitcoin has become less reactive to changes in monetary policy over time, suggesting improved efficiency, it still displays inefficiencies, as it reacts negatively to its own news. However, according to the findings of Chu et al. (2019, p.1), “types of news and events may not be significant factor in determining the efficiency of cryptocurrency markets”. This suggests that other factors could be more influential in shaping market efficiency in the cryptocurrency sector.

This brings us to the next topic. Behavioral economics can also influence market efficiency, particularly when talking about issues concerning changes in market conditions, or the presence of asymmetry of information between market participants. Informational asymmetries arise when one party has access to more or better-quality information, creating imbalances that can be exploited by the other party. Leland et al. (1977) noted that such asymmetries are remarkably pronounced in financial markets, stating that "without information transfer, markets may perform poorly". This is particularly true when analyzing the cryptocurrency market. Bad actors can manipulate information to their advantage, leading to scams like pump-and-dump schemes and fake Initial Coin Offerings (ICOs). Xia et al. (2020) stated that many scams were reported in cryptocurrency exchanges, leading to huge financial losses to market participants. This undermines market trust and contributes to the incapacity of the markets to correctly absorb accurate information, distorting asset prices. Such distortions might lead to significant price divergences between regions, and the creation of possible arbitrage opportunities, by directly affecting the CBCP.

Makarov and Schoar (2020) found that cryptocurrency markets exhibit significant arbitrage opportunities, especially across countries, due to capital controls and transaction costs that hinder the free movement of arbitrage capital. Price deviations tend to widen during periods of significant Bitcoin appreciation, highlighting the impact of cross-market frictions. Crépellière et al. (2023) found as well that price differences exist across exchanges, although the discrepancies are smaller than previously reported. These findings contrast with the research proposed by Makarov and Schoar, indicating that increased informed trading has significantly enhanced market efficiency and reduced arbitrage opportunities.

3.2. Cross-Border Cryptocurrency Premium

The *Cross-Border Cryptocurrency Premium* (CBCP), a term derived from the concept of the "Kimchi Premium", reflects underlying market inefficiencies where a cryptocurrency, such as Bitcoin or Ethereum, trades at different prices across multiple exchanges in various countries. This price discrepancy creates potentially profitable arbitrage opportunities for savvy investors who can buy at lower prices in one market and sell at higher prices in another. The CBCP may be influenced by several key variables categorized in this research as control, country-specific, and crypto-specific, which have

the capability to affect the closing prices of cryptocurrencies, contributing to the creation of the “premium”. The understanding of the CBCP is crucial as it reflects the evolving nature of digital asset markets and their integration into the global financial system. As cryptocurrencies gain prominence, policymakers and financial institutions must navigate the implications of the CBCP to establish economic stability, as the presence of this premium reflects a market who lacks efficiency.

According to Eom (2021, p.1) “in an efficient market, there should be no Kimchi premium because competition will drive prices to their correct values”. However, as will be demonstrated further, the CBCP remains a persistent phenomenon in various markets, serving as a proxy for bubbles in BTC and ETH markets. Severe speculative bubbles have been reported, particularly in China and the United States, as highlighted by Asako and Liu (2013). Choi et al. (2022) highlights how market frictions, such as capital controls and transaction costs, contribute to sustained price differences. These frictions exacerbate potential arbitrage opportunities, allowing the premium to persist over time. Seo et al. (2024, p.1) also presents some interesting findings as the premium exhibits mean-reverting behavior when it exceeds certain thresholds, suggesting that it is not purely a random walk. They conclude that “only for relatively large-sized premiums, arbitrageurs exploit the premium”.

Many market players often view cryptocurrencies as speculative instruments, comparing their volatile behavior to the speculative bubbles observed in traditional equity markets (Baur et al., 2018; Haykir et al., 2022). These bubbles are marked by sudden, steep price increases driven primarily by market sentiment and market momentum rather than underlying fundamentals (Geuder et al., 2019). Reasonable valuation models cannot account for such price levels. Extrapolating from traditional speculative bubble theory, according to John Maynard Keynes (1936), speculators in financial markets often base their decisions on what they believe average opinion expects, rather than on fundamental values. This behavior can lead to asset prices diverging significantly from their intrinsic value (Flood and Hodrick, 1990).

It is also relevant to point out that during market bubbles, asset prices are often driven by the beliefs of the most optimistic investors, especially in the presence of short-sales constraints (Harrison and Kreps, 1978). According to Scheinkman and Xiong (2003) the degree of the agent's overconfidence and the asset's fundamental volatility determine how

large the bubble is because as these parameters increase, beliefs become more heterogenous, and prices have a tendency to soar. Behavioral biases like herding, where less sophisticated investors mimic the actions of others, therefore exacerbating bubble formation, leads to increased market volatility and delayed incorporation of new information into prices (Chiang and Zheng, 2010).

Speculative bubbles are not confined to traditional equity markets like the stock market; they also manifest in the cryptocurrency space, especially for BTC markets. According to Kyriazis et al. (2020) Bitcoin has experienced multiple bubble phases, notably in the years 2013 and 2017. Also Chen and Hafner (2019) tested for the presence of speculative bubbles by employing a "sentiment index" derived from social media activity. They identified the presence of bubbles in the cryptocurrency market, demonstrating that price dynamics during these periods were driven by investor sentiment rather than fundamentals. Additionally, Cheah and Fry (2015) documented that bubbles exist in the Bitcoin market.

The idea that cryptocurrencies are a means to make huge capital gains fast may induce investors to trade speculatively, suggesting that cryptocurrencies might lack intrinsic value. Lambrecht and Larue (2018, p.2) concluded that "BTC specifically can have intrinsic value if i) complies with its practical promise of constituting a stable currency; ii) helps reduce state coercion; iii) constitutes a more efficient and safe system of payment; and iv) better protects transaction privacy than the conventional banking system". Conversely, Baur et al. (2018) states that the price impact of potential users and speculators in virtual currencies undermines their function as a medium of exchange. It suggests that Bitcoins are primarily held as speculative investment assets rather than being used for everyday transactions.

As aforementioned, speculative behavior of traders is particularly evident when analyzing Bitcoin's market. Its comparatively high price and high turnover in the Korean cryptocurrency market is reminiscent of the late 1990s dot-com bubble. Ok et al. (2023) explore whether the Kimchi Premium can be classified as a speculative bubble. Despite showing traits consistent with speculative bubbles, they lack conclusive evidence to support this claim as the premium is also influenced by microstructural factors unique to the South Korean market, such as the investors time-varying beliefs, strict capital controls, and limited access to international exchanges. Seo et al. (2024) also found that

the Kimchi Premium's dynamics are influenced by speculative trading and regulatory constraints, which create temporary price distortions. However, these tend to be corrected over time. Eom (2021) added by discovering that higher premiums are linked to higher trading volume and price volatility. This relationship emphasizes how speculative activity and investor sentiment can amplify price disparities, giving birth to speculative bubbles.

4. Research Questions

In this study, we explore various facets of the CBCP phenomenon, particularly its magnitude, determinants, and implications across cryptocurrencies and different markets with high levels of economic freedom. The focus on countries with high economic freedom is strategic allowing for a more nuanced analysis of the CBCP's presence in markets with more libertarian policies for international trade. This approach enables us to account not only for country-specific factors, and crypto-specific indicators that might influence the CBCP, but also the impact of macroeconomic indicators, defined as *control* in the dissertation. According to Choi et al. (2018, p.21), utilizing the Index of Economic Freedom allows us to "measure capital controls and other regulatory restrictions". The following research questions have been developed to explore CBCP complexities in depth:

RQ1: Is the Cross-Border Cryptocurrency Premium (CBCP), a phenomenon well-documented in the South Korean cryptocurrency market, also observable in other financially stable countries with high economic freedom?

RQ2: Does the presence of the CBCP still hold true for cryptocurrencies other than Bitcoin, like Ethereum?

RQ3: What are the key indicators that influence the CBCP?

RQ4: Do the key indicators that influence the CBCP exert the same impact across all sample markets?

These research questions address some gaps in the existing literature, which predominantly focuses on the trading relationship between the US and Korean Bitcoin markets. By expanding the scope to other global market complexities, this study provides a more comprehensive understanding of the CBCP. By answering these research questions, we are also examining whether profitable arbitrage opportunities exist (and why) for savvy investors.

Figure 1 illustrates the conceptual framework that guides our empirical research.

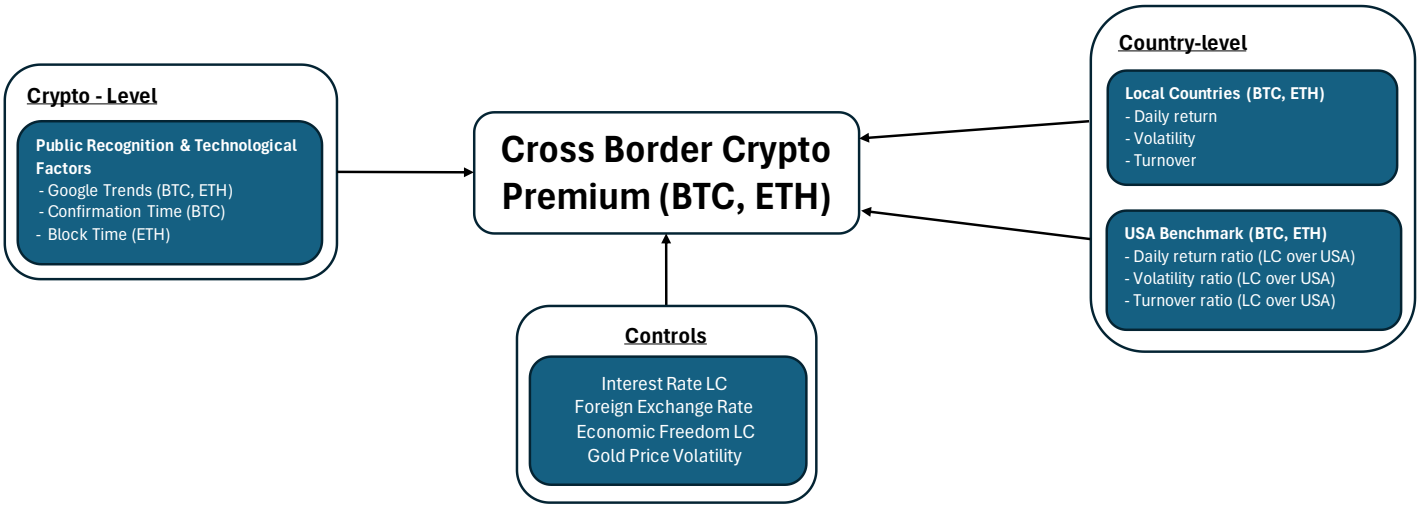

***Figure 1**. Conceptual Framework*

5. Empirical Design

5.1. Data

It is well-documented in the literature that cross-border arbitrage opportunities are more prevalent in countries with limited access to international markets or stringent capital controls (Makarov and Schoar, 2020; Borri and Shakhnov, 2020). To offer a unique and less-explored perspective, our research will focus on the study of the CBCP in developed nations, as theoretically, arbitrage opportunities should not exist in efficient, well-regulated markets.

To select the pool of countries for examination, we employed a threefold criteria: first, we measured economic and financial stability using the country's GDP growth rate, as collected from the World Bank database. Second, we assessed the technological advancements in the crypto industry using the "Crypto Adoption Index" provided by Chainalysis. Finally, we evaluated market openness and the regulatory environment using the "Index of Economic Freedom" provided by the Heritage Foundation. From the data collected, we created a dataset of the top 50 countries that met our criteria, giving higher priority to the "Crypto Adoption Index" and GDP growth rate. We selected the countries with the highest scores in these categories and finalized the shortlist: the United States (USA), Germany (GER), Japan (JPN), Australia (AUS), Canada (CAN), and the United Kingdom (UK).

Data on cryptocurrency prices was collected from multiple crypto exchanges from 01/01/2018 to 31/12/2023 for both BTC and ETH. Exchanges were selected based on data availability, trading history length, and the current and historical market share of Bitcoin and Ethereum[5]. The dataset includes the daily high price, low price, adjusted closing price, and CEX trading volume. USD data is from Gemini, EUR is from Bitstamp, JPY data is from Bitfinex, AUD is from Binance, CAD is from Kraken, and GBP data is from

[5] Pricing information and trading volume were collected through https://www.cryptodatadownload.com/ as the data is gathered in one place. It serves as a proxy for all the cryptocurrency exchanges present in the study.

Coinbase. Additionally, the daily foreign exchange rates, crucial for calculating the CBCP, were obtained through Yahoo Finance.

Extrapolating from the raw data above, in our analysis the CBCP can be determined by multiplying the Bitcoin-adjusted closing price denominated in the domestic currency of a local market (in our case Germany, Japan, Australia, Canada, and the United Kingdom) by the foreign exchange rate of one unit of the domestic currency in USD, and then subtracting the obtained value by the Bitcoin-adjusted closing price in the US market, in USD. This value is then divided by the Bitcoin-adjusted closing price in the US market, in USD. Thus, the CBCP on date (*t)* for a given country (*i)* for Bitcoin is calculated as follows[6]:

$$\boldsymbol{CBCP_{t,i}} = \frac{P_{BTC\_LM/DC_{t,i}} * FX_{DC/USD_{t,i}} - P_{BTC\_US/USD_{t,i}}}{P_{BTC\_US/USD_{t,i}}} \quad \textbf{(1)}$$

Where:

- $\boldsymbol{P_{BTC\_LM/DC}}$ = Price of one BTC in the local market (LM), in domestic currency (DC)
- $\boldsymbol{FX_{DC/USD}}$= Value of one unit of domestic currency in USD
- $\boldsymbol{P_{BTC\_US/USD}}$ = Price of one BTC in the US market, in USD

5.2. Variables

To analyze the dynamics of the CBCP and its determinants, we looked at a number of different variables. This analysis will initially be performed on a global scale and then separately for each sample market. All the variables considered for this study were carefully selected to elucidate the factors contributing to observed price discrepancies in global cryptocurrency trading, specifically in Bitcoin and Ethereum markets.

First, crypto-specific indicators were selected, offering valuable insights into market dynamics, and investor sentiment. For Bitcoin (BTC) we considered the *Confirmation Time on Blockchain*, as for Ethereum (ETH) *Block Time* was the selected indicator. Additionally, *Google Trends Searches* will serve as a global variable, applicable to

[6] This formula applies to other crypto assets (e.g. Ethereum).

examine CBCP in BTC and ETH based on search intensity. Second, country-specific metrics were added in line with literature on the analysis of the "premium" in cryptocurrency markets (e.g., Eom, 2021); i.e., *daily return*, *volatility*, and *turnover* are considered for both Bitcoin and Ethereum. To incorporate a comparative component between the sample markets (local countries) and the benchmark country (USA), we created ratios of the country-specific metrics; i.e., local country to US ratio of *daily return*, *volatility*, and *turnover*. This approach allows us to contextualize the performance of local markets in relation to a well-established and influential market (USA), thereby enhancing the robustness and credibility of our analysis.

Finally, we control for macroeconomic variables that are critical for understanding the broader financial context influencing cryptocurrency prices. The variables included in this category are *interest rates*, *foreign exchange rates*, *index of economic freedom*, and *gold price volatility*.

For a detailed overview of all variables used in this study, focusing on their measure, definition, and data sources, please refer to **Table 1**.

Table 1. *Variables Definition*

Dependent Variables	Measure	Country - Crypto Variance	Time Variance	Definition	Sources
CBCP_Global	Basis Points (bps)	(GER, JPN, AUS, CAN, GB), (BTC, ETH)	Daily	Gaps in cryptocurrency prices (BTC and ETH) in the USA exchange compared to foreign countries	Authors Computation
CBCP_Global_ABS	ABS(bps)			Is the absolute value of CBCP_Global	Authors Computation
Independent Variables					
Crypto Level					
Google Trends Intensity BTC and ETH	Range (1:100)	BTC	Monthly	Measure of search intensity for the term "Bitcoin"//"Ethereum"	Google Trends
Confirmation Time BTC	Minutes	BTC	Every 3-days	Avg. time for a transaction to be added to the ledger	BlockChain
ln (Confirmation Time BTC)	ln(Minutes)			Is the logarithm of Confirmation Time BTC	
Block Time ETH	Seconds	ETH	Daily	Avg. time taken in seconds for a block to be included in the ETH blockchain	Etherscan
Country level					
Local Countries (LC)					
Daily Return LC	%	(GER, JPN, AUS, CAN, GB), (BTC, ETH)	Daily	Difference between the closing price and the opening price divided by the opening price in a LC exchange	Eom (2021)
Volatility LC	%	(GER, JPN, AUS, CAN, GB), (BTC, ETH)	Daily	Difference between a high price and a low price divided by the closing price in a LC exchange	Eom (2021)
Turnover LC	%	(GER, JPN, AUS, CAN, GB), (BTC, ETH)	Daily	LC exchange trading volume divided by (BTC, ETH) market capitalization	Eom (2021)
USA (Benchmark)					
Daily return Ratio	Ratio (%)	LC over USA	Daily	Ratio between daily return in each country over daily return in the US	Authors Computation
Volatility Ratio	Ratio (%)	LC over USA	Daily	Ratio between volatility in each country over volatility in the US	Authors Computation
Turnover Ratio	Ratio (%)	LC over USA	Daily	Ratio between turnover in each country over turnover in the US	Authors Computation
Controls					
Interest Rate LC	Rate (%)	(GER, JPN, AUS, CAN, GB)	Monthly	Long term real interest rates	OECD
Foreign Exchange Rate	in USD	(GER, JPN, AUS, CAN, GB)	Daily	The relative price of the LC currency expressed in USD	Yahoo Finance
Economic Freedom LC	Range (0:100)	(GER, JPN, AUS, CAN, GB)	Annualy	Measure of the impact of liberty and free markets in a country	The Heritage Foundation
Gold Price Volatility	in USD	USA	Daily	Benchmark for gold price volatility	World Gold Council

5.3. Descriptive Statistics

Table 2 reports summary statistics for key variables that exert significant influence over the (absolute) value of the CBCP for Bitcoin (BTC) and Ethereum (ETH). Several interesting insights emerge from the data.

The mean CBCP in absolute value for ETH (58.29 bps) is slightly higher than for BTC (54.93 bps), indicating that ETH may experience greater price discrepancies across markets. This difference suggests that arbitrage opportunities could be more lucrative in ETH markets. The maximum CBCP for ETH (1092.96 bps) exceeds that of BTC (934.33 bps), reinforcing this point. This could mean that at its peak valuation, market dynamics or ETH demand could push its premium above BTC. However, the same cannot be said for the standard deviation, as ETH (74.81 bps) presents a lower value than BTC (78.91 bps) for this category. This suggests that while ETH premiums can be higher, they are also more stable and less variable, highlighting ETH as the superior choice over BTC for investors seeking profitable arbitrage opportunities.

Examining the independent variables, we see that *Google Trends Intensity* for BTC and ETH has a similar mean value, indicating a comparable level of public interest in both cryptocurrencies during the sample period. However, ETH shows a wider range (4 to 100) compared to BTC (8 to 64), reflecting more volatile interest levels. For the country-level variables, focusing on the benchmark (USA), we find that the *daily return ratios* for ETH (1.344%) and BTC (0.894%) are comparable, with ETH slightly higher. Similarly, the *volatility ratios* for ETH (1.012%) and BTC (1.019%) indicate comparable risk levels, as for *turnover ratios* for BTC (1.011%) and ETH (1.010%). Such results corroborate our previous affirmation that ETH is the superior choice over BTC.

A detailed description of the sample by country is provided in **Table A1** in the appendix.

Additionally, **Table 3** displays a pairwise correlation matrix with two panels: Panel A for BTC and Panel B for ETH. The results indicate the absence of high pairwise correlations between the variables, suggesting that multicollinearity is not a problem.

***Table 2**. Descriptive Statistics*

		Bitcoin					Ethereum				
	Measure	**Obs.**	**Mean**	**Std. Dev.**	**Min.**	**Max.**	**Obs.**	**Mean**	**Std. Dev.**	**Min.**	**Max.**
Dependent Variables											
CBCP_Global	Basis Points (bps)	10,955	-1.213	96.137	-934.334	765.994	10,955	13.431	93.886	-1092.963	868.972
CBCP_Global_ABS	ABS(bps)	10,955	54.932	78.905	0.001	934.334	10,955	58.294	74.810	0.001	1092.963
Independent Variables											
Crypto Level											
Google Trends Intensity BTC and ETH	Range (1:100)	10,955	23.397	13.332	8.000	64.000	10,955	22.162	19.018	4.000	100.000
Confirmation Time BTC	Minutes	10,955	107.383	266.887	8.494	2449.604	0				
ln(Confirmation Time BTC)	ln(Minutes)	10,955	3.798	1.113	2.139	7.804	0				
Block Time ETH	Seconds	0					10,955	13.357	1.153	12.030	20.760
Country level											
Local Countries (LC)											
Daily Return LC	%	10,955	0.113	3.594	-37.128	21.339	10,955	0.152	4.632	-42.254	25.960
Volatility LC	%	10,955	4.464	3.681	0.003	61.808	10,955	5.819	4.614	0.030	74.785
Turnover LC	%	10,955	0.085	0.071	0.010	0.756	10,955	0.191	0.224	0.010	2.404
USA (Benchmark)											
Daily return Ratio	Ratio (%)	10,955	0.894	8.346	-147.005	282.973	10,955	1.344	15.248	-95.232	840.011
Volatility Ratio	Ratio (%)	10,955	1.019	0.415	0.004	11.079	10,955	1.012	0.331	0.036	7.017
Turnover Ratio	Ratio (%)	10,955	1.011	0.157	0.255	2.904	10,955	1.010	0.151	0.273	2.510
Controls											
Interest Rate LC	Rate (%)	10,955	1.318	1.330	-0.649	4.626	10,955	1.318	1.330	-0.649	4.626
Foreign Exchange Rate	in USD	10,955	0.780	0.446	0.007	1.434	10,955	0.780	0.446	0.007	1.434
Economic Freedom LC	Range (0:100)	10,955	75.761	3.594	69.300	82.600	10,955	75.761	3.594	69.300	82.600
Gold Price Volatility	in USD	10,955	1663.412	259.084	1176.700	2115.100	10,955	1663.412	259.084	1176.700	2115.100

***Table 3**. Pairwise Correlation Matrix*

Panel A. Bitcoin

		1	2	3	4	5	6	7	8	9	10	11	12	13
Dependent Variables														
CBCP_Global_ABS	**1**	1.0000												
Independent Variables														
Crypto Level														
Google Trends Intensity BTC	**2**	-0.0455*	1.0000											
ln(Confirmation Time BTC)	**3**	0.2030*	0.2242*	1.0000										
Country level														
Local Countries (LC)														
Daily return LC	**4**	0.0201*	-0.0082	0.0254*	1.0000									
Volatility LC	**5**	-0.0271*	0.3955*	0.0236*	-0.1489*	1.0000								
Turnover LC	**6**	-0.0964*	-0.2138*	-0.0271*	0.0104	0.2629*								
USA (Benchmark)														
Daily return ratio	**7**	-0.0172	0.0011	0.0124	-0.0007	-0.0111	0.0146	1.0000						
Volatility ratio	**8**	-0.1302*	-0.0245*	0.1237*	-0.0003	0.0818*	-0.0482*	0.0041	1.0000					
Turnover ratio	**9**	-0.1863*	-0.0221*	0.0942*	-0.0044	0.0364*	-0.0275*	-0.0672*	0.7504*	1.0000				
Controls														
Interest rate LC	**10**	0.2812*	-0.0737*	0.1242*	-0.0178	-0.1311*	-0.3356*	-0.0173	0.0895*	0.0842*	1.0000			
Foreign Exchange Rate	**11**	-0.0088	0.0417*	-0.0025	-0.0016	0.0183	-0.0177	0.0019	-0.0207*	-0.0047	0.2094*	1.0000		
Economic Freedoms LC	**12**	-0.1679*	0.0436*	-0.1318*	0.0031	0.1022*	0.2131*	0.0121	-0.0731*	-0.0643*	0.1306*	0.3054*	1.0000	
Gold price volatility	**13**	0.2500*	0.3456*	0.4298*	0.0210*	-0.0660*	-0.1652*	-0.0102	0.0758*	0.0736*	0.1936*	-0.0149	-0.2432*	1.0000

Table 3. (Cont.)

Panel B. Ethereum

		1	2	3	4	5	6	7	8	9	10	11	12	13
Dependent Variables														
CBCP_Global_ABS	**1**	1.0000												
Independent Variables														
Crypto Level														
Google Trends Intensity ETH	**2**	-0.0123	1.0000											
Block Time ETH	**3**	-0.2182*	-0.1296*	1.0000										
Country level														
Local Countries (LC)														
Daily return LC	**4**	0.0138	0.0211*	-0.0220*	1.0000									
Volatility LC	**5**	-0.0634*	0.2857*	0.1483*	-0.1996*	1.0000								
Turnover LC	**6**	-0.1271*	-0.3677*	0.1192*	0.0760*	0.1626*	1.0000							
USA (Benchmark)														
Daily return ratio	**7**	-0.0175	-0.0026	0.0038	-0.0029	-0.0139	-0.0054	1.0000						
Volatility ratio	**8**	-0.1442*	-0.0310*	-0.0630*	-0.0072	0.0644*	-0.0411*	-0.0323*	1.0000					
Turnover ratio	**9**	-0.1673*	-0.0205*	-0.0717*	-0.0002	0.0167	-0.0363*	-0.0322*	0.7579*	1.0000				
Controls														
Interest rate LC	**10**	0.2190*	-0.0272*	-0.2417*	-0.0247*	-0.1547*	-0.3862*	0.0078	0.0716*	0.0822*	1.0000			
Foreign Exchange Rate	**11**	0.0258*	0.0349*	0.0280*	0.0000	0.0214*	-0.0151	0.0074	-0.0148	-0.0044	0.2094*	1.0000		
Economic Freedoms LC	**12**	-0.0918*	0.0034	0.2328*	0.0102	0.1232*	0.2321*	0.0061	-0.0852*	-0.0632*	0.1306*	0.3054*	1.0000	
Gold price volatility	**13**	0.2366*	0.4300*	-0.5916*	0.0338*	-0.1075*	-0.1756*	-0.0095	0.0688*	0.0730*	0.1936*	-0.0149	-0.2432*	1.0000

5.4. Methodology

A multiple linear regression model for panel data analysis was considered to estimate the impact of key indicators on the CBCP for BTC and ETH markets. This model aims to capture the nonlinear dynamics of the phenomenon by incorporating time (*t*), country (*i*), and cryptocurrency (*c*) variant characteristics. The regression model is specified as follows[7]:

$$\boldsymbol{CBCP\_Global\_ABS_{t,i,c}} = \beta_0 + \beta_1 google\_trends_{t,i,c} + \beta_2 conf\_time\_btc_{t,i,c} + \beta_3 conf\_time\_btc\_ln_{t,i,c} + \beta_4 blk\_time\_eth_{t,i,c} + \beta_5 daily\_return_{t,i,c} + \beta_6 vol_{t,i,c} + \beta_7 turn_{t,i,c} + \beta_8 dailyreturn\_ratio_{t,i,c} + \beta_9 vol\_ratio_{t,i,c} + \beta_{10} turn\_ratio_{t,i,c} + \beta_{11} int_{t,i} + \beta_{12} fx\_rate_{t,i} + \beta_{13} econ\_freed_{t,i} + \beta_{14} gold\_usd_{t,i} + \varepsilon_{t,i,c} \quad \textbf{(2)}$$

where $\boldsymbol{CBCP\_Global\_ABS_{t,i,c}}$ is the dependent variable, $\boldsymbol{\beta_0}$ is the intercept, $\boldsymbol{\beta_1}$ to $\boldsymbol{\beta_{14}}$ the coefficients for the independent variables, and $\boldsymbol{\varepsilon_{t,i,c}}$ is the residual term.

This investigation aims to examine the effects of specific variables on the CBCP, both through a joint analysis, combining potential CBCP values of multiple countries into one, and by highlighting key differences when analyzing each country individually. The previous equation provides a generalized framework for our approach.

To determine the appropriate model specification, the Hausman test was conducted to compare fixed effects versus random effects. The null hypothesis was rejected based on statistical significance (p-value < 0.05), indicating that a fixed effects model is the preferred choice. Further validity tests were performed, identifying multiple error structures within the equation. The Breusch-Pagan test revealed the presence of heteroskedasticity, indicating a non-constant variance of the error terms. Additionally, the Wooldridge test stated the occurrence of autocorrelation, suggesting that the error terms are correlated across time within panels (Wooldridge, 2010). To address these

[7] The regression model applies to both Bitcoin (BTC) and Ethereum (ETH). The primary distinction lies in the crypto-specific indicators included. For BTC, the model incorporates variables such as conf_time_btc, conf_time_btc_ln, whereas for ETH, it includes blk_time_eth.

issues, robust standard errors were employed to ensure the reliability of the regression results.

Following the research proposed by Blackwell (2005), when panel heteroskedasticity, panel autocorrelation, and contemporaneous correlation are identified in the regression model, the most efficient approach is to use panel-corrected standard errors (PCSE) – "*xtpcse*" introduced by Beck and Katz (1995). While PCSE provides robust standard errors to account for heteroskedasticity and contemporaneous correlation across panels, we also needed to correct for the presence of autocorrelation. The Prais-Winsten method addresses serial correlation by transforming the data to correct for first-order autoregressive processes - AR(1).

Table A2, in the appendix, displays the validity tests for Prais–Winsten model assumptions.

6. Findings

In Section 6.1, a thorough graphical analysis spanning multiple countries and cryptocurrencies from 2018 to 2023 examines the *Cross-Border Cryptocurrency Premium* (CBCP). In order to answer Research Questions 1 and 2, this visual exploration clarifies the dynamics and trends. Section 6.2. dives deeper into the factors influencing the CBCP with an in-depth multivariate analysis of the pooled samples of five countries. This section provides clarification and responses to Research Question 3 by carefully examining the key factors that influence the CBCP. In Section 6.3, the country-by-country investigation of the CBCP determinates provides evidence to address Research Question 4.

6.1. Graphical Analysis

Figure 2 and **Figure 3** display the BTC and ETH *CBCP* for the countries with the highest economic freedom, namely Germany, Japan, Australia, Canada, and the United Kingdom.

Source: Stata generated graphs using Bitcoin CBCP data for the top 5 countries

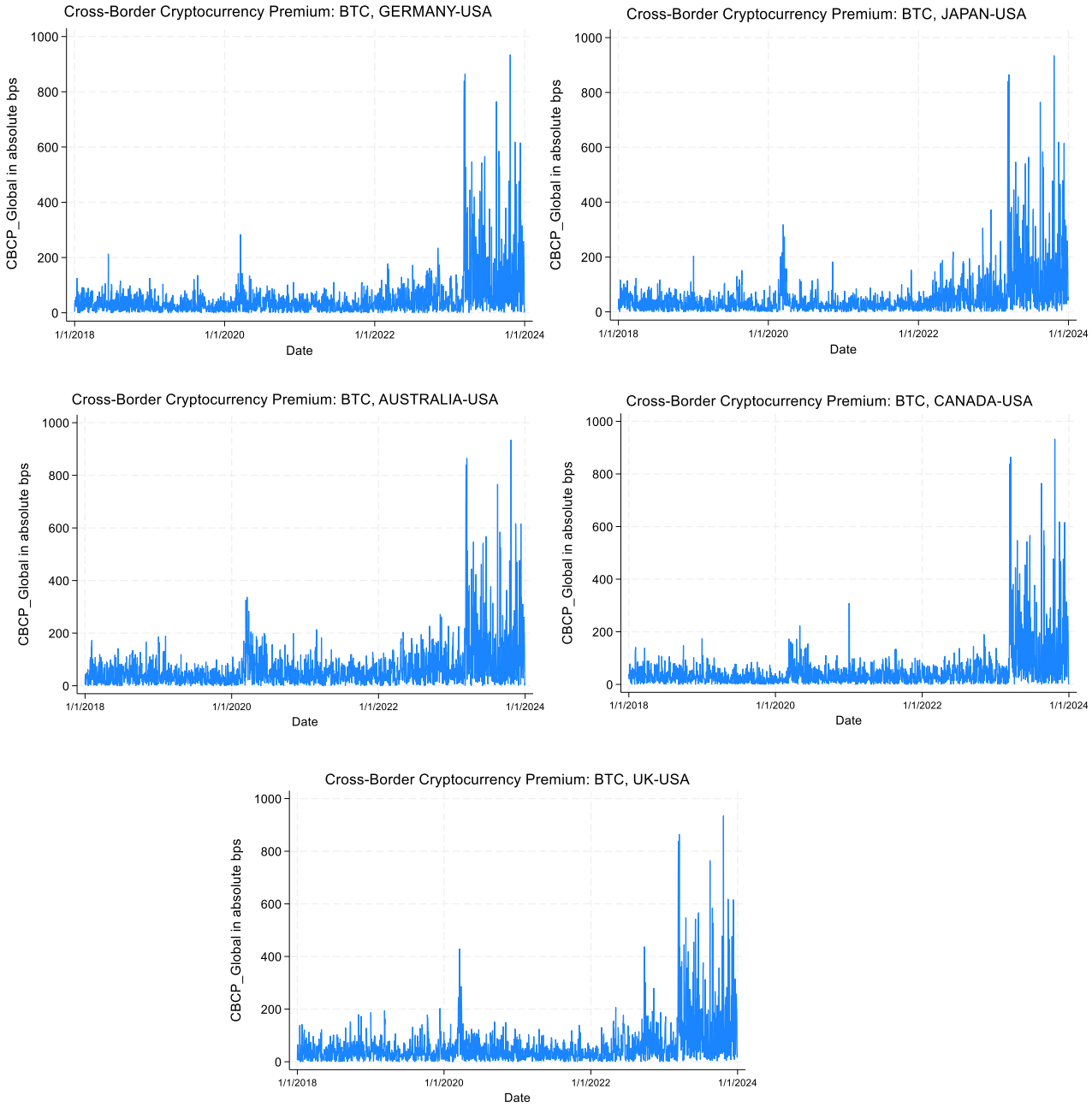

Figure 2. *Bitcoin CBCP - Top 5 Countries*

Source: Stata generated graphs using Ethereum CBCP data for the top 5

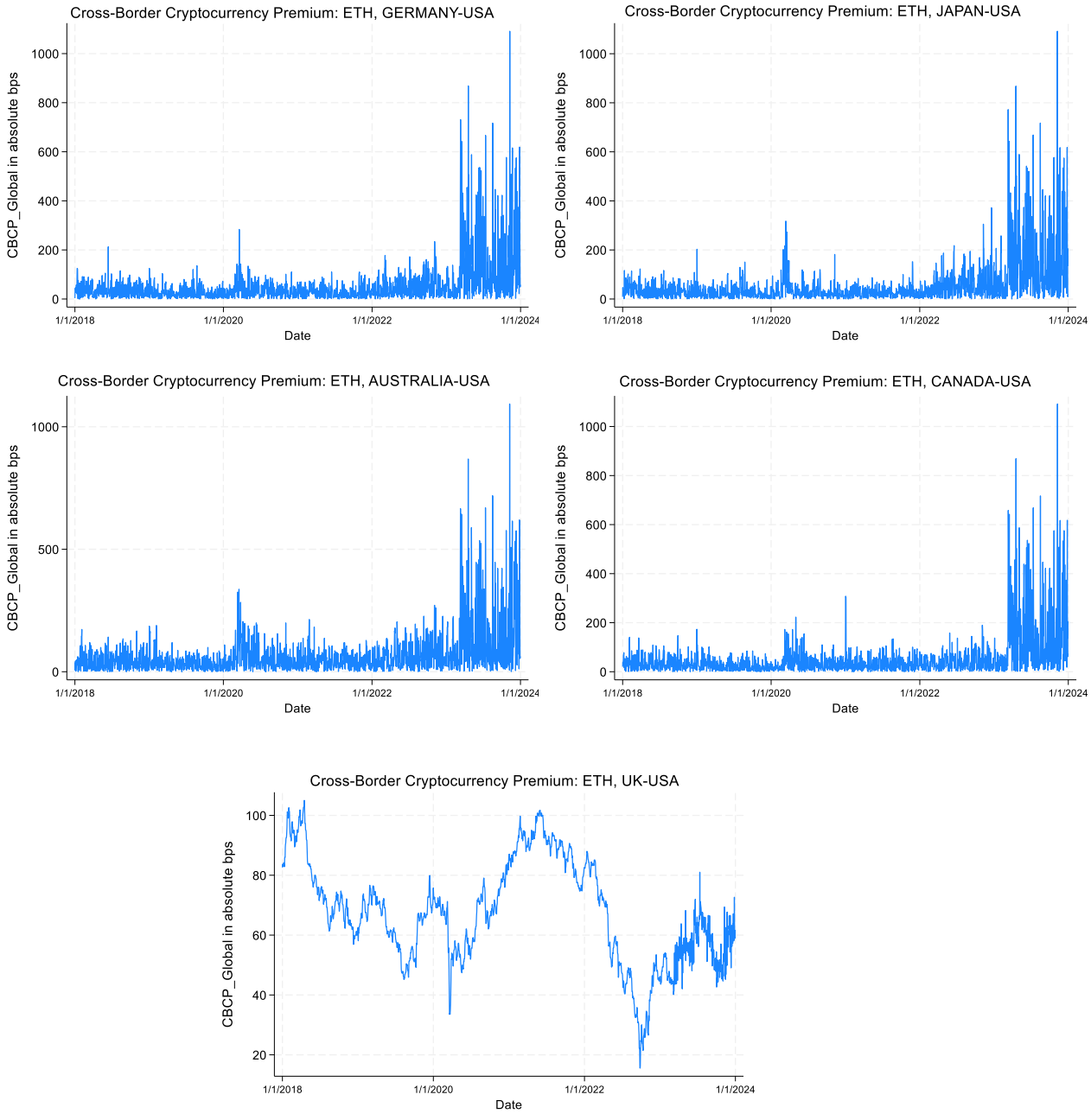

***Figure 3**. Ethereum CBCP - Top 5 Countries*

There is a clear presence of the CBCP across all BTC sample markets (**Figure 2**). This indicates that the CBCP phenomenon is not confined to the BTC market in Korea but is also observable in other major economies. On average, the values for the premium are consistent across these markets, demonstrating that no particular country pairing offers a significantly more compelling opportunity for arbitrage. Additionally, we observed that at the beginning of 2023, the CBCP exhibited substantial fluctuations, reaching peak values. Such observation is consistent with the inherently volatile nature of cryptocurrency markets experienced during this period. This graphical analysis allows us to answer the Research Question (RQ1) with a *"yes"*; the CBCP, a phenomenon well-documented in the South Korean cryptocurrency market, is also observable in other countries with high economic freedom.

As observed in BTC markets, the CBCP phenomenon is also evident in ETH markets, as shown in **Figure 3**. The behavior of the CBCP is consistent across all samples, exhibiting significant fluctuations, especially during periods of heightened market activity. Peaks in CBCP values are observed around early 2023 as portrayed in BTC markets, except for UK-USA ETH markets, which show a unique pattern with less pronounced peaks. Across all country pairings, the average premium value is about 10%, whereas the UK-USA pairing shows a significantly lower premium of approximately 1%. This disparity indicates that the UK-USA market is relatively more stable and integrated, with fewer arbitrage opportunities compared to other countries' ETH markets (but not in BTC markets). This stability suggests that the UK-USA ETH market may have better liquidity and efficiency, reducing the extent of price discrepancies that typically present profitable arbitrage opportunities for savvy investors. According to Seo et al. (2024), "arbitrageurs tend to exploit the premium only when it is relatively large." Overall, this graphical evidence also allows us to answer RQ2 with a *"yes"*; the presence of the CBCP still holds true for Ethereum markets. However, there are different patterns between BTC and ETH in UK-USA markets. Future research may address this evidence with more detailed lenses.

6.2. Pooled Findings

6.2.1. Joint CBCP in Bitcoin markets

Table 4 presents the baseline estimations of the determinants of CBCP in BTC markets, applying the Prais-Winsten regression method for the top five countries. This analysis, which is divided into partial models (I, II, III) and full models (IV.1, IV.2), provides a comprehensive understanding of the effects of various independent variables at the crypto, country, and control levels.

	Partial Models			Full Models	
	I	II	III	IV.1	IV.2
Independent Variables					
Crypto Level					
Google Trends BTC	-0.551***			-0.564***	-0.612***
	(0.161)			(0.181)	(0.160)
ln(Confirmation Time BTC)	6.741***			6.709***	8.069***
	(1.900)			(1.871)	(1.870)
Country level					
Local Countries (LC)					
Daily return LC		0.166		0.231	
		(0.357)		(0.360)	
Volatility LC		-0.419		0.255	
		(0.444)		(0.487)	
Turnover LC		58.381*		12.503	
		(30.192)		(31.704)	
USA (Benchmark)					
Daily return ratio			-0.159		-0.174
			(0.123)		(0.123)
Volatility ratio			-23.137***		-23.262***
			(4.068)		(4.073)
Turnover ratio			-75.485***		-76.803***
			(11.070)		(11.078)
Controls					
Interest rates LC	15.086***	17.301***	17.782***	15.415***	16.348***
	(1.240)	(1.292)	(1.242)	(1.310)	(1.231)
Foreign Exchange Rate	-2.457**	-2.830***	-3.649***	-2.418**	-2.966***
	(1.063)	(1.083)	(1.181)	(1.036)	(1.133)
Economic Freedoms LC	-2.976***	-3.588***	-3.707***	-3.065***	-3.270***
	(0.349)	(0.362)	(0.351)	(0.365)	(0.347)
Gold price volatility	0.048***	0.048***	0.051***	0.048***	0.050***
	(0.009)	(0.008)	(0.008)	(0.009)	(0.009)
Fixed Effects					
Weekend	Yes	Yes	Yes	Yes	Yes
3-days period	Yes	Yes	Yes	Yes	Yes
Constant	171.021***	223.707***	330.435***	174.712***	285.427***
	(31.963)	(31.713)	(33.229)	(32.064)	(33.004)
Observations	10,955	10,955	10,955	10,955	10,955
R-squared	0.093	0.086	0.169	0.097	0.180
Number of sample	5	5	5	5	5

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4. *Joint Estimations - Bitcoin CBCP (Prais Winsten)*

In **Table 4**, at the crypto level, we document that Google trends searches have a significant negative impact on the Bitcoin CBCP. The results indicate that higher search interest in Bitcoin is associated with a decrease in CBCP. This suggests that a more informed and active investor base enhances market efficiency, reduces information asymmetry, and ultimately minimizes price differentials between global exchanges. This trend is consistent across both partial and full models, with a high level of significance (p-value < 0.01). Conversely, the confirmation time on the blockchain positively impacts the CBCP. Higher confirmation times are associated with increased Bitcoin premiums, likely due to transaction delays, increased uncertainty, network congestion, and a consequent reduction in market efficiency, which leads to increased price discrepancies between exchanges. This finding is supported by the research conducted by Choi et al. (2018).

At the country level, most variables presented for both partial and full models do not show a significant impact on CBCP, apart from the turnover. In partial models (II) turnover shows a positive effect over the CBCP, indicating that higher market turnover is associated with a higher BTC premium value for a significance level of 10%. However, the high standard error for this result limits the accuracy of the assumptions. This effect diminishes and becomes insignificant in the full models (IV.1).

When using the USA as a benchmark, the daily return ratio does not significantly influence the CBCP, as evidenced by the values presented in both models. In contrast, the volatility ratio for BTC markets shows a significant negative impact on CBCP in both partial models (III) and full models (IV.2) at the 1% level. This finding suggests that higher local volatility compared to the USA is associated with a lower CBCP. As volatility peaks in a local exchange relative to the benchmark exchange, arbitrageurs may exploit significant price swings to profit; in turn, arbitrageurs will promote market efficiency and reduce the existing premium. Similarly, the turnover ratio shows a strong negative effect on the CBCP at a 1% significance level, indicating that higher market liquidity and trading activity (as proxied by turnover) enhances market efficiency, thereby reducing price differences reflected in the premium.

Control variables also play a crucial role as all results produce a high level of significance (p-value < 0.01) across all models. Interest rates in local countries are positively related to the CBCP, being all highly significant. When interest rates increase

in a given local country, the CBCP rises. This is because higher interest rates attract foreign capital, as investors seek higher ROI denominated in the local currency. The resultant appreciation of the local currency increases the relative cost of purchasing cryptocurrencies within that country. Consequently, the local price of cryptocurrencies rises in comparison to other countries, leading to an increase in the CBCP. Gold price volatility exhibits a comparable behavior. It consistently shows a significant positive impact on CBCP. When the gold price volatility increases investors might seek to diversify their portfolios. By potentially redirecting their funds into cryptocurrencies, which are mostly uncorrelated and often move independently from traditional assets like gold (Klein et al., 2018; Kurka, 2019; Baur et al., 2021), this increased demand can elevate local prices, consequently raising the premium in those markets. Distinctively, the coefficients for the foreign exchange rates show significant negative effects on the CBCP. When foreign exchange rates increase in a local country, making it more expensive to buy cryptocurrencies in the local currency, it becomes more profitable for arbitrageurs to buy cryptocurrencies where they are cheaper (benchmark) and sell them where they are more expensive (local country). This arbitrage activity tends to reduce price differentials between exchanges, thereby lowering the CBCP. Finally, the higher the economic freedom index the lower the CBCP in the BTC markets. Countries with high values for this index typically have more transparent and predictable regulatory environments. This fosters greater investor confidence and participation in cryptocurrency markets, reducing the likelihood of significant price discrepancies between exchanges. As a result, the CBCP tends to be lower in these jurisdictions. For detailed estimations, variable-by-variable, see **Table A3** in the appendix.

6.2.2. Joint CBCP in Ethereum Markets

Table 5 presents baseline estimations using the Prais-Winsten regression method for ETH markets (for variable-by-variable estimations see **Table A4** in appendix). The results largely align with findings in BTC markets, with a few notable exceptions. Block time, specific to ETH, shows a significant negative relationship with the CBCP across all models for a 5% level. Higher block time values lead to lower CBCP values, as increased block time results in longer transaction confirmation and settlement times. This delay can cause discrepancies in pricing across different exchanges. Traders and arbitrageurs capitalize on these price differences caused by slower transaction processing, which ultimately leads to a decrease in the CBCP value as arbitrage enhances market efficiency.

Similarly, the negative coefficient for the daily return ratio for partial models (I) and full models (IV.2) indicates that if the daily returns in the local countries increase relative to the USA, the CBCP decreases (p-value < 0.1). This could imply that higher relative returns in local crypto markets make them more attractive to investors, which ends up creating significant discrepancies between exchanges. Arbitrageurs will take advantage of such opportunities, contributing to increased market efficiency, and consequently reducing the premium. In contrast to BTC markets, the foreign exchange rate does not show any statistical significance in ETH markets, indicating that it is not a driving factor behind the CBCP across the presented models.

	Partial Models			Full Models	
	I	II	III	IV.1	IV.2
Independent Variables					
Crypto Level					
Google Trends BTC	-0.522***			-0.535***	-0.559***
	(0.120)			(0.137)	(0.121)
Block Time ETH	-4.316**			-4.339**	-4.312**
	(2.152)			(2.136)	(2.156)
Country level					
Local Countries (LC)					
Daily return LC		0.044		0.214	
		(0.210)		(0.213)	
Volatility LC		-0.495*		0.045	
		(0.284)		(0.299)	
Turnover LC		22.872**		-1.366	
		(9.711)		(10.665)	
USA (Benchmark)					
Daily return ratio			-0.077*		-0.077*
			(0.044)		(0.044)
Volatility ratio			-37.671***		-37.199***
			(3.788)		(3.780)
Turnover ratio			-43.077***		-43.820***
			(8.582)		(8.563)
Controls					
Interest rates LC	18.224***	21.541***	20.182***	18.204***	18.459***
	(1.438)	(1.535)	(1.401)	(1.596)	(1.412)
Foreign Exchange Rate	-0.890	-0.762	-1.392	-0.809	-0.745
	(1.187)	(1.214)	(1.366)	(1.159)	(1.316)
Economic Freedoms LC	-4.205***	-5.208***	-4.832***	-4.242***	-4.249***
	(0.427)	(0.456)	(0.412)	(0.473)	(0.414)
Gold price volatility	0.048***	0.048***	0.051***	0.048***	0.050***
	(0.009)	(0.008)	(0.008)	(0.009)	(0.009)
Fixed Effects					
Weekend	Yes	Yes	Yes	Yes	Yes
Constant	311.168***	325.217***	377.747***	314.069***	389.704***
	(49.897)	(37.683)	(36.576)	(51.603)	(49.968)
Observations	10,955	10,956	10,957	10,958	10,959
R-squared	0.155	0.144	0.191	0.156	0.201
Number of sample	5	5	5	5	5

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 5. *Joint Estimations - Ethereum CBCP (Prais Winsten)*

6.2.3. Robustness Checks

To check the robustness of our estimates, we applied our specification in *Equation 1* using the Generalized Least Squares (GLS) method. This method assumes the same premises as the Prais-Winsten model and is useful for addressing potential inefficiencies in the presence of AR(1) autocorrelation within panels, as well as cross-sectional correlation and heteroskedasticity across panels. The results are reported in **Table 6** and **Table 7** for BTC and ETH markets, respectively.

	Pooled Results (reported on Table 4)	Partial Models			Full Models	
		I	II	III	IV.1	IV.2
Independent Variables						
Crypto Level						
Google Trends BTC	-	-0.548***			-0.563***	-0.609***
		(0.079)			(0.089)	(0.079)
ln(Confirmation Time BTC)	+	6.743***			6.724***	8.064***
		(0.919)			(0.907)	(0.915)
Country level						
Local Countries (LC)						
Daily return LC	n/sig.		0.165		0.231	
			(0.174)		(0.174)	
Volatility LC	n/sig.		-0.423**		0.249	
			(0.215)		(0.237)	
Turnover LC	n/sig.		56.587***		10.708	
			(14.861)		(15.793)	
USA (Benchmark)						
Daily return ratio	n/sig.			-0.161**		-0.176**
				(0.071)		(0.071)
Volatility ratio	-			-23.047***		-23.169***
				(2.100)		(2.103)
Turnover ratio	-			-75.804***		-77.110***
				(5.596)		(5.600)
Controls						
Interest rates LC	+	15.126***	17.316***	17.864***	15.415***	16.413***
		(0.764)	(0.804)	(0.774)	(0.820)	(0.767)
Foreign Exchange Rate	-	-2.168	-2.511	-3.230	-2.134	-2.593
		(2.323)	(2.362)	(2.413)	(2.270)	(2.340)
Economic Freedoms LC	-	-3.059***	-3.667***	-3.825***	-3.136***	-3.375***
		(0.292)	(0.299)	(0.297)	(0.300)	(0.293)
Gold price volatility	+	0.048***	0.048***	0.051***	0.048***	0.050***
		(0.004)	(0.004)	(0.004)	(0.004)	(0.005)
Fixed Effects						
Weekend	Yes	Yes	Yes	Yes	Yes	Yes
3-days period	Yes	Yes	Yes	Yes	Yes	Yes
Constant		176.899***	229.520***	339.088***	179.922***	293.127***
		(24.438)	(24.448)	(25.157)	(24.582)	(24.892)
Observations		10,955	10,955	10,955	10,955	10,955
Number of sample		5	5	5	5	5

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 6. *Joint Estimations - Bitcoin CBCP (GLS)*

	Pooled Results (reported on Table 5)	Partial Models			Full Models	
		I	II	III	IV.1	IV.2
Independent Variables						
Crypto Level						
Google Trends BTC	-	-0.161***			-0.175***	-0.470***
		(0.032)			(0.035)	(0.063)
Block Time ETH	-	-0.760**			-0.844**	-3.716***
		(0.341)			(0.375)	(1.085)
Country level						
Local Countries (LC)						
Daily return LC	n/sig.		-0.050***		-0.043***	
			(0.015)		(0.014)	
Volatility LC	n/sig.		-0.035		-0.023	
			(0.022)		(0.022)	
Turnover LC	n/sig.		0.933		0.183	
			(1.429)		(1.367)	
USA (Benchmark)						
Daily return ratio	-			-0.022		-0.023
				-0.02		(0.020)
Volatility ratio	-			-14.457***		-14.285***
				(1.611)		(1.607)
Turnover ratio	-			-19.137***		-19.354***
				(3.586)		(3.578)
Controls						
Interest rates LC	+	14.687***	15.861***	15.571***	14.667***	14.432***
		(0.784)	(0.826)	(0.875)	(0.793)	(0.882)
Foreign Exchange Rate	n/sig.	3.290	1.742	-0.026	2.477	0.560
		(2.790)	(2.888)	(2.805)	(2.703)	(2.748)
Economic Freedoms LC	-	-3.221***	-3.456***	-3.132***	-3.184***	-2.792***
		(0.288)	(0.305)	(0.334)	(0.292)	(0.334)
Gold price volatility	+	0.056***	0.055***	0.057***	0.057***	0.065***
		(0.004)	(0.004)	(0.004)	(0.004)	(0.006)
Fixed Effects						
Weekend	Yes	Yes	Yes	Yes	Yes	Yes
Constant		199.825***	205.611***	214.362***	198.286***	236.187***
		(23.220)	(24.304)	(27.660)	(23.749)	(32.149)
Observations		10,955	10,955	10,955	10,955	10,955
Number of sample		5	5	5	5	5

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 7. *Joint Estimations - Ethereum CBCP (GLS)*

Overall the findings obtained from using the GLS method are largely in line with those from the Prais-Winsten method. The main differences are only observed in the significance and magnitude of certain variables like the *daily return ratio* and the *foreign exchange rate*. This shows consistent results across both methods, indicating robustness in the estimations of the CBCP in BTC markets. The same can be said for the estimations verified in ETH markets, meaning that the results from the GLS method are mostly consistent with those from the Prais-Winsten method. Some differences are observed primarily in the magnitude of the results, rather than their significance levels. However,

these differences do not alter the overall conclusions. Such variables include *block time*, *daily return LC*, *daily return ratio*, *volatility ratio*, and *turnover ratio*.

6.3. Country-by-Country Findings

6.3.1. CbC CBCP in Bitcoin markets

Table 8 presents a country-by-country panel approach for the baseline estimations using the Prais Winsten method on Bitcoin CBCP. In this chapter, we examine whether the key indicators of the CBCP exert similar impacts across each individual market under analysis.

At the crypto level, the impact of Google trend searches on Bitcoin-CBCP aligns with the results obtained in the pooled findings for Germany (Column A.2), Japan (B.1, B.2), and the UK (E.1, E.2); in this country-markets there is a negative effect of Google trend searches on CBCP for BTC. However, we find that Canada does not follow the same pattern (D.1, D.2); in that market there is evidence of a positive effect of Google trend searches on CBCP in BTC (p-value < 0.01), indicating higher premiums with increased search interest. Higher search volumes for BTC in Canada reflects a surge in public and investor interest. This heightened interest often leads to increased buying activity, driving up the demand for BTC in Canadian exchanges in relation to US (benchmark) exchanges, contributing to the creation of significant price discrepancies. In Australia search intensity is not a driving factor behind the CBCP (C.1, C.2).

Confirmation time on the blockchain positively impacts the CBCP across all sample markets (A.2; B.1, B.2; C.1., C.2; D.2; E.1, E2), suggesting that longer confirmation times are associated with higher premium values. This result aligns with those reported for the pooled sample.

Similar to the findings reported in **Table 4**, most variables at the country level (Columns .1) do not show a significant impact on CBCP in BTC, apart from a few exceptions. For a significance level of 5%, a positive coefficient for daily returns is observed in Japan. This implies that the CBCP value in this country benefits from positive daily returns in BTC markets. When investors in a particular country experience higher returns, they may perceive their local market as more favorable or stable. This perception can increase the demand for cryptocurrencies within the country, which ultimately results

in an increase in the BTC price relative to other markets, leading to a higher CBCP. Volatility levels present in Australian BTC markets also show statistically effects on the CBCP (p-value< 0.05). This suggests that when BTC experiences greater price fluctuations, investors may view it as more speculative and riskier, but there is also the potential to obtain excess returns. Consequently, the increased demand in these markets drives up the local price of BTC, leading to a higher CBCP. Additionally, the turnover in British markets exhibits significant positive influence over the CBCP in BTC markets, which contradicts the results obtained in the *pooled findings.* When turnover is high, it indicates that a significant volume of BTC is being traded frequently. This heightened activity elevates local cryptocurrency prices, creating significant price discrepancies between countries exchanges. As a result, the CBCP increases.

When using the USA as a benchmark and comparing the country-by-country estimates (Columns .2) with the results from **Table 4***,* the only marked difference in the results lies in the significance of the daily return ratio as a predictor of CBCP. In Germany (A.2), the daily return ratio has a significant negative impact on the CBCP (p-value <0.1), which contradicts the non-significance of this variable in the *pooled findings*. When the daily return ratio is high, it suggests that the local market is performing well in comparison to the benchmark, attracting more investors and increasing the demand for the cryptocurrency[8]. This increased demand in the local market is met with heightened arbitrage trading, which ultimately reduces price differences between exchanges and consequently lowers the premium.

Control variables playing a crucial role in the CBCP reported in the pooled findings exhibit similar influence in for each country-market. However, the interest rates affect the CBCP differently in Canada. Specifically, higher interest rates in Canada are associated with diminishing CBCP values (p-value<0.1).

For detailed estimations of the determinants of BTC CBCP, following a country-by-country approach, report to the appendix **Tables A5 – A9**.

[8] The demand for the cryptocurrency was measured using Google trends searches as a proxy.

Table 8. Country-by-Country Estimations - Bitcoin CBCP

	Pooled Results (reported on Table 4)	Panel A Germany		Panel B Japan		Panel C Australia		Panel D Canada		Panel E United Kingdom	
		A.1	A.2	B.1	B.2	C.1	C.2	D.1	D.2	E.1	E.2
Independent Variables											
Crypto Level											
Google Trends BTC	-	-0.292	-0.391**	-0.453**	-0.526***	0.128	0.250	0.635***	0.594***	-0.327	-0.496**
		(0.194)	(0.179)	(0.202)	(0.181)	(0.225)	(0.219)	(0.232)	(0.226)	(0.217)	(0.208)
ln(Confirmation Time BTC)	+	2.784	3.856*	5.614***	6.654***	5.642***	7.216***	2.448	3.606*	4.809**	25.764***
		(2.087)	(2.038)	(2.087)	(2.106)	(1.904)	(1.929)	(1.980)	(1.990)	(2.119)	(5.007)
Country level											
Local Countries (LC)											
Daily return LC	n/sig.	0.379		0.796**		0.278		0.014		-0.211	
		(0.380)		(0.384)		(0.413)		(0.374)		(0.397)	
Volatility LC	n/sig.	-0.005		0.412		1.272**		0.501		-0.167	
		(0.524)		(0.522)		(0.553)		(0.522)		(0.549)	
Turnover LC	n/sig.	25.368		25.012		9.410		-53.591		97.468**	
		(37.027)		(35.263)		(43.878)		(42.298)		(40.906)	
USA (Benchmark)											
Daily return ratio	n/sig.		-0.317*		-0.088		-0.165		-0.188		-0.157
			(0.188)		(0.155)		(0.151)		(0.175)		(0.135)
Volatility ratio	-		-20.254***		-27.737***		-24.461***		-20.448***		-21.246***
			(4.565)		(4.703)		(4.984)		(4.598)		(4.712)
Turnover ratio	-		-91.528***		-66.547***		-74.068***		-84.340***		-80.641***
			(12.228)		(12.575)		(13.374)		(11.912)		(12.604)
Controls											
Interest rates LC	+	29.853***	31.700***	39.470**	54.354***	11.730***	11.821***	-7.509*	-7.189	25.047***	25.764***
		(2.884)	(2.361)	(19.391)	(19.064)	(4.263)	(4.222)	(4.459)	(4.452)	(4.941)	(5.007)
Foreign Exchange Rate	-	8.468	9.947	-17,224.272***	-15,698.121***	-337.809***	-358.081***	-528.150***	-393.206***	-3.611	-28.143
		(55.767)	(50.244)	(5,714.555)	(5,922.944)	(85.974)	(71.119)	(142.075)	(117.918)	(48.322)	(43.473)
Economic Freedoms LC	-	-8.555***	-9.954***	-4.498*	-4.299*	-2.732	-3.149	-22.183***	-25.724***	1.346	2.327
		(2.365)	(2.362)	(2.469)	(2.560)	(1.992)	(2.003)	(3.435)	(3.370)	(2.058)	(2.064)
Gold price volatility	+	0.034***	0.036***	0.028***	0.029***	0.033***	0.030***	-0.004	-0.009	0.035***	0.041***
		(0.010)	(0.010)	(0.011)	(0.011)	(0.011)	(0.011)	(0.012)	(0.012)	(0.013)	(0.013)
Fixed Effects											
Weekend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
3-days period	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant		597.845***	807.791***	456.043***	522.993***	406.936**	559.320***	2,161.498***	2,437.374***	-155.296	-103.046
		(215.190)	(210.455)	(148.444)	(154.279)	(168.416)	(179.648)	(265.283)	(269.008)	(173.544)	(177.557)
Observations		2,191	2,191	2,191	2,191	2,191	2,191	2,191	2,191	2,191	2,191
R-squared		0.136	0.225	0.135	0.209	0.122	0.224	0.138	0.220	0.108	0.181
Number of sample		1	1	1	1	1	1	1	1	1	1

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

6.3.2. CbC CBCP in Ethereum markets

Table 9 reports several key observations about the determinants of ETH CBCP across different countries. At the crypto level, most variable coefficients within this category demonstrated negative effects on the premium, aligning with the pooled findings in **Table 5**, with a few exceptions. Notably, Google Trends searches exerted a positive influence on CBCP in the UK markets at the 1% significance level, indicating that increased search intensity leads to higher premium values. This finding mirrors a specific case observed in the country-by-country analysis of BTC markets in Canada. In contrast, for the other countries in the study, CBCP was negatively influenced by Google searches, with higher significance observed in Germany, Japan, and the UK, as previously mentioned. Similarly, block time generally acted as a negative driver of CBCP values across countries, but it was particularly significant as a determinant of the premium in the Japanese market.

Country-level variables in ETH pooled findings displayed non-significant results on the CBCP, indicating that their influence can be disregarded as determinants of premium values. However, the same cannot be said when adopting a country-by-country approach. In this analysis, we observed that in Japan, the daily return had a significant positive impact on the CBCP at the 5% level. This result aligns with the conclusion drawn from the country-by-country findings in BTC markets. Additionally, turnover showed significant effects on CBCP values in Germany and the UK. In Germany, the results indicate that turnover positively impacts the CBCP at the 10% level. However, the high standard error for this estimate limits the accuracy of the assumptions. Conversely, in the UK, turnover has a significant negative effect on the premium (p-value < 0.05). This indicates that a larger volume of trades is occurring frequently, enhancing market liquidity. This increased trading activity makes it easier for buyers and sellers to execute transactions without causing significant price fluctuations, between local exchanges and the benchmark, such as US exchanges, thereby reducing the premium.

When using the USA as a benchmark, the only significant result that differentiates from the ETH pooled findings lies on the relationship between the volatility ratio and the CBCP for British markets. In the UK the volatility ratio positively impacts the premium (p-value < 0.01), showing that higher local volatility compared to the USA is associated with a higher CBCP. Higher volatility in cryptocurrency markets indicates more

significant and frequent price fluctuations, making the market more unpredictable. This environment is primed for speculative investors who are looking to capitalize on rapid price changes. These investors might be willing to pay a premium to access the cryptocurrency in local markets, anticipating higher potential returns despite the increased risk. Such speculative engagement creates discrepancies between countries exchanges, leading to higher CBCP values.

Regarding control variables, their effects on the premium differ substantially from what was found in the ETH pooled findings, apart from the estimates for gold price volatility, which present similar positive results across all sample markets. Conversely, interest rates do not have a uniform impact on the CBCP across all countries. Specifically, in Canada, interest rates negatively influence the premium (p-value < 0.05), which contradicts the findings reported in **Table 5**. Higher interest rates tend to strengthen the local currency, making it less appealing to seek alternative investments such as cryptocurrencies. Consequently, the reduced demand and increased opportunity cost of investing in cryptocurrencies contribute to lower CBCP values, as local prices tend to decrease, aligning more closely with those in other countries exchanges. Similarly, foreign exchange rates deviate from the assumptions made in the pooled findings. Contrary to the pooled estimates lacking statistical significance, **Table 9** shows that foreign exchange rates negatively impact the CBCP for almost every country in the study, especially for Japan. The sheer magnitude of the estimates suggests that fluctuations in the exchange rate greatly influence the CBCP in Japan, more so than in other countries analyzed in the study (p-value < 0.01). Conversely, in Germany this indicator does not have any determinative power over the CBCP. Finally, we found that the index of economic freedom positively impacts the CBCP for UK (p-value < 0.01), suggesting that higher economic freedom in this context correlates with an increase in the premium. This might happen because in countries with high economic freedom, there is usually less government intervention and fewer barriers to trade, which can encourage a more speculative behavior out of investors in crypto markets, thereby driving up local prices relative to the benchmark. As a result, the increased demand in these economically free environments leads to higher premiums.

For detailed estimations of the determinants of ETH CBCP, following a country-by-country approach, report to the appendix **Tables A10 – A14**.

Table 9. *Country-by-Country Estimations - Ethereum CBCP*

	Pooled Results (reported on Table 5)	Panel A Germany		Panel B Japan		Panel C Australia		Panel D Canada		Panel E Great Britain	
		A.1	A.2	B.1	B.2	C.1	C.2	D.1	D.2	E.1	E.2
Independent Variables											
Crypto Level											
Google Trends BTC	-	-0.220	-0.408***	-0.560***	-0.651***	-0.119	-0.166	0.193	0.177	0.023***	0.026***
		(0.147)	(0.127)	(0.158)	(0.135)	(0.156)	(0.157)	(0.176)	(0.180)	(0.003)	(0.003)
Block Time ETH	-	-0.910	-0.650	-4.189*	-3.946*	-1.925	-1.853	1.898	1.655	-0.015	-0.012
		(2.135)	(2.221)	(2.253)	(2.372)	(2.224)	(2.320)	(2.148)	(2.251)	(0.044)	(0.044)
Country level											
Local Countries (LC)											
Daily return LC	n/sig.	0.219		0.803**		0.107		0.247		-0.001	
		(0.327)		(0.331)		(0.352)		(0.325)		(0.008)	
Volatility LC	n/sig.	-0.252		0.361		0.600		0.604		0.001	
		(0.427)		(0.423)		(0.458)		(0.413)		(0.010)	
Turnover LC	n/sig.	23.188*		7.660		15.243		-10.794		-0.634**	
		(13.818)		(12.477)		(16.480)		(13.537)		(0.266)	
USA (Benchmark)											
Daily return ratio	-		-0.153		-0.475***		-0.069		-0.391***		-0.001
			(0.105)		(0.181)		(0.067)		(0.139)		(0.002)
Volatility ratio	-		-50.174***		-53.731***		-50.527***		-51.637***		0.529***
			(5.896)		(6.248)		(6.136)		(6.072)		(0.159)
Turnover ratio	-		-73.008***		-55.435***		-63.185***		-62.791***		-2.027***
			(12.976)		(13.914)		(13.663)		(13.012)		(0.354)
Controls											
Interest rates LC	+	36.198***	36.648***	58.846***	76.553***	14.897***	13.306***	-10.917**	-11.477**	0.490***	0.556***
		(3.138)	(2.403)	(18.553)	(18.461)	(4.571)	(4.419)	(4.501)	(4.498)	(0.092)	(0.090)
Foreign Exchange Rate	n/sig.	63.661	36.002	-17,814.825***	-16,772.830***	-233.159***	-258.159***	-390.731***	-282.386**	251.852***	252.531***
		(55.614)	(49.917)	(5,878.411)	(6,211.437)	(86.663)	(72.680)	(138.576)	(129.239)	(0.867)	(0.806)
Economic Freedoms LC	-	-9.642***	-12.628***	-2.896	-2.254	-3.160	-3.683*	-28.098***	-32.147***	0.232***	0.221***
		(2.297)	(2.320)	(2.522)	(2.643)	(1.997)	(2.093)	(3.236)	(3.388)	(0.038)	(0.037)
Gold price volatility	+	0.044***	0.052***	0.038***	0.042***	0.055***	0.057***	0.005	0.002	0.000	0.000
		(0.011)	(0.011)	(0.013)	(0.012)	(0.012)	(0.013)	(0.013)	(0.014)	(0.000)	(0.000)
Fixed Effects											
Weekend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant		620.055***	983.473***	409.019***	456.947***	380.263**	559.320***	2,496.890***	2,852.893***	-277.084***	-275.750***
		(213.099)	(207.549)	(157.430)	(164.757)	(171.494)	(179.648)	(260.733)	(275.460)	(3.276)	(3.277)
Observations		2,191	2,191	2,191	2,191	2,191	2,191	2,191	2,191	2,191	2,191
R-squared		0.167	0.272	0.159	0.250	0.137	0.224	0.169	0.263	0.989	0.989
Number of sample		1	1	1	1	1	1	1	1	1	1

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

7. Conclusion

Given the growing interest that institutional and retail investors are paying to cryptocurrencies, it is critical to comprehend the intricacies of this evolving market. This study was motivated by the desire to investigate lucrative arbitrage opportunities in the cryptocurrency space, with a particular emphasis on the long-term price differences known as the *Cross-Border Cryptocurrency Premium* (CBCP).

Drawing inspiration from the traditional concept of the *Kimchi Premium*, used to describe persistent price discrepancies of Bitcoin between South Korean and US exchanges, we conducted a study to explore this phenomenon across other developed markets and cryptocurrencies. It was already extensively researched in the literature that Bitcoin tends to be more expensive in South Korea compared to the US (e.g., Choi et al., 2018; Lee et al., 2022). However, by broadening the scope of previous research, we discovered that the premium (CBCP) is not only present in Bitcoin (BTC) markets but extends to Ethereum (ETH) as well. We offer evidence that this phenomenon is observed globally, affecting major economies such as the United States, Germany, Japan, Australia, Canada, and the United Kingdom, beyond South Korea. On average, ETH trades at a higher premium compared to BTC. This suggests that ETH may present more attractive arbitrage opportunities, potentially making it a more favorable choice for traders seeking to capitalize on price discrepancies. However, it is important to note that the UK-USA ETH market offers fewer arbitrage opportunities, which indicates high efficiency and liquidity on that market.

Our analysis also uncovered several key factors impacting the CBCP. We observed that blockchain confirmation time, interest rates, and gold price volatility have a positive effect on the Bitcoin premium, and similar influences are noted for Ethereum. Conversely, country-specific variables like daily return, volatility, and turnover show no significant impact on the CBCP for either cryptocurrency. Such finding is in line with the conventional view in stock market bubble literature, which asserts that “rational bubble models are incapable of connecting bubbles with turnover” (Scheinkman et al., 2003, p. 6). We also found that both Bitcoin and Ethereum premiums are adversely affected by

factors including Google Trends searches, volatility ratio, turnover ratio[9], foreign exchange rates, and the index of economic freedom. Furthermore, the Ethereum CBCP is also influenced by block time and the daily return ratio, variables that do not significantly impact the Bitcoin CBCP. This indicates that each cryptocurrency has its own unique sensitivities and is affected by specific factors, reflecting their distinct market characteristics and trading behaviors. The country-by-country analysis reveals that the CBCP is influenced by heterogeneous microeconomic environments, resulting in inconsistencies across different national contexts. For instance, while Google trends searches for Bitcoin generally decrease the CBCP in the joint findings, in Canada, they are associated with higher premiums. Similarly, this effect is observed with Ethereum trading in the UK markets.

The evidence we provide contributes to the literature by closing current knowledge gaps about the speculative nature of cryptocurrency markets and the arbitrage opportunities they offer. The study guide investors, regulators, and policymakers navigating the complex terrain of the global cryptocurrency market by shedding light on the CBCP phenomena. However, it is key to acknowledge that this study has some limitations, especially regarding the data collection process for crypto-specific variables. The reliability and availability of data could pose a constraint as the decentralization of cryptocurrency data might lack standardization among exchanges. Also, our findings are based on selected markets and cryptocurrencies (BTC and ETH), which may not be generalizable to other cryptocurrencies or emerging crypto categories that exhibit different characteristics or liquidity profiles.

In conclusion, while the dream of a global currency free from government interventions remains elusive, understanding the determinants of the CBCP can help navigate the complex terrain of the cryptocurrency market, ultimately promoting greater market efficiency and stability.

[9] Both the volatility ratio and turnover ratio measure the impact of the volatility and turnover verified on local countries relative to the volatility or turnover in the USA (benchmark).

Appendix

Panel A. Summary statistics of CBCP (in absolute terms) by Local Country and Cryptocurrency

A.1) Bitcoin

	Obs.	Mean	Std. Dev.	Min.	Max.
Germany	2,191	50.750	77.290	0.062	934.080
Japan	2,191	51.956	80.094	0.035	934.334
Australia	2,191	63.394	79.730	0.001	933.638
Canada	2,191	50.045	76.558	0.007	932.575
United Kingdom	2,191	58.513	80.001	0.002	934.156

A.2) Ethereum

	Obs.	Mean	Std. Dev.	Min.	Max.
Germany	2,191	52.699	81.474	0.062	1091.196
Japan	2,191	53.853	84.920	0.036	1091.704
Australia	2,191	65.309	83.740	0.001	1092.963
Canada	2,191	52.169	81.335	0.007	1091.958
United Kingdom	2,191	67.443	17.144	15.555	105.020

Panel B. Summary statistics of Daily Return by Local Country and Cryptocurrency

B.1) Bitcoin

	Obs.	Mean	Std. Dev.	Min.	Max.
Germany	2,191	0.112	3.606	-36.753	21.339
Japan	2,191	0.121	3.649	-37.128	21.255
Australia	2,191	0.113	3.553	-35.161	19.142
Canada	2,191	0.110	3.577	-36.423	18.599
United Kingdom	2,191	0.111	3.590	-35.946	19.435

B.2) Ethereum

	Obs.	Mean	Std. Dev.	Min.	Max.
Germany	2,191	0.151	4.640	-41.910	25.544
Japan	2,191	0.160	4.690	-42.254	25.960
Australia	2,191	0.151	4.590	-40.448	25.654
Canada	2,191	0.148	4.613	-41.607	25.889
United Kingdom	2,191	0.149	4.632	-41.169	25.874

Panel C. Summary statistics of Volatility by Local Country and Cryptocurrency

C.1) Bitcoin

	Obs.	Mean	Std. Dev.	Min.	Max.
Germany	2,191	4.449	3.685	0.003	60.589
Japan	2,191	4.500	3.709	0.089	61.808
Australia	2,191	4.500	3.709	0.089	61.808
Canada	2,191	4.439	3.645	0.016	59.835
United Kingdom	2,191	4.430	3.661	0.005	58.632

C.2) Ethereum

	Obs.	Mean	Std. Dev.	Min.	Max.
Germany	2,191	5.830	4.633	0.039	73.462
Japan	2,191	5.879	4.659	0.243	74.785
Australia	2,191	5.763	4.582	0.030	69.204
Canada	2,191	5.815	4.593	0.069	72.639
United Kingdom	2,191	5.810	4.608	0.116	71.332

Panel D. Summary statistics of Turnover by Local Country and Cryptocurrency

D.1) Bitcoin

	Obs.	Mean	Std. Dev.	Min.	Max.
Germany	2,191	0.085	0.071	0.010	0.735
Japan	2,191	0.085	0.071	0.010	0.756
Australia	2,191	0.085	0.071	0.010	0.743
Canada	2,191	0.085	0.071	0.010	0.727
United Kingdom	2,191	0.085	0.071	0.010	0.750

D.2) Ethereum

	Obs.	Mean	Std. Dev.	Min.	Max.
Germany	2,191	0.191	0.224	0.010	2.340
Japan	2,191	0.191	0.224	0.010	2.404
Australia	2,191	0.191	0.224	0.010	2.366
Canada	2,191	0.191	0.224	0.010	2.314
United Kingdom	2,191	0.191	0.224	0.010	2.388

Table A1. *Detailed Sample Description*

Dependent variable:		Bitcoin		Ethereum	
Independent variables regressed on:		Table 4.		Table 5.	
		Column IV.1	Column IV.2	Column IV.1	Column IV.2
Panel A. Test for panel-level heteroskedasticity					
Breusch-Pagan / Cook-Weisberg test		H0: *Constant variance (i.e., Homoscedasticity)*			
	chi2	18350.45***	39099.29***	340115.5***	329752.5***
Panel B. Test for autocorrelation					
Wooldridge test		H0: *no first-order autocorrelation*			
	F stat	155.211***	203.248***	235.141***	113.277***
Panel C. Fixed versus Random Effects					
Hausman test		H0: *Difference in coefficients not systematic*			
	chi2	94.03***	114.54***	84.22***	200.8***

*** p<0.01, ** p<0.05, * p<0.1

Table A2*. Validity Tests*

***Table A3**. Detailed Estimations - Bitcoin CBCP*

	Column I		Column II			Column III		
	Crypto Level		Country Level - Local Countries			Country Level - USA (Benchmark)		
	I.1	**I.2**	**II.1**	**II.2**	**II.3**	**III.1**	**III.2**	**III.3**
Independent Variables								
Crypto Level								
Google Trends BTC	-0.493***							
	(0.163)							
ln(Confirmation Time BTC)		6.061***						
		(1.909)						
Country level								
Local Countries (LC)								
Daily return LC			0.210					
			(0.352)					
Volatility LC				-0.251				
				(0.423)				
Turnover LC					50.169*			
					(29.249)			
USA (Benchmark)								
Daily return ratio						-0.031		
						(0.132)		
Volatility ratio							-45.024***	
							(2.730)	
Turnover ratio								-121.355***
								(7.450)
Controls								
Interest rates LC	15.478***	16.114***	16.382***	16.269***	17.305***	16.368***	17.687***	17.575***
	(1.258)	(1.228)	(1.241)	(1.244)	(1.299)	(1.243)	(1.286)	(1.245)
Foreign Exchange Rate	-2.437**	-3.154***	-3.062***	-3.032***	-2.929***	-3.062***	-3.968***	-3.276***
	(1.078)	(1.093)	(1.104)	(1.097)	(1.094)	(1.105)	(1.225)	(1.173)
Economic Freedoms LC	-3.091***	-3.296***	-3.372***	-3.341***	-3.592***	-3.369***	-3.681***	-3.659***
	(0.354)	(0.347)	(0.351)	(0.351)	(0.364)	(0.352)	(0.364)	(0.352)
Gold price volatility	0.059***	0.037***	0.048***	0.048***	0.048***	0.048***	0.051***	0.051***
	(0.009)	(0.009)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
Fixed Effects								
Weekend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
3-days period	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	185.801***	201.855***	212.587***	211.551***	222.742***	212.368***	275.322***	350.081***
	(32.285)	(31.693)	(31.932)	(31.783)	(31.882)	(31.975)	(33.247)	(33.088)
Observations	10,955	10,955	10,955	10,955	10,955	10,955	10,955	10,955
R-squared	0.087	0.088	0.083	0.083	0.085	0.082	0.154	0.160
Number of sample	5	5	5	5	5	5	5	5

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A4. *Detailed Estimations - Ethereum CBCP*

	Column I		Column II			Column III		
	Crypto Level		Country Level - Local Countries			Country Level - USA (Benchmark)		
	I.1	**I.2**	**II.1**	**II.2**	**II.3**	**III.1**	**III.2**	**III.3**
Independent Variables								
Crypto Level								
Google Trends BTC	-0.553***							
	(0.119)							
Block Time ETH		-5.540**						
		(2.165)						
Country level								
Local Countries (LC)								
Daily return LC			0.199					
			(0.201)					
Volatility LC				-0.416				
				(0.271)				
Turnover LC					21.034**			
					(9.447)			
USA (Benchmark)								
Daily return ratio						-0.042		
						(0.043)		
Volatility ratio							-52.234***	
							(2.509)	
Turnover ratio								-105.574***
								(5.828)
Controls								
Interest rates LC	18.759***	19.211***	20.007***	19.721***	21.700***	19.989***	20.401***	20.148***
	(1.425)	(1.445)	(1.429)	(1.436)	(1.534)	(1.428)	(1.447)	(1.405)
Foreign Exchange Rate	-0.922	-1.333	-1.418	-1.401	-0.832	-1.413	-1.525	-1.292
	(1.194)	(1.214)	(1.228)	(1.226)	(1.215)	(1.227)	(1.386)	(1.331)
Economic Freedoms LC	-4.361***	-4.576***	-4.813***	-4.727***	-5.264***	-4.807***	-4.966***	-4.748***
	(0.423)	(0.430)	(0.426)	(0.427)	(0.457)	(0.426)	(0.428)	(0.414)
Gold price volatility	0.079***	0.046***	0.059***	0.059***	0.060***	0.059***	0.061***	0.061***
	(0.009)	(0.010)	(0.008)	(0.008)	(0.008)	(0.008)	(0.009)	(0.008)
Fixed Effects								
Weekend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	246.256***	378.728***	299.809***	296.610***	325.916***	299.263***	359.309***	396.079***
	(37.045)	(48.858)	(36.656)	(36.659)	(37.684)	(36.640)	(37.306)	(36.652)
Observations	10,955	10,955	10,955	10,955	10,955	10,955	10,955	10,955
R-squared	0.153	0.146	0.143	0.143	0.144	0.142	0.189	0.175
Number of sample	5	5	5	5	5	5	5	5

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A5. *Detailed Estimations - Bitcoin CBCP (GER)*

	Column I			**Column II**				**Column III**			
	Crypto Level			Country Level - **Germany**				**Germany** - USA (Benchmark)			
	I.1	**I.2**	**I.3**	**II.1**	**II.2**	**II.3**	**II.4**	**III.1**	**III.2**	**III.3**	**III.4**
Independent Variables											
Crypto Level											
Google Trends BTC	-0.292		-0.315*								
	(0.181)		(0.181)								
ln(Confirmation Time BTC)		2.690	3.018								
		(2.078)	(2.081)								
Country level											
Local Countries (LC)											
Daily return LC				0.375			0.341				
				(0.373)			(0.379)				
Volatility LC					-0.183		-0.341				
					(0.446)		(0.487)				
Turnover LC						36.640	47.149				
						(32.998)	(35.398)				
USA (Benchmark)											
Daily return ratio								-0.110			-0.305
								(0.200)			(0.188)
Volatility ratio									-46.356***		-20.237***
									(2.979)		(4.564)
Turnover ratio										-130.097***	-90.827***
										(7.977)	(12.228)
Controls											
Interest rates LC	29.613***	28.977***	28.665***	29.831***	29.769***	31.368***	31.764***	29.788***	33.205***	32.543***	33.140***
	(2.299)	(2.382)	(2.382)	(2.297)	(2.287)	(2.686)	(2.707)	(2.299)	(2.405)	(2.289)	(2.292)
Foreign Exchange Rate	-5.810	-46.511	-7.471	-41.917	-39.142	-16.226	-1.864	-42.170	-28.903	-38.017	-33.217
	(51.047)	(45.755)	(50.872)	(45.699)	(46.243)	(51.345)	(54.328)	(45.734)	(47.596)	(45.391)	(45.380)
Economic Freedoms LC	-10.048***	-9.646***	-8.786***	-10.657***	-10.682***	-10.259***	-9.981***	-10.709***	-12.659***	-11.927***	-12.390***
	(2.235)	(2.347)	(2.392)	(2.197)	(2.188)	(2.228)	(2.233)	(2.198)	(2.291)	(2.182)	(2.185)
Gold price volatility	0.038***	0.026***	0.034***	0.030***	0.030***	0.031***	0.031***	0.030***	0.031***	0.032***	0.032***
	(0.009)	(0.009)	(0.010)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.009)	(0.008)	(0.008)
Fixed Effects											
Weekend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
3-days period	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	731.165***	749.694***	635.773***	822.558***	821.968***	758.610***	721.870***	826.656***	998.643***	1,037.924***	1,047.710***
	(203.319)	(203.300)	(213.064)	(194.330)	(193.944)	(203.530)	(206.585)	(194.420)	(202.593)	(193.385)	(193.307)
Observations	2,191	2,191	2,191	2,191	2,191	2,191	2,191	2,191	2,191	2,191	2,191
R-squared	0.130	0.130	0.131	0.129	0.130	0.130	0.132	0.129	0.198	0.213	0.221
Number of sample	1	1	1	1	1	1	1	1	1	1	1

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A6. *Detailed Estimations - Bitcoin CBCP (JPN)*

	Column I			Column II				Column III			
	Crypto Level			Country Level - **Japan**				**Japan** - USA (Benchmark)			
	I.1	**I.2**	**I.3**	**II.1**	**II.2**	**II.3**	**II.4**	**III.1**	**III.2**	**III.3**	**III.4**
Independent Variables											
Crypto Level											
Google Trends BTC	-0.432**		-0.447**								
	(0.182)		(0.180)								
ln(Confirmation Time BTC)		5.691***	5.863***								
		(2.125)	(2.113)								
Country level											
Local Countries (LC)											
Daily return LC				0.756**			0.737*				
				(0.374)			(0.382)				
Volatility LC					-0.105		-0.184				
					(0.453)		(0.475)				
Turnover LC						64.194**	68.790**				
						(31.781)	(32.580)				
USA (Benchmark)											
Daily return ratio								-0.020			-0.072
								(0.165)			(0.155)
Volatility ratio									-46.755***		-27.720***
									(3.004)		(4.697)
Turnover ratio										-121.779***	-65.473***
										(8.120)	(12.564)
Controls											
Interest rates LC	51.533***	31.005	35.016*	46.670**	47.314***	58.255***	58.722***	47.164***	69.340***	61.237***	67.896***
	(18.142)	(18.964)	(18.904)	(18.143)	(17.924)	(18.785)	(18.639)	(18.159)	(18.992)	(18.312)	(18.449)
Foreign Exchange Rate	-15,375.247***	-16,711.373***	-16,921.626***	-15,473.295***	-15,134.109**	-14,954.529**	-15,057.936***	-15,215.533**	-13,438.424**	-14,548.779**	-13,769.314**
	(5,923.847)	(5,924.185)	(5,883.706)	(5,954.683)	(5,888.060)	(5,900.333)	(5,837.749)	(5,958.860)	(6,209.885)	(5,998.431)	(6,032.632)
Economic Freedoms LC	-3.579	-6.164**	-4.451*	-5.239**	-5.234**	-5.268**	-5.196**	-5.264**	-5.206**	-5.325**	-5.280**
	(2.552)	(2.463)	(2.542)	(2.463)	(2.437)	(2.441)	(2.414)	(2.466)	(2.571)	(2.483)	(2.497)
Gold price volatility	0.036***	0.021**	0.029***	0.027***	0.027***	0.025**	0.024**	0.027***	0.026**	0.026***	0.026**
	(0.011)	(0.010)	(0.011)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
Fixed Effects											
Weekend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
3-days period	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	385.278**	578.445***	452.209***	510.443***	507.127***	504.044***	500.873***	509.513***	536.759***	629.643***	591.340***
	(152.643)	(145.082)	(152.820)	(144.146)	(142.739)	(142.839)	(141.482)	(144.287)	(150.544)	(145.568)	(146.560)
Observations	2,191	2,191	2,191	2,191	2,191	2,191	2,191	2,191	2,191	2,191	2,191
R-squared	0.120	0.122	0.125	0.119	0.120	0.121	0.125	0.117	0.188	0.189	0.200
Number of sample	1	1	1	1	1	1	1	1	1	1	1

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table A7. *Detailed Estimations - Bitcoin CBCP (AUS)*

	Column I			Column II				Column III			
	Crypto Level			Country Level - **Australia**				**Australia** - USA (Benchmark)			
	I.1	**I.2**	**I.3**	**II.1**	**II.2**	**II.3**	**II.4**	**III.1**	**III.2**	**III.3**	**III.4**
Independent Variables											
Crypto Level											
Google Trends BTC	0.398*		0.310								
	(0.220)		(0.220)								
ln(Confirmation Time BTC)		6.065***	5.695***								
		(1.929)	(1.944)								
Country level											
Local Countries (LC)											
Daily return LC				0.098			0.307				
				(0.406)			(0.413)				
Volatility LC					1.403***		1.368**				
					(0.467)		(0.535)				
Turnover LC						67.735*	17.559				
						(39.611)	(44.102)				
USA (Benchmark)											
Daily return ratio								0.018			-0.163
								(0.158)			(0.151)
Volatility ratio									-45.268***		-24.122***
									(3.214)		(4.982)
Turnover ratio										-121.611***	-73.450***
										(8.673)	(13.382)
Controls											
Interest rates LC	10.803**	11.862***	10.921***	12.044***	11.992***	13.602***	12.467***	12.031***	12.716***	12.750***	12.773***
	(4.281)	(4.192)	(4.238)	(4.238)	(4.125)	(4.314)	(4.243)	(4.240)	(4.380)	(4.213)	(4.241)
Foreign Exchange Rate	-372.696***	-295.063***	-354.023***	-296.854***	-328.747***	-228.134***	-309.195***	-297.165***	-312.316***	-309.657***	-312.762***
	(71.864)	(57.956)	(71.449)	(58.598)	(57.957)	(70.919)	(76.787)	(58.611)	(60.565)	(58.246)	(58.634)
Economic Freedoms LC	-2.859	-2.287	-2.736	-2.279	-2.486	-2.883	-2.627	-2.282	-2.771	-2.665	-2.775
	(2.031)	(1.989)	(2.011)	(2.010)	(1.959)	(2.031)	(1.986)	(2.011)	(2.077)	(1.998)	(2.011)
Gold price volatility	0.036***	0.037***	0.028**	0.048***	0.047***	0.049***	0.047***	0.048***	0.051***	0.050***	0.051***
	(0.011)	(0.010)	(0.011)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.010)	(0.009)	(0.009)
Fixed Effects											
Weekend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
3-days period	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	461.079***	343.623**	431.193**	348.551**	382.225**	335.763**	376.437**	348.955**	437.772***	504.605***	490.853***
	(173.356)	(160.519)	(171.940)	(162.273)	(158.369)	(161.570)	(158.654)	(162.333)	(167.789)	(161.660)	(162.756)
Observations	2,191	2,191	2,191	2,191	2,191	2,191	2,191	2,191	2,191	2,191	2,191
R-squared	0.109	0.113	0.114	0.107	0.116	0.109	0.117	0.107	0.168	0.174	0.182
Number of sample	1	1	1	1	1	1	1	1	1	1	1

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A8. *Detailed Estimations - Bitcoin CBCP (CAN)*

	Column I			**Column II**				**Column III**			
	Crypto Level			Country Level - **Canada**				**Canada** - USA (Benchmark)			
	I.1	**I.2**	**I.3**	**II.1**	**II.2**	**II.3**	**II.4**	**III.1**	**III.2**	**III.3**	**III.4**
Independent Variables											
Crypto Level											
Google Trends BTC	0.726***		0.658***								
	(0.220)		(0.228)								
ln(Confirmation Time BTC)		3.838*	2.355								
		(1.961)	(2.015)								
Country level											
Local Countries (LC)											
Daily return LC				-0.028			0.087				
				(0.367)			(0.375)				
Volatility LC					0.591		0.901*				
					(0.445)		(0.507)				
Turnover LC						-15.453	-48.379				
						(38.349)	(42.365)				
USA (Benchmark)											
Daily return ratio								-0.005			-0.174
								(0.186)			(0.175)
Volatility ratio									-45.420***		-20.625***
									(2.987)		(4.595)
Turnover ratio										-123.294***	-83.598***
										(7.738)	(11.911)
Controls											
Interest rates LC	-7.881*	-5.834	-6.716	-7.717*	-7.353*	-8.041*	-8.181*	-7.709*	-9.366**	-8.161*	-8.800**
	(4.372)	(4.498)	(4.475)	(4.417)	(4.324)	(4.497)	(4.360)	(4.421)	(4.576)	(4.399)	(4.413)
Foreign Exchange Rate	-445.706***	-203.363**	-424.951***	-199.724**	-224.771**	-225.169**	-317.844***	-199.458**	-171.711*	-200.415**	-188.140**
	(117.508)	(91.337)	(118.607)	(91.751)	(91.460)	(111.803)	(120.901)	(91.829)	(95.015)	(91.361)	(91.651)
Economic Freedoms LC	-24.432***	-22.371***	-23.400***	-23.986***	-23.887***	-23.673***	-22.854***	-23.983***	-27.353***	-25.988***	-26.867***
	(3.274)	(3.390)	(3.384)	(3.304)	(3.231)	(3.396)	(3.323)	(3.307)	(3.428)	(3.292)	(3.307)
Gold price volatility	-0.006	0.004	-0.007	0.007	0.008	0.008	0.010	0.007	0.003	0.007	0.005
	(0.012)	(0.011)	(0.012)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.012)	(0.011)	(0.011)
Fixed Effects											
Weekend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
3-days period	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	2,280.279***	1,917.391***	2,176.449***	2,051.979***	2,058.651***	2,048.650***	2,051.822***	2,051.552***	2,345.490***	2,331.874***	2,375.399***
	(255.801)	(256.795)	(270.233)	(248.681)	(243.144)	(248.984)	(241.171)	(248.894)	(258.262)	(248.270)	(249.128)
Observations	2,191	2,191	2,191	2,191	2,191	2,191	2,191	2,191	2,191	2,191	2,191
R-squared	0.132	0.128	0.133	0.126	0.132	0.126	0.134	0.126	0.193	0.207	0.214
Number of sample	1	1	1	1	1	1	1	1	1	1	1

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A9. Detailed Estimations - Bitcoin CBCP (UK)

	Column I			Column II				Column III			
	Crypto Level			Country Level - **United Kingdom**				**United Kingdom** - USA (Benchmark)			
	I.1	**I.2**	**I.3**	**II.1**	**II.2**	**II.3**	**II.4**	**III.1**	**III.2**	**III.3**	**III.4**
Independent Variables											
Crypto Level											
Google Trends BTC	-0.320		-0.379*								
	(0.211)		(0.210)								
ln(Confirmation Time BTC)		4.923**	5.374**								
		(2.148)	(2.156)								
Country level											
Local Countries (LC)											
Daily return LC				-0.210			-0.240				
				(0.389)			(0.396)				
Volatility LC					0.114		-0.477				
					(0.473)		(0.519)				
Turnover LC						102.070***	117.400***				
						(37.425)	(40.386)				
USA (Benchmark)											
Daily return ratio								-0.054			-0.147
								(0.142)			(0.135)
Volatility ratio									-43.711***		-20.697***
									(3.106)		(4.708)
Turnover ratio										-121.197***	-80.525***
										(8.343)	(12.608)
Controls											
Interest rates LC	27.438***	25.144***	23.503***	28.573***	28.613***	29.676***	29.581***	28.545***	31.640***	31.653***	32.017***
	(4.840)	(4.980)	(5.046)	(4.792)	(4.720)	(4.717)	(4.684)	(4.791)	(4.981)	(4.790)	(4.775)
Foreign Exchange Rate	-55.738	-99.114***	-58.308	-91.194**	-92.657**	-30.268	-15.556	-90.732**	-64.075	-80.936**	-71.735*
	(44.109)	(37.490)	(43.694)	(37.642)	(37.490)	(43.143)	(45.693)	(37.634)	(39.169)	(37.616)	(37.538)
Economic Freedoms LC	3.787*	3.035	2.331	4.302**	4.300**	3.032	2.795	4.279**	4.627**	4.787**	4.761**
	(2.016)	(2.050)	(2.080)	(1.993)	(1.961)	(2.007)	(2.010)	(1.993)	(2.069)	(1.990)	(1.983)
Gold price volatility	0.052***	0.034***	0.039***	0.047***	0.047***	0.042***	0.041***	0.047***	0.049***	0.051***	0.050***
	(0.012)	(0.013)	(0.013)	(0.012)	(0.011)	(0.011)	(0.011)	(0.012)	(0.012)	(0.012)	(0.011)
Fixed Effects											
Weekend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
3-days period	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-280.396	-159.400	-156.597	-274.935	-273.372	-259.684	-258.048	-273.459	-300.771*	-215.178	-245.482
	(173.490)	(179.375)	(178.819)	(173.754)	(170.864)	(170.453)	(169.232)	(173.730)	(180.419)	(173.560)	(173.116)
Observations	2,191	2,191	2,191	2,191	2,191	2,191	2,191	2,191	2,191	2,191	2,191
R-squared	0.096	0.098	0.100	0.095	0.098	0.101	0.103	0.095	0.157	0.167	0.175
Number of sample	1	1	1	1	1	1	1	1	1	1	1

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

***Table A10**. Detailed Estimations – Ethereum CBCP (GER)*

	Column I			Column II				Column III			
	Crypto Level			Country Level - **Germany**				**Germany** - USA (Benchmark)			
	I.1	**I.2**	**I.3**	**II.1**	**II.2**	**II.3**	**II.4**	**III.1**	**III.2**	**III.3**	**III.4**
Independent Variables											
Crypto Level											
Google Trends BTC	-0.347***		-0.344***								
	(0.122)		(0.123)								
Block Time ETH		-1.264	-0.999								
		(2.161)	(2.148)								
Country level											
Local Countries (LC)											
Daily return LC				0.324			0.135				
				(0.310)			(0.322)				
Volatility LC					-0.324		-0.522				
					(0.369)		(0.391)				
Turnover LC						31.035***	34.143***				
						(11.413)	(11.849)				
USA (Benchmark)											
Daily return ratio								-0.079			-0.155
								(0.116)			(0.105)
Volatility ratio									-75.599***		-50.229***
									(3.803)		(5.898)
Turnover ratio										-155.905***	-72.470***
										(8.606)	(12.982)
Controls											
Interest rates LC	32.740***	33.236***	32.530***	33.554***	33.354***	38.142***	38.377***	33.520***	37.588***	36.622***	37.687***
	(2.253)	(2.300)	(2.297)	(2.252)	(2.257)	(2.809)	(2.823)	(2.247)	(2.440)	(2.316)	(2.361)
Foreign Exchange Rate	13.149	-28.897	16.347	-32.863	-25.759	44.378	64.705	-33.826	-17.659	-25.728	-20.671
	(47.492)	(45.496)	(47.981)	(44.842)	(45.651)	(52.905)	(55.491)	(44.751)	(48.332)	(45.951)	(46.771)
Economic Freedoms LC	-10.893***	-12.105***	-10.730***	-12.253***	-12.146***	-10.410***	-9.898***	-12.334***	-14.516***	-13.604***	-14.408***
	(2.200)	(2.188)	(2.227)	(2.156)	(2.163)	(2.251)	(2.283)	(2.150)	(2.325)	(2.209)	(2.251)
Gold price volatility	0.049***	0.032***	0.047***	0.034***	0.035***	0.037***	0.037***	0.035***	0.036***	0.037***	0.037***
	(0.010)	(0.009)	(0.011)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.009)	(0.008)	(0.008)
Fixed Effects											
Weekend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	755.364***	930.020***	756.782***	924.282***	910.069***	688.471***	629.901***	931.235***	1,144.710***	1,165.470***	1,186.464***
	(199.203)	(190.675)	(199.197)	(190.707)	(191.869)	(208.975)	(213.969)	(190.252)	(205.729)	(195.790)	(199.227)
Observations	2,191	2,191	2,191	2,191	2,191	2,191	2,191	2,191	2,191	2,191	2,191
R-squared	0.163	0.159	0.164	0.159	0.159	0.164	0.164	0.160	0.255	0.248	0.268
Number of sample	1	1	1	1	1	1	1	1	1	1	1

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A11. *Detailed Estimations - Ethereum CBCP (JPN)*

	Column I			**Column II**				**Column III**			
	Crypto Level			Country Level - **Japan**				**Japan** - USA (Benchmark)			
	I.1	**I.2**	**I.3**	**II.1**	**II.2**	**II.3**	**II.4**	**III.1**	**III.2**	**III.3**	**III.4**
Independent Variables											
Crypto Level											
Google Trends BTC	-0.611***		-0.575***								
	(0.128)		(0.129)								
Block Time ETH		-5.767**	-4.239*								
		(2.305)	(2.289)								
Country level											
Local Countries (LC)											
Daily return LC				0.769**			0.601*				
				(0.315)			(0.327)				
Volatility LC					-0.395		-0.322				
					(0.381)		(0.393)				
Turnover LC						35.461***	34.314***				
						(10.537)	(10.645)				
USA (Benchmark)											
Daily return ratio								-0.322			-0.481***
								(0.200)			(0.182)
Volatility ratio									-73.340***		-54.208***
									(3.881)		(6.247)
Turnover ratio										-146.073***	-53.930***
										(8.911)	(13.916)
Controls											
Interest rates LC	54.299***	55.644***	54.759***	55.038***	55.104***	73.410***	72.822***	55.020***	77.302***	69.786***	77.040***
	(17.713)	(17.997)	(17.656)	(18.116)	(18.065)	(18.692)	(18.669)	(18.075)	(19.559)	(18.693)	(18.969)
Foreign Exchange Rate	19,722.749***	13,255.032**	17,650.007**	15,764.227**	15,654.364**	16,541.343**	16,434.041**	15,756.020**	14,185.922**	15,005.172**	14,270.625**
	(5,876.165)	(5,992.005)	(5,962.570)	(5,947.778)	(5,932.178)	(5,878.873)	(5,865.834)	(5,934.546)	(6,401.466)	(6,125.524)	(6,209.189)
Economic Freedoms LC	-2.009	-6.123**	-2.517	-5.844**	-5.499**	-5.561**	-5.468**	-5.736**	-5.902**	-5.893**	-5.934**
	(2.529)	(2.449)	(2.536)	(2.460)	(2.463)	(2.430)	(2.438)	(2.455)	(2.650)	(2.535)	(2.570)
Gold price volatility	0.050***	0.018	0.040***	0.029***	0.030***	0.025**	0.025**	0.030***	0.029***	0.030***	0.029***
	(0.011)	(0.011)	(0.012)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.011)	(0.010)	(0.010)
Fixed Effects											
Weekend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	290.884*	648.404***	382.296**	553.751***	529.582***	537.410***	532.878***	545.523***	615.395***	693.508***	653.854***
	(150.372)	(148.841)	(157.805)	(143.924)	(144.181)	(142.086)	(142.714)	(143.550)	(155.176)	(148.602)	(150.755)
Observations	2,191	2,191	2,191	2,191	2,191	2,191	2,191	2,191	2,191	2,191	2,191
R-squared	0.150	0.141	0.152	0.139	0.138	0.144	0.146	0.139	0.230	0.214	0.238
Number of sample	1	1	1	1	1	1	1	1	1	1	1

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A12. *Detailed Estimations - Ethereum CBCP (AUS)*

	Column I			**Column II**				**Column III**			
	Crypto Level			Country Level - **Australia**				**Australia** - USA (Benchmark)			
	I.1	**I.2**	**I.3**	**II.1**	**II.2**	**II.3**	**II.4**	**III.1**	**III.2**	**III.3**	**III.4**
Independent Variables											
Crypto Level											
Google Trends BTC	-0.086		-0.090								
	(0.151)		(0.151)								
Block Time ETH		-1.630	-1.679								
		(2.242)	(2.242)								
Country level											
Local Countries (LC)											
Daily return LC				0.029			0.088				
				(0.334)			(0.350)				
Volatility LC					0.643		0.517				
					(0.397)		(0.440)				
Turnover LC						23.053	16.221				
						(14.835)	(16.008)				
USA (Benchmark)											
Daily return ratio								-0.047			-0.069
								(0.072)			(0.067)
Volatility ratio									-71.994***		-50.447***
									(4.091)		(6.136)
Turnover ratio										-145.799***	-63.106***
										(9.358)	(13.666)
Controls											
Interest rates LC	13.262***	12.819***	13.271***	12.833***	12.504***	15.521***	14.467***	12.769***	12.057***	13.487***	12.488***
	(4.250)	(4.181)	(4.248)	(4.183)	(4.133)	(4.513)	(4.567)	(4.182)	(4.459)	(4.260)	(4.353)
Foreign Exchange Rate	-287.333***	-298.387***	-276.299***	-308.069***	-325.008***	-232.385***	-268.200***	-307.910***	-303.125***	-319.363***	-309.341***
	(68.419)	(59.340)	(69.967)	(57.825)	(57.955)	(75.514)	(81.131)	(57.799)	(61.654)	(58.899)	(60.169)
Economic Freedoms LC	-2.796	-2.913	-2.718	-2.981	-3.268*	-3.338*	-3.469*	-3.011	-4.213**	-3.495*	-4.111**
	(2.010)	(1.986)	(2.012)	(1.985)	(1.967)	(1.992)	(1.974)	(1.985)	(2.116)	(2.021)	(2.066)
Gold price volatility	0.057***	0.049***	0.053***	0.053***	0.052***	0.055***	0.054***	0.052***	0.052***	0.055***	0.053***
	(0.012)	(0.010)	(0.012)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.010)	(0.009)	(0.010)
Fixed Effects											
Weekend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	370.998**	421.658***	385.439**	406.174**	438.406***	366.088**	404.408**	408.877**	573.447***	594.130***	608.787***
	(171.532)	(161.540)	(172.554)	(160.153)	(159.324)	(161.644)	(163.471)	(160.140)	(170.961)	(163.522)	(167.032)
Observations	2,191	2,191	2,191	2,191	2,191	2,191	2,191	2,191	2,191	2,191	2,191
R-squared	0.132	0.132	0.132	0.131	0.135	0.133	0.136	0.132	0.215	0.204	0.224
Number of sample	1	1	1	1	1	1	1	1	1	1	1

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A13. *Detailed Estimations - Ethereum CBCP (CAN)*

	Column I			**Column II**				**Column III**			
	Crypto Level			Country Level - **Canada**				**Canada** - USA (Benchmark)			
	I.1	**I.2**	**I.3**	**II.1**	**II.2**	**II.3**	**II.4**	**III.1**	**III.2**	**III.3**	**III.4**
Independent Variables											
Crypto Level											
Google Trends BTC	0.239		0.255								
	(0.173)		(0.174)								
Block Time ETH		1.448	1.808								
		(2.170)	(2.179)								
Country level											
Local Countries (LC)											
Daily return LC				0.114			0.275				
				(0.310)			(0.323)				
Volatility LC					0.516		0.698*				
					(0.372)		(0.401)				
Turnover LC						-3.892	-11.654				
						(12.890)	(13.424)				
USA (Benchmark)											
Daily return ratio								-0.262*			-0.388***
								(0.154)			(0.139)
Volatility ratio									-74.177***		-51.844***
									(3.891)		(6.068)
Turnover ratio										-145.912***	-62.606***
										(8.582)	(13.006)
Controls											
Interest rates LC	-9.927**	-9.024**	-10.097**	-8.901**	-8.872**	-9.390**	-10.091**	-8.956**	-10.974**	-9.565**	-10.655**
	(4.326)	(4.275)	(4.327)	(4.275)	(4.213)	(4.526)	(4.460)	(4.259)	(4.586)	(4.372)	(4.446)
Foreign Exchange Rate	-317.194***	-213.374**	-339.893***	-201.097**	-225.516**	-220.633**	-290.277**	-202.122**	-174.440*	-199.297**	-183.144**
	(121.955)	(90.558)	(124.860)	(88.821)	(89.141)	(109.134)	(113.987)	(88.514)	(95.246)	(90.834)	(92.340)
Economic Freedoms LC	-28.097***	-27.645***	-28.436***	-27.403***	-27.610***	-27.271***	-27.242***	-27.446***	-31.581***	-29.734***	-31.377***
	(3.233)	(3.218)	(3.256)	(3.200)	(3.158)	(3.234)	(3.174)	(3.189)	(3.437)	(3.274)	(3.333)
Gold price volatility	-0.001	0.011	0.002	0.008	0.008	0.008	0.008	0.008	0.004	0.007	0.004
	(0.013)	(0.012)	(0.013)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.012)	(0.011)	(0.011)
Fixed Effects											
Weekend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	2,475.300***	2,325.253***	2,488.916***	2,321.797***	2,352.333***	2,328.037***	2,376.799***	2,326.442***	2,707.666***	2,647.071***	2,737.322***
	(264.497)	(240.652)	(264.761)	(240.670)	(238.237)	(241.419)	(238.501)	(239.856)	(258.934)	(246.905)	(251.110)
Observations	2,191	2,191	2,191	2,191	2,191	2,191	2,191	2,191	2,191	2,191	2,191
R-squared	0.163	0.162	0.163	0.162	0.166	0.162	0.168	0.164	0.250	0.240	0.262
Number of sample	1	1	1	1	1	1	1	1	1	1	1

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table A14. Detailed Estimations - Ethereum CBCP (UK)

	Column I			Column II				Column III			
	Crypto Level			Country Level - **United Kingdom**				**United Kingdom** - USA (Benchmark)			
	I.1	**I.2**	**I.3**	**II.1**	**II.2**	**II.3**	**II.4**	**III.1**	**III.2**	**III.3**	**III.4**
Independent Variables											
Crypto Level											
Google Trends BTC	0.026***		0.026***								
	(0.003)		(0.003)								
Block Time ETH		-0.008	-0.010								
		(0.047)	(0.045)								
Country level											
Local Countries (LC)											
Daily return LC				-0.004			0.006				
				(0.008)			(0.008)				
Volatility LC					0.016*		0.027***				
					(0.009)		(0.009)				
Turnover LC						-1.276***	-1.424***				
						(0.248)	(0.251)				
USA (Benchmark)											
Daily return ratio								-0.001			-0.001
								(0.002)			(0.002)
Volatility ratio									-0.206*		0.461***
									(0.108)		(0.161)
Turnover ratio										-1.224***	-1.986***
										(0.240)	(0.358)
Controls											
Interest rates LC	0.541***	0.364***	0.537***	0.367***	0.379***	0.308***	0.321***	0.366***	0.378***	0.396***	0.389***
	(0.089)	(0.093)	(0.090)	(0.092)	(0.092)	(0.091)	(0.090)	(0.092)	(0.091)	(0.091)	(0.091)
Foreign Exchange Rate	252.584***	256.418***	252.613***	256.393***	256.168***	254.129***	253.498***	256.384***	256.491***	256.498***	256.342***
	(0.797)	(0.731)	(0.807)	(0.719)	(0.728)	(0.835)	(0.854)	(0.719)	(0.715)	(0.710)	(0.715)
Economic Freedoms LC	0.217***	0.133***	0.216***	0.135***	0.137***	0.183***	0.191***	0.134***	0.135***	0.139***	0.139***
	(0.037)	(0.038)	(0.037)	(0.038)	(0.038)	(0.039)	(0.038)	(0.038)	(0.038)	(0.038)	(0.038)
Gold price volatility	0.000	0.001***	0.000	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Fixed Effects											
Weekend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-277.149***	-275.739***	-276.933***	-275.967***	-275.954***	-276.665***	-276.750***	-275.881***	-275.951***	-275.310***	-274.815***
	(3.148)	(3.479)	(3.291)	(3.326)	(3.315)	(3.274)	(3.232)	(3.328)	(3.303)	(3.288)	(3.306)
Observations	2,191	2,191	2,191	2,191	2,191	2,191	2,191	2,191	2,191	2,191	2,191
R-squared	0.989	0.987	0.989	0.987	0.988	0.988	0.988	0.987	0.988	0.988	0.988
Number of sample	1	1	1	1	1	1	1	1	1	1	1

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

8. References

Asako, K., & Liu, Z. (2013). A statistical model of speculative bubbles, with applications to the stock markets of the United States, Japan, and China. Journal of Banking & Finance, 37(7), 2639-2651

Baur, D. G., & Hoang, L. (2021). The Bitcoin gold correlation puzzle. Journal of Behavioral and Experimental Finance, 32, 100561.

Baur, D. G., Hong, K., & Lee, A. D. (2018). Bitcoin: Medium of exchange or speculative assets?. Journal of International Financial Markets, Institutions and Money, 54, 177-189.

Beaver, W. H. (1981). Market efficiency. Accounting Review, 23-37.

Beck, N., & Katz, J. N. (1995). What to do (and not to do) with time-series cross-section data. American political science review, 89(3), 634-647.

Bitcoin could potentially become the 21st-century gold. (n.d.). Deutsche Bank. https://www.db.com/what-next/digital-disruption/dossier-payments/i-could-potentially-see-bitcoin-to-become-the-21st-century-gold

Blackwell III, J. L. (2005). Estimation and testing of fixed-effect panel-data systems. The STATA journal, 5(2), 202-207.

Borri, N., & Shakhnov, K. (2020). Regulation spillovers across cryptocurrency markets. Finance research letters, 36, 101333.

Bouri, E., Lau, C. K. M., Lucey, B., & Roubaud, D. (2019). Trading volume and the predictability of return and volatility in the cryptocurrency market. Finance Research Letters, 29, 340-346.

Bunjaku, F., Gjorgieva-Trajkovska, O., & Miteva-Kacarski, E. (2017). Cryptocurrencies–advantages and disadvantages. Journal of Economics, 2(1), 31-39

Buterin, V. (2014). A next-generation smart contract and decentralized application platform. white paper, 3(37), 2-1.

Buterin, V. (2016). Ethereum: platform review. Opportunities and challenges for private and consortium blockchains, 45.

Cheah, E. T., & Fry, J. (2015). Speculative bubbles in Bitcoin markets? An empirical investigation into the fundamental value of Bitcoin. Economics letters, 130, 32-36.

Chen, C. Y. H., & Hafner, C. M. (2019). Sentiment-induced bubbles in the cryptocurrency market. Journal of Risk and Financial Management, 12(2), 53.

Choi, K. J., Lehar, A., & Stauffer, R. (2022). Bitcoin microstructure and the kimchi premium.

Chiang, T. C., & Zheng, D. (2010). An empirical analysis of herd behavior in global stock markets. Journal of Banking & Finance, 34(8), 1911-1921.

Chu, J., Zhang, Y., & Chan, S. (2019). The adaptive market hypothesis in the high frequency cryptocurrency market. International Review of Financial Analysis, 64, 221-231.

Crépellière, T., Pelster, M., & Zeisberger, S. (2023). Arbitrage in the market for cryptocurrencies. Journal of Financial Markets, 64, 100817.

Eom, Y. (2021). Kimchi premium and speculative trading in bitcoin. Finance Research Letters, 38, 101505

Eross, A., McGroarty, F., Urquhart, A., & Wolfe, S. (2019). The intraday dynamics of Bitcoin. Research in international business and finance, 49, 71-81.

Fama, E. F. (1970). Efficient capital markets. Journal of finance, 25(2), 383-417.

Farell, R. (2015). An analysis of the cryptocurrency industry. Wharton Research Scholars, 130, 1-23.

Flood, R. P., & Hodrick, R. J. (1990). On testing for speculative bubbles. Journal of economic perspectives, 4(2), 85-101.

Foley, S., Karlsen, J. R., & Putniņš, T. J. (2019). Sex, drugs, and bitcoin: How much illegal activity is financed through cryptocurrencies?. The Review of Financial Studies, 32(5), 1798-1853.

Geuder, J., Kinateder, H., & Wagner, N. F. (2019). Cryptocurrencies as financial bubbles: The case of Bitcoin. Finance Research Letters, 31.

Giudici, G., Milne, A., & Vinogradov, D. (2020). Cryptocurrencies: market analysis and perspectives. Journal of Industrial and Business Economics, 47, 1-18.

Gkillas, K., & Longin, F. (2019). Is Bitcoin the new digital gold? Evidence from extreme price movements in financial markets. Evidence From Extreme Price Movements in Financial Markets (January 18, 2019).

Harrison, J. M., & Kreps, D. M. (1978). Speculative investor behavior in a stock market with heterogeneous expectations. The Quarterly Journal of Economics, 92(2), 323-336.

Haykir, O., & Yagli, I. (2022). Speculative bubbles and herding in cryptocurrencies. Financial innovation, 8(1), 78.

Keynes, J. M. (1937). The general theory of employment. The quarterly journal of economics, 51(2), 209-223.

Khan, S. N., Loukil, F., Ghedira-Guegan, C., Benkhelifa, E., & Bani-Hani, A. (2021). Blockchain smart contracts: Applications, challenges, and future trends. Peer-to-peer Networking and Applications, 14, 2901-2925.

Klein, T., Thu, H. P., & Walther, T. (2018). Bitcoin is not the New Gold–A comparison of volatility, correlation, and portfolio performance. International Review of Financial Analysis, 59, 105-116.

Kurka, J. (2019). Do cryptocurrencies and traditional asset classes influence each other?. Finance Research Letters, 31, 38-46.

Kyriazis, N., Papadamou, S., & Corbet, S. (2020). A systematic review of the bubble dynamics of cryptocurrency prices. Research in International Business and Finance, 54, 101254.

Lambrecht, M., & Larue, L. (2018). After the (virtual) gold rush: is Bitcoin more than a speculative bubble?. Internet Policy Review, 7(4).

Leland, H. E., & Pyle, D. H. (1977). Informational asymmetries, financial structure, and financial intermediation. The journal of Finance, 32(2), 371-387

Li, X., & Wang, C. A. (2017). The technology and economic determinants of cryptocurrency exchange rates: The case of Bitcoin. Decision support systems, 95, 49-60

Makarov, I., & Schoar, A. (2020). Trading and arbitrage in cryptocurrency markets. Journal of Financial Economics, 135(2), 293-319.

Nakamoto, S. (2008). Bitcoin: A peer-to-peer electronic cash system. Decentralized business review.

Noda, A. (2021). On the evolution of cryptocurrency market efficiency. Applied Economics Letters, 28(6), 433-439.

Ok, H., Kim, J., & Kim, Y. (2023). Is the Kimchi premium a speculative bubble?. Finance Research Letters, 57, 104207.

Scheinkman, J. A., & Xiong, W. (2003). Overconfidence and speculative bubbles. Journal of political Economy, 111(6), 1183-1220.

Schwert, G. W. (2003). Anomalies and market efficiency. Handbook of the Economics of Finance, 1, 939-974.

Seo, M. H., Koo, B., & Yang, Y. F. (2024). Nonlinear dynamics of Kimchi premium. Economic Modelling, 135, 106726.

Smales, L. A. (2022). Investor attention in cryptocurrency markets. International Review of Financial Analysis, 79, 101972.

Tasca, P., Hayes, A., & Liu, S. (2018). The evolution of the bitcoin economy: Extracting and analyzing the network of payment relationships. The Journal of Risk Finance, 19(2), 94-126.

Team, C. (2023, October 23). Latin America: Venezuela and Argentina stand out as examples of crypto's unique utility. Chainalysis. https://www.chainalysis.com/blog/latin-america-cryptocurrency-adoption

Tikhomirov, S., Voskresenskaya, E., Ivanitskiy, I., Takhaviev, R., Marchenko, E., & Alexandrov, Y. (2018, May). Smartcheck: Static analysis of ethereum smart contracts. In Proceedings of the 1st international workshop on emerging trends in software engineering for blockchain (pp. 9-16).

Treiblmaier, H. (2022). Do cryptocurrencies really have (no) intrinsic value?. Electronic markets, 32(3), 1749-1758.

Trump, B. D., Wells, E., Trump, J., & Linkov, I. (2018). Cryptocurrency: governance for what was meant to be ungovernable. Environment Systems and Decisions, 38, 426-430.

Vidal-Tomás, D., & Ibañez, A. (2018). Semi-strong efficiency of Bitcoin. Finance Research Letters, 27, 259-265.

Wei, W. C. (2018). Liquidity and market efficiency in cryptocurrencies. Economics Letters, 168, 21-24

Xia, P., Wang, H., Zhang, B., Ji, R., Gao, B., Wu, L., ... & Xu, G. (2020). Characterizing cryptocurrency exchange scams. Computers & Security, 98, 101993

What's the most Crypto-Savvy country in the world? (Hint: It's not the USA) | Consensys. (n.d.). Consensys. https://consensys.io/blog/whats-the-most-crypto-savvy-country-in-the-world-hint-its-not-the-usa

Wooldridge, J. M. (2010). Econometric analysis of cross section and panel data. MIT press.