

Media Sentiment and Economic Signals of Emerging Blockchain Adoption in Vietnam

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ABSTRACT: This paper examines the emerging relationship between blockchain-based media sentiment and relevant economic indicators in Vietnam. Although Vietnam is positioning itself to become a regional leader in blockchain technology, frameworks for adoption remain under development and are ambiguous. Also, due to a lack of enterprise-driven data, no studies to date have formally assessed its impact on the economic landscape. Addressing this gap, we construct a multi-layered approach, integrating quantitative (news sentiment and six macroeconomic indicators) and qualitative data (policy contexts and two technology readiness indexes). Using natural language processing (NLP) models, we analyze sentiment across thousands of Vietnamese-language articles from four popular newspapers, filtered by blockchain-related keywords. We then align sentiment trends with macroeconomic variables in a time-series perspective to perform EDA, exploring whether fluctuations in media sentiment correlate with economic shifts. While causality is not definitive, findings show meaningful correlations between indicators that are congruent with qualitative factors. Conclusively, our research methodology aims to lay the foundation for evaluating economic signals of developing countries at an early stage.

KEYWORDS: Development Economics, Blockchain Adoption (BCA), Macroeconomic Indicators, Sentiment Analysis, Natural Language Processing (NLP), Regression, Granger Causality.

■ Introduction

The emergence of blockchain (BC) technology is increasingly prominent, serving as a remedy for prolonged infrastructure deficits and a catalyst for the efficacy of diverse industries in emerging economies. However, insufficient public data and barriers to adoption present a challenge to drawing empirical conclusions at an early stage. Our multidimensional analysis, both dynamic and exploratory, investigates how BC diffusion relates to economic development, aiming to foster trust and efficiency in the Vietnam BCA framework. In this paper, we answer three core questions:

- RQ1: How is sentiment measured quantitatively in our dataset?

- RQ2: How do shifts in Vietnamese media sentiment associate with BC-related economic activity?

- RQ3: Which macroeconomic indicators exhibit significant relationships with blockchain adoption sentiment in Vietnam?

The remainder of this paper proceeds as follows. The background section provides the context of the paper, portraying the BC situation in the ASEAN and Vietnam contexts. The literature review section reviews existing papers on related works. We then present our methodology section, detailing data collection, sentiment-scoring models, and time-series techniques. In the findings section, we use correlation, regression, and Granger causality to identify relationships between news sentiment and economic signals. In the following section, we discuss the study's limitations and directions for future research. The paper concludes with a summary of important insights.

■ Background

Amidst rapid changes in technological innovation, the influence of emerging markets in the global economy, especially those situated in Southeast Asia, has overshadowed the growth of advanced economies. Characterized by burgeoning financial infrastructure and evolving institutional frameworks, they garner much attention from practitioners and investors alike. Their growth trajectory fuels capital flows, trade, and economic prosperity. However, it also presents unique challenges. In many Association of Southeast Asian Nations (ASEAN) countries, financial inclusion is notably uneven. For example, approximately 98 million Indonesian people (48% of the country's adult population) remain underbanked, restricting access to savings, credit, and basic payment services.¹ As a high proportion of SMEs constitutes the private sector, opaque supply chains are increasingly susceptible to market trust and quality assurance issues. Most logistics of goods and services are operated without verification.²⁻⁴ In addition, record-keeping in public services is largely paper-based and bureaucratic. Such is the underlying circumstance in Thailand, where centralized databases suffer from inefficiency and a lack of transparency.⁵ Banking systems and business corporations experience similar centralization, resulting in relatively low public confidence across institutions.⁵ Collectively, these gaps in financial inclusion, supply chain vulnerability, governance structure, and transparency hamper economic resilience and pose barriers to artificial intelligence (AI) and digital transformation.

A promising solution to emerging markets' challenges is blockchain. The term, which originated from Satoshi Nakamoto's 2008 Bitcoin whitepaper, one of the earliest forms of BC

applications, is a distributed ledger technology that addresses structural challenges securely and transparently.⁶ Fundamentally, BC records a sequence of blocks using cryptography, where each block—containing transaction records—is linked to the previous block. One of its key attributes is immutability. Once a block is added to the ledger, the block order is irreversible and cannot be modified, creating a tamper-proof audit trail for corporate registries and end-to-end provenance of goods.^{6,7} To bolster data integrity, the BC system is built on a peer-to-peer (P2P) network of consensus mechanisms, allowing individuals to perform trustless transactions without the need for central intermediaries, so-called decentralization.^{6,8} On top of that, BC is highly interoperable. It serves as a backbone for seamless exchange of standardized data and automating complex tasks such as credit disbursement, significantly reducing manual processing and intervention, compliance costs, and delays.^{6,7} Thus, blockchain's versatile architecture offers a wide range of practical applications.

By far, digital wallet platforms and decentralized finance (DeFi) represent leading applications of BC technology. Whereas digital wallets incentivize the unbanked population to gain financial flexibility, bypassing conventional banking constraints and transaction fees, DeFi leverages smart contracts to radically transform the financial service landscape, providing automated P2P lending and novel asset tokenization.^{8,9} Yet, the potential of BC hinges on a proper regulatory environment.^{10,11} Conforming to safeguards, the Monetary Authority of Singapore has implemented a stringent sandbox to experiment with integrating BC in Fintech.¹² The Securities and Exchange Commission (SEC) of the Philippines, by contrast, has issued regulations that acknowledge the increased digital asset space.¹³ Despite proactive actions, many governments struggle to keep pace as digital advancements outstrip policy frameworks. The tension between the promise of BC technology and regulatory limitations in emerging economies creates a pressing need for further research.

Vietnam exemplifies this dynamic as an emerging, low-to-middle-income country with unregulated economic and institutional infrastructures due to scarce digital record-keeping.¹⁴ Because of this, Vietnam has yet to develop a viable banking system, transparent supply chains, and effective public government, reflecting underlying structural challenges of a typical emerging market.¹⁵⁻¹⁷ Concurrently, Vietnam's digital asset adoption rate has seen exceptional growth, ranking among the top five countries within three years consecutively.¹⁸ Over 17 million Vietnamese—the majority in early adulthood—have reportedly been involved in the cryptocurrency market, underscoring a strong participation rate in decentralized applications (dApps), including DeFi and P2P activities. Notably, Vietnam secured over 105 billion USD from blockchain investments from 2023 to 2024.¹⁹ While upward trends reflect public optimism, the reverse is true for policymakers. The decentralized and borderless nature of digital assets in the absence of state regulatory oversight has exposed users to unprecedented threats: cyberfraud, money laundering, tax evasion, and personal data breaches.¹⁹ Furthermore, the lack of regulatory clarity forces BC start-ups, such as the on-chain

liquidity protocol Kyber Network and the play-to-earn (P2E) gaming platform Axie Infinity, to register overseas. Consequently, this results in substantial capital outflows and losses in tax revenue, placing a strain on the national budget. As a result, the government is actively pursuing frameworks to address contemporary infrastructure challenges and strengthen user protections, positioning Vietnam to become a regional leader in BC by 2030.²⁰

■ Literature Review

In recent years, numerous studies have been conducted to bring to light the potential of BCA across domains such as education, health, logistics, financial technology, and supply chain management. We determine three pertinent strands of existing BCA studies that build the foundation of our research: (1) frameworks and determinants; (2) news sentiment; and (3) Vietnam's BC economy. We articulate notable gaps across these strands and position our paper to bridge them.

Frameworks and Determinants:

Frameworks, such as the Technology Acceptance Model (TAM), are used as theoretical models to study BCA. At the same time, determinants are specific factors—e.g., perceived usefulness and perceived ease of use—constructed within these models.

Literature surveys elucidate a comprehensive perspective on BC technology, ranging from its historical background and principles to its areas of application.^{6,7,11,21-23} On the other hand, empirical studies develop granular approaches to identify determinants affecting BCA. For instance, Lou & Li propose a conceptual framework, integrating TAM with Innovation Diffusion Theory (IDT) to survey perceptions of BCA from business managers' perspectives in the Taiwan fintech industry.²⁴ However, the work mainly highlights blueprints for future research due to data scarcity and sampling difficulty. Building on TAM methodology, Nuryyev *et al.* examine how individuals in Taiwanese SMEs in tourism and hospitality perceive the usefulness of cryptocurrency payment, a popular application of BC technology.²⁵ Extending contextualized determinants, they find that behavioral intention is engendered by social influence, strategic orientation, and individual SME characteristics. Malik *et al.* conduct a cross-sectional analysis on Australian organizational behaviors through the lens of the Technology Organization Environment (TOE) model, advising future research to enhance generalization.²⁶ Chittipaka *et al.* refine TOE with a larger sample size across many sectors, shedding light on prospects of the Indian supply chain, improving generalizability, and tackling the diminutive data sampling of previous studies.²⁷ Determinants stimulating the adoption are “relative advantage, trust, compatibility, security, firm's IT resources, higher authority support, firm size, monetary resources, rivalry pressure, business partner pressure, and regulatory pressure”. Beyond organizational and behavioral determinants, Guo *et al.* emphasize the interplay between economic factors—such as inflation and exchange rates—and cryptocurrency adoption, employing various econometric models with panel data.²⁸ Similar studies suggest that mac-

ro-level drivers become more pronounced, supporting the justification of indicators in the methodology section.²⁹⁻³²

News Sentiment:

News sentiment analysis (SA) is an emerging technique that extracts the semantic meaning from text. Its application holds immense benefits for technology adoption and business domains, allowing entities to gauge public perception, predict market behavior, and derive quantitative insights. Early on, Godbole *et al.* developed a two-step system to determine the sentiment weighted by each word and aggregate these values to determine the overall sentiment of a text.³³ Shapiro *et al.* created a more advanced, specialized system for capturing economic news. They experimented with the reliability of sentiment in reflecting market responses to macroeconomic variables such as consumption, output, interest rates, and inflation.³⁴ Khedr *et al.* amalgamate news sentiment with historical prices, predicting stock market behavior with up to 90% accuracy via a naive Bayes algorithm.³⁵ SA is also prevalent in cryptocurrency and BC applications. Coulter peruses SA on thousands of international cryptocurrency articles to underscore certain topics that drive the volatility of the Bitcoin price.³⁶ Caviggioli *et al.* explore how SA on specific tweets can affect the corporate reputations of retail companies that adopt Bitcoin payment.³⁷ Recently, the advent of state-of-the-art NLP models—including Large Language Models (LLMs) such as GPT-4, BERT, and FinBert—has outperformed conventional sentiment paradigms. Their efficacy in capturing nuances facilitates investors in navigating the unpredictable nature of cryptocurrencies and optimizing strategies.³⁸ SA techniques have also been adapted for non-English contexts. Vu *et al.* implement the Vietnamese-language model PhoBERT to classify the polarity of nearly 40,000 financial-oriented articles, providing investors with greater data accessibility and certainty when engaging with markets.³⁹ Although PhoBERT achieves 81% accuracy, there is a weak correlation between news sentiment and stock prices, but a strong link between negative sentiment shocks (i.e., sudden decrease of sentiment) and increased market volatility. A possible explanation is that the Vietnamese stock market is relatively young.

Vietnam's Blockchain Economy:

As an emerging market, Vietnam has attracted growing public and academic interest in BCA due to its potential to support economic development and digital transformation. While papers synthesizing the context of blockchain-based economy are abundant,⁴⁰⁻⁴² empirical studies on domain applications are inadequate.

Existing case studies and surveys are concentrated within the supply chain spectrum—including logistics, agriculture, and food supply.^{43,44} Nguyen *et al.* fill the gap by conducting a study on the potential benefits of BC technology in tackling the limitations of traditional real estate.⁴⁵ Both Pham *et al.* and Nguyen *et al.* explore determinants driving blockchain in journalism and logistics based on Unified Theory of Acceptance and Use of Technology (UTAUT), respectively, as an effort to address the nascent stage of BCA in Vietnam.^{46,47} While

the former omit social influence as a determinant of BCA, the latter identify it as the most salient factor via neural-network analysis. Nevertheless, existing fragmented frameworks and ill-defined guardrails have prevented Vietnam from capitalizing on the pre-emptive phase of Asian technological advancement. The legal stance on cryptocurrency is not receptive to recognizing it as legal tender; instead, it is treated as proprietary, citing concerns that cryptocurrency poses immeasurable risks to consumers and has yet to fulfill the monetary role of the Vietnamese dong.⁴¹ However, this approach may stifle innovation in fintech and BC entrepreneurship, causing Vietnam to lag behind its Asian neighbors by overlooking key benefits of BC, such as removing intermediaries, reducing transaction costs, and generating a potential source of tax revenue.^{40, 42-48} In extreme cases, current government practices may inadvertently incentivize unrecognized digital transfer activities, posing even greater risks to consumers. In addition to the absence of BCA-driven enterprises and limited data availability, the literature in this subsection mostly relies on surveys and theoretical concepts.

Research Gaps:

Although previous studies examine blockchain adoption frameworks, cryptocurrency sentiment, and blockchain applications in Vietnam separately, limited research investigates how blockchain-related sentiment may relate to broader economic indicators. This study addresses this gap by integrating sentiment analysis with macroeconomic variables.

- **Considering Macroeconomic Indicators:** Our paper occupies a unique position compared to prior work in frameworks and determinants. Rather than reinforcing BCA determinants stipulated by theoretical models such as TAM or TOE, our objective is to evaluate the early economic impact of BCA by examining its relationship with macroeconomic indicators, a distinct category of determinants that deviates from prior studies. Unlike Guo *et al.* and similar studies,²⁸⁻³² whose works are foundational to standard econometric models and most comparable to ours, our study engineers an innovative blockchain sentiment approach. Crucially, we encompass Vietnam's regulatory timeline to strengthen the rigor of BCA assessment rather than treating cryptocurrency adoption as the main focus.

- **Extending the Application of News Sentiment Beyond Price Prediction:** Existing papers implementing sentiment analysis predominantly focus on the interconnection between news and historical prices of cryptocurrencies. Extending its application beyond price prediction, we selectively leverage news sentiment as a measurable proxy, given the pivotal role of Vietnamese news media in interpreting the trajectory of BCA.

- **Data-Driven Insights:** Supply chain management is a particularly narrow topic of research in Vietnam BCA. Studies heavily rely on surveys due to the unavailability of data, leaving a vacuum of case studies on other blockchain applications. As we present more robust, data-driven economic insights through correlation, regression, and Granger causality, our assessment of BCA helps illuminate the nascent stage of BCA for future research to expand upon.

Taken together, this work bridges these gaps to deliver the first integrated economic perspective on BCA in Vietnam.

■ Methods

In this section, we elaborate on the steps taken to conduct the empirical research. First, we describe the data scraped from Vietnamese news articles, followed by the translation process. Second, we design techniques for sentiment analysis and article categorization. Next, we introduce both quantitative and qualitative metrics. While the former are aligned into time-series datasets and analyzed using Pearson correlation, regression, and Granger causality methods, the latter provide contextual observations. Finally, we briefly describe the coding environment used to implement the methodology.

Data Preprocessing and Sentiment Analysis:

Due to unstructured HTML layouts of Vietnamese news (e.g., formatting errors, duplicates of topics, incoherent configuration), there are no open-source datasets on articles with specific keywords targeting ‘blockchain’, ‘crypto’, or ‘bitcoin’. As a result, we manually create our own pipelines, using the BeautifulSoup library to extract thousands of articles by title, URL, date of publication, and content. We specifically hand-pick four domestic outlets based on their high reputation and credibility. The leading newspaper is VnExpress, characterized by fast and diverse news coverage and representing the public discourse of socioeconomic shifts in Vietnam.⁴⁹ The secondary popular choices are Tuoitre, Vietnamnet, and VnEconomy, but each has its own niche.⁵⁰⁻⁵² While Vietnamnet publishes the government’s voice on reforms and policies, revealing the roadblocks of BCA, Tuoitre offers a youth-focused perspective. VnEconomy’s specialization in economics and business helps contextualize the role of macroeconomic indicators in a broader context.

Facilitating international academic accessibility, we import the Google Translate module to translate article titles and contents into English. This enables our research to perform sentiment analysis with both English and Vietnamese pretrained NLP models, thereby normalizing the benchmark across models. The four models we used are ElKulako/cryptobert, ProsusAI/finbert, wonrax/phobert-base-vietnamese-sentiment, and mr4/phobert-base-vi-sentiment-analysis, all available through the Hugging Face repository.⁵³⁻⁵⁵ We justify the selection of models by their performance on past studies in the realm of financial text filled with blockchain and crypto lexicons. FinBERT is effective in this context, as it is fine-tuned from a large corpus of corporate reports and financial PhraseBank news. Its sentiment classification achieves an accuracy of 97%, outstripping the performance of Long Short-Term Memory (LSTM) models.⁵⁴ We also deploy CryptoBERT, a similarly advanced BERT model trained on cryptocurrency corpora, to capture nuances in crypto-specific terminology where generic financial interpretation may underperform.⁵³ For Vietnamese models, we implement two variants of PhoBERT models: Mr4 and Wonrax.⁵⁵ PhoBERT is a state-of-the-art model for Vietnamese-specific NLP. To ensure robustness, we inspect a small sample by randomly se-

lecting ten articles. All the NLP models achieve 90% accuracy in correctly identifying sentiment values.

The sample size of the paper is small. As manually reviewing and labeling Vietnamese blockchain-related articles is highly labor-intensive, the validation step was primarily designed as a robustness check rather than a full model training process. The sentiment models used in this study (i.e., FinBERT, CryptoBERT, and PhoBERT variants) are already pre-trained and validated by previous studies. Thus, the purpose of the validation was to evaluate whether these models could capture sentiment in Vietnamese blockchain news reasonably, instead of evaluating model performance from scratch.

After sentiment analysis, the dataset now contains two new columns: sentiment value [bullish, neutral, bearish], indicating the overall polarity of the text; and confidence score (0–1), indicating the model’s probability weighted for the assigned sentiment class. The dataset was then processed using a defined prompt on the OpenAI API platform to classify articles as ‘national’, ‘international’, and ‘irrelevant’. The batches of articles, originally separated by keywords and outlets, are combined and sorted chronologically from January 2018 to July 2025 (articles before 2018 are excluded). To prepare for time-series analysis, sentiment scores are aggregated by month to observe how sentiment changes. We compute that neutral articles contribute a score of 0, bullish articles contribute +1 multiplied by their confidence score, and bearish articles contribute -1 multiplied by their confidence score (Equation 1). The average sentiment score is then computed as the total aggregated sentiment divided by the number of articles.

$$AS = \frac{\sum_{i=1}^N S_i}{N}$$

where:

AS = Average Sentiment

S_i = Sentiment score of article i

N = Total number of articles in a given period

Equation 1: The equation, the average sentiment method, computes the overall polarity of all articles in a given period of time.

Quantitative Data:

Our granular quantitative dataset comprises eight variables: two sentiment indices derived from international and national news articles, and six macroeconomic indicators compiled from multiple sources. The macro-indicators are the exchange rate, inflation rate, foreign exchange reserve, balance of trade, foreign direct investment in blockchain-related sectors, and industrial production index.⁵⁶⁻⁶¹ Owing to reporting lags and data availability, the monthly time-series spans January 2020 to January 2025. Our explanation of these indicators is included below.

Exchange rate (EXR) denotes the rate at which a country’s currency can be exchanged for another.²⁸ In our study, EXR is expressed as USD/VND to reflect the monetary stability of the Vietnamese Dong (VND) because the dollar is the dominant global reserve currency. EXR, grounded in monetary policies

and economic theories, is a marker for digital activities, shaping economic development and BCA.^{28,30,31} When the dollar appreciates against VND (e.g., high EXR), VND diminishes its purchasing power, raising the cost of cross-border payments and remittances.³¹ Such volatility encourages individuals to adopt cryptocurrencies both as a store of value and a decentralized transaction medium that bypasses traditional high-cost channels.²⁹ While fluctuations in EXR can undermine financial stability, they stimulate capital flows into digital financial infrastructure and, by extension, broader BCA.

Inflation rate (INF) is the percentage increase in the price level of goods and services over time. Akin to EXR, higher INF strengthens the appeal of hedging assets like cryptocurrencies. Nguyen & Nguyen report that an inflation crisis often results in a higher crypto adoption rate,³² which is also consistent in Guo *et al.*'s analysis across 37 countries.²⁸

FX reserve (FXR) acts as the ultimate barometer of monetary confidence, yet it has been neglected by prior research on this subject. Largely dollar-denominated, it is a powerful intervention tool that the State Bank of Vietnam (SBV) could use to prevent the devaluation of VND.⁶² For an emerging country, where remittances and external trades are vitally integrated in the financial market, a high FX reserve signals a healthy economic outlook. It implies a stable exchange rate, a cushion against external shocks (e.g., trade imbalances or capital outflows), confidence in investors, and the ability to service international debt.^{63,64} Interestingly, Vietnam's FX reserves peaked in 2022. This hints at Vietnam's long-term strategy to achieve the "National Credit Rating Improvement Project by 2030" in tandem with its goal to become a central blockchain hub.⁶⁴ Especially, given that crypto transactions under the economy's shadow exceed 100 billion dollars,¹⁸ FX reserves—combined with EXR and INF—will present a deeper understanding of the linkage between monetary uncertainty and increases in digital asset investment.

Balance of trade (BoT) determines whether a country has a trade surplus or deficit; in other words, it is the difference between the amount of exports and imports of goods and services. Although its role in BCA is underexplored, Chang *et al.* stress how blockchain enhances transparency, trust, and efficiency in the supply chain.²² Therefore, BoT is a valid measurement for the use of blockchain solutions in trade.

Foreign Direct Investment (FDI) refers to the capital inflows into domestic businesses from foreign entities. Since Vietnam necessitates large-scale R&D to drive burgeoning digital infrastructure, incorporating FDI in the macroeconomic spectrum of BCA is essential.^{30,32} We define FDI blockchain-related sectors (FDI-BS) to be composed of three elements: professional, scientific, and technical activities; information and communication; and financial, banking, and insurance activities. Our rationale is that technology transfer, expertise, international alliances, and financial support can cultivate interest in fintech startups and digital trade platforms. A strong FDI-BS indicates growth in the digital ecosystem, and a low FDI-BS, conversely, might suggest weak governance and regulatory barriers.

The Industrial Production Index (IPI) is our last macroeconomic indicator, measuring the production output of the manufacturing and mining sectors. IPI is critical because Vietnam's economy is manufacturing- and export-oriented (e.g., processed seafood, electronic components, metal products). In general, it indicates how technologically advanced the overall economic infrastructure is. Also, its impact mirrors that of the supply chain in BoT. Growth in IPI could reflect the integration of blockchain to streamline the manufacturing process.

Certain indicators, such as GDP, unemployment, and remittance inflows, are deliberately excluded from our methodology for several reasons. In Vietnam, GDP is public service-driven, whereas the BCA only accounts for a marginal share of overall economic activity. Similarly, we speculate that structural unemployment, a primary form of unemployment in wholesale and retail sectors, also bears little relevance to BCA. Remittance inflow, in theory, can explain how monetary policies could influence payment activities. However, as Vietnam's financial governance remains non-digitalized, signs of substitution toward blockchain-based channels are nearly undetectable.

The omission of the nominal interest rate (INT) is due to a lack of data. INT interacts with monetary policy to a greater extent. It refers to an additional proportion, by annual percentage, that borrowers repay lenders on debt. Higher INT likely tightens up liquidity and discourages investment. Conversely, lower INT makes the cost of borrowing cheaper and depreciates VND, sparking investments. Similar to EXR, it can be associated with higher BCA.²⁸ That said, INT does not guarantee FDI because investors also expect long-term regulatory certainty and market optimism, which cannot be offset by favorable lending conditions alone. But that raises a problem—INT is sticky and only varies by year. This fixation produces lags in data updates, which is incoherent with our monthly timeframe and makes it elusive to obtain data (e.g., INT is only scaled to the year 2023 on TradingEconomics).

Qualitative Data:

Moving on to qualitative data, we collect policy context from government sources, digital adoption rate (DAR), and Network Readiness Index (NRI) from annual reports by Chainalysis and Portulans Institute, respectively.^{18,65-73} We utilize qualitative data to interpret findings in quantitative data.

Policy context is constructed to support the reliability of news sentiment and macroeconomic indicators. It is established as a solid source of data—a concrete timeline (2018-2025) of government BC-related decisions, regulations, and initiatives—that narrates the outcome of BCA. The voice of government adds depth for correlation and causation, hedging against mere speculation from other dimensions. The progression in policies indicates a positive government stance on BCA, stemming from skepticism to endorsement of BC technology.

Digital adoption rate (DAR), collected from 2020 to 2024, measures the population's rate of digital adoption, such as the internet, mobile payments, and digital wallets. **Network Readiness Index (NRI)**, collected from 2022 to 2024, indicates the impact of internet and communication technology (ICT) by

skill and widespread infrastructure levels. In Vietnam, ICT lies in the strength of e-commerce legislation, internet traffic and subscriptions, mobile apps development, and R&D of emerging technologies.⁶⁷ Vietnam also ranks fifth globally in adoption rate, especially in cryptocurrency trading.¹⁸ However, it is important to note that this reflects a limited form of BCA, as broader benefits of BCT, such as DeFi applications, supply chain viability, and digital governance, have yet to be fully leveraged.

Regression Analysis:

$$Y_i = \beta_0 + \beta_1 \text{nat_sen}_{1i} + \epsilon_i \text{ (Model-1)}$$

$$Y_i = \beta_2 + \beta_3 \text{int_sen}_{1i} + \epsilon_i \text{ (Model-2)}$$

Where Y_i is the dependent variable for observation i , referring to the six macroeconomic indicators. β_0 and β_2 are the constant terms, representing the expected value of the dependent variable when the independent variable equals zero. β_1 and β_3 are the coefficients of the independent variables, representing national and international sentiment in Models 1 and 2, respectively. ϵ_i is the error term, representing the difference between the actual value and the predicted value generated by the model. The estimated coefficients indicate how much the dependent variable changes when the corresponding independent variable increases by one unit.

Granger Causality Analysis:

Granger causality analysis is a statistical technique used to determine whether one time-series variable contains predictive information about another variable. The general Granger causality framework is based on the Vector Autoregression (VAR) model, in which each variable is expressed as a function of its own lagged values and the lagged values of other variables.

$$Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \alpha_2 Y_{t-2} + \alpha_3 \text{nat_sen}_{t-1} + \alpha_4 \text{nat_sen}_{t-2} + \epsilon_t \text{ (Model-3a)}$$

$$\text{nat_sen}_t = \alpha_5 + \alpha_6 \text{nat_sen}_{t-1} + \alpha_7 \text{nat_sen}_{t-2} + \alpha_8 Y_{t-1} + \alpha_9 Y_{t-2} + \epsilon_t \text{ (Model-3b)}$$

$$Y_t = \alpha_{10} + \alpha_{11} Y_{t-1} + \alpha_{12} Y_{t-2} + \alpha_{13} \text{int_sen}_{t-1} + \alpha_{14} \text{int_sen}_{t-2} + \epsilon_t \text{ (Model-4a)}$$

$$\text{int_sen}_t = \alpha_{15} + \alpha_{16} \text{int_sen}_{t-1} + \alpha_{17} \text{int_sen}_{t-2} + \alpha_{18} Y_{t-1} + \alpha_{19} Y_{t-2} + \epsilon_t \text{ (Model-4b)}$$

Where Y_t represents the dependent variable at time t , while nat_sen and int_sen represent the explanatory variables. ϵ_t denotes the error term. The null hypothesis of the Granger causality test states that the lagged values of sentiment variables do not jointly affect Y_t . If the null hypothesis is rejected, then the sentiment variable Granger-causes Y_t , meaning that historical information from sentiment contributes significantly to forecasting Y_t . If both variables Granger-cause each other, a bidirectional relationship exists. Conversely, if neither variable Granger-causes the other, then no predictive relationship exists between them. In this paper, the Granger causality method is employed to examine whether changes in media sentiment contain predictive information regarding macroeconomic indicators and whether macroeconomic indicators can similarly predict future movements in sentiment.

Coding Environment:

Our work is demonstrated through our GitHub repository, which includes full pipelines from data scraping and preprocessing to statistical and econometric analyses.⁷⁴ The coding scripts were implemented in the Python 3.12 environment on VSCode. Core libraries are BeautifulSoup for scraping, Pandas for data structure, Scikit-learn and Transformer modules for NLP models, and Matplotlib for plotting and visualization. We have documented the repository so that it is comprehensible and replicable in minimal steps.

Findings

After applying the methodology presented above, the final dataset consists of 3546 blockchain, 4721 bitcoin, and 478 crypto articles. We notice that 'crypto' articles are drastically low, solely reported from a single outlet—Vietnamnet. Preliminary trials underline that articles filtered by the latter two keywords are prone to cyclic speculation and high-frequency swings, adding noise to our analysis. Blockchain articles show stable sentiment scores, thus constituting our primary dataset. Our findings are divided into three subsets: (a) Performance of NLP models; (b) Sentiment trends and macroeconomic variables; (c) Statistical Relationship between Sentiment and Economic Indicators.

Mr4 and Wonrax models will capture sentiment in national articles of original Vietnamese text; FinBERT and CryptoBERT score sentiment in international articles, both before and after translation. Since presenting all models would be redundant and complex, we rely on FinBERT and Mr4 figures for (b) and (c). Due to data constraints discussed in the methodology section, the period of sentiment is trimmed from January 2020 to January 2025 to align with economic factors. To preserve the integrity of sentiment collection, subset (a) was conducted on the full timeline and interpretation of international models across all categories within blockchain articles.

Performance of NLP models:

The subsection showcases the benchmark between CryptoBERT and FinBERT, and a distribution of sentiment classified by each NLP model. It validates our decision to examine FinBERT analysis over the others and outlines an overall outlook of sentiment across all articles. Figure 1 displays the effect of translation on sentiment scores, strictly when the sentiment value of an article is identical. After translation, CryptoBERT shows a slight positive bias (+0.0365), in which the frequencies of the delta score cluster around zero. FinBERT exhibits a negative bias (-0.0950). Although its deviation leans to the left, most of the articles are centered around the interval (-0.1 to 0.1). The translation effect reflects FinBERT's higher sensitivity towards linguistic nuances; nevertheless, the difference between the two models is minimal.

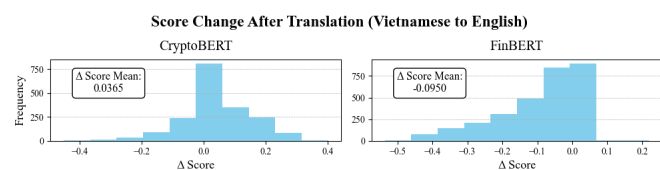


Figure 1: Histogram of sentiment score changes before and after translation for CryptoBERT and FinBERT. While CryptoBERT shows a slight positive bias (+0.0365), FinBERT exhibits a negative bias (-0.0950) after translation.

Figure 2, which compares sentiment matches, reveals a stark contrast. Both models show that the percentage of matching exceeds that of mismatching. However, CryptoBERT shows an even split, retaining 52.8% of articles, whereas FinBERT achieved a much higher proportion of matches, up to 84%. The figure suggests that FinBERT is a stronger candidate for interpreting international articles because its reliability score is superior to that of its counterpart.

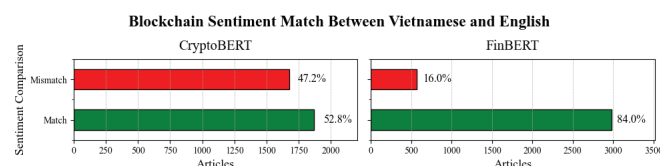


Figure 2: Comparison of sentiment matches and mismatches before and after translation for CryptoBERT and FinBERT. FinBERT achieves a substantially higher match rate (84.0%) than CryptoBERT (52.8%), suggesting greater reliability for sentiment analysis of translated articles.

In Figure 3, the sentiment is unequally distributed among the four models tested. Neutral and bullish values stand out as an eminent representation of articles, implying the impartiality of the writing tone and a glimpse of buoyancy in BC. Still, the partition of sentiment values deduced by each model differs substantially. Before translation, bearish sentiment is infinitesimal, with CryptoBERT detecting 0.3% and FinBERT detecting none at all. FinBERT insists that the proportion of bullish articles, which is relatively rare, sits at 0.4%, mirroring that of the bearish class. CryptoBERT's finding is opposite, identifying 34.1% of articles to be positive. This disparity leads to a dissimilarity in neutral classification: whereas CryptoBERT assigns 65.6% of articles to this value, FinBERT assigns 99.6% of them. After translation, both models agree that the number of negative articles was underestimated. CryptoBERT and FinBERT, respectively, re-evaluate negative articles to make up 4.1% and 8.0% of the dataset, though pessimism coverage is seemingly negligible. CryptoBERT shifts previously neutral articles into bullish, highlighting a transition in sentiment dominance. Such a shift also occurs in FinBERT's analysis; however, neutral articles remain the majority.

Classification by both Vietnamese models paints an overarching tone of bullishness. Mr4 registers 56.7% of articles as bullish, 18.6% as neutral, and 24.6% as bearish. Wonrax corresponds with the trend. It treats 68.6% of articles as bullish—a slightly higher proportion—15.8% neutral, and 24.6% bearish—a slightly lower proportion.

The results suggest that both PhoBERT variants are better attuned to local nuances because they specialize in the Vietnamese language. For this reason, we interpret that the

media tone of blockchain is confidence-skewed and distinctly forward-looking. In contrast, international models show that there is a low polarity of sentiment because articles are interpreted as overwhelmingly neutral. FinBERT clearly portrays this pattern, insinuating a cautious stance on the blockchain narrative in Vietnam.

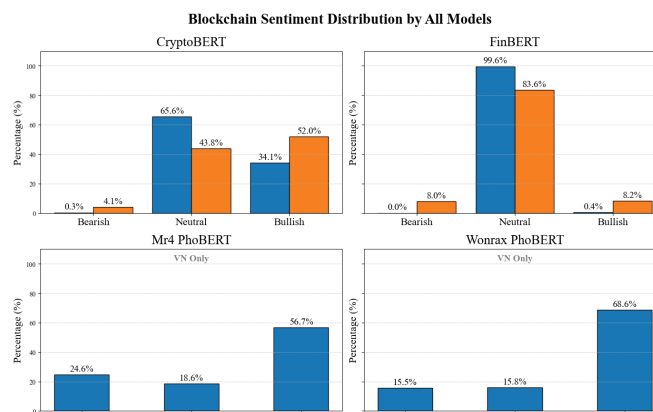


Figure 3: Percentage distribution of bearish, neutral, and bullish sentiment classifications across all NLP models. The results show that both PhoBERT variants are better attuned to capturing Vietnamese-written articles, as they are trained specifically for this language.

Sentiment Trends and Macroeconomic Variables:

For this subset, we present a trimmed timeline of how the sentiment score, captured by Mr4 PhoBERT, and all variables, before being embedded in the correlation map, progress by month.

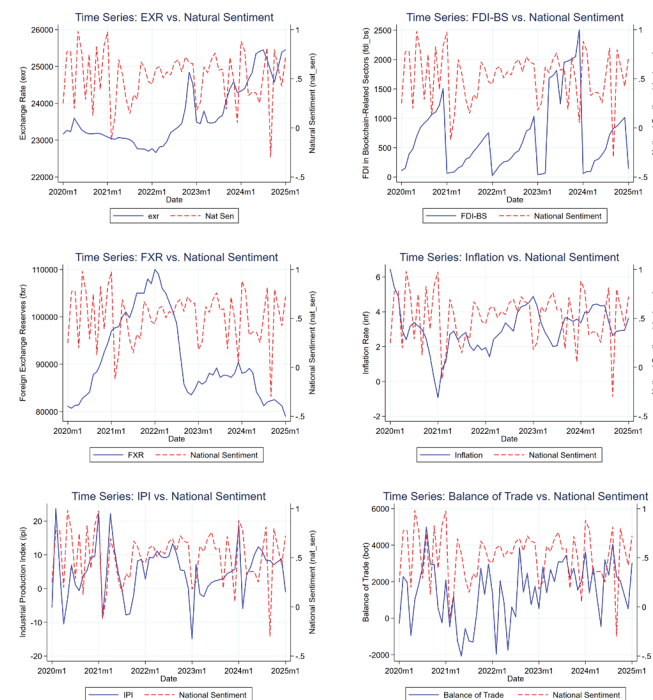


Figure 4: Time-Series Trends of National Sentiment and Macroeconomic Indicators in Vietnam (2020–2025). Visual patterns suggest a possible relationship between national sentiment and industrial production and trade activities; however, statistical analyses are required to confirm these relationships.

Figure 4 shows the relationship between national sentiment and the six macroeconomic indicators over time. Over the five years, national sentiment maintains a generally positive outlook, with fluctuations ranging between approximately 0.25 and 0.75 and a monthly average of 0.52. During the first year, sentiment shows an upward movement toward values between 0.8 and 1.0. Although national sentiment experienced a slight decline below 0.5 in mid-2023, it remained above 0.5 during most of the subsequent periods. Overall, despite several fluctuations, national sentiment demonstrates resilience and follows a more positive long-term trend toward 2025.

The macroeconomic indicators display different patterns alongside national sentiment. EXR steadily increases from around 23,000 to 25,500 USD/VND, with a noticeable rise between 2022 and 2023. FXR reached its highest level of over 110 billion USD during the first two years before declining toward 2025. IPI shows substantial fluctuations, repeatedly moving between -15% and +20%. Similarly, BoT alternates between trade surpluses and deficits, although surpluses become more dominant after 2021. Inflation decreases from approximately 6% to below 0% in 2021 and later stabilizes between 3% and 4%. FDI-BS generally shows an increasing trend over time despite a temporary decline in mid-2023. Overall, visual patterns suggest a possible relationship between national sentiment and industrial production and trade activities; however, statistical analyses are required to confirm these relationships.

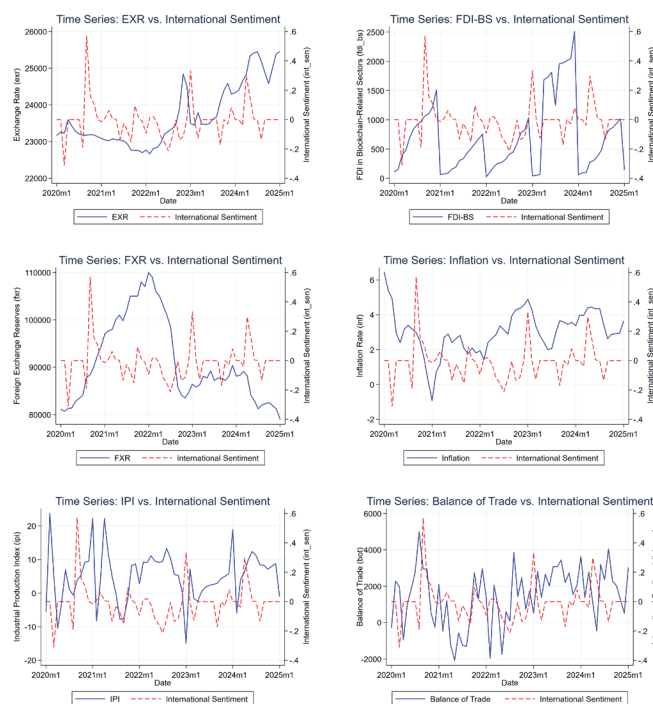


Figure 5: Time-Series Trends of International Sentiment and Macroeconomic Indicators in Vietnam (2020–2025). The relationships between international sentiment and macroeconomic indicators appear weaker than those observed for national sentiment.

Figure 5 illustrates the time series relationship between international sentiment and the six macroeconomic indicators. International sentiment has a lower monthly mean of 0.11, and it tends to stay closer to neutral values during the study period.

International sentiment was negative for a number of quarters in a row in the first year, then improved at the end of 2020, and then slowly declined. International sentiment dropped in mid-2023, but recovered quickly. Except for these fluctuations, the overall direction of international sentiment is slowly upwards to 2025.

While macroeconomic indicators still exhibit long-term trends and short-term fluctuations, international sentiment does not appear to follow these variables closely. International sentiment is less correlated with Vietnam's economic conditions than national sentiment, indicating that it may be indicative of more global conversations and external perspectives rather than domestic economic developments.

Statistical Relationship between Sentiment and Economic Indicators:

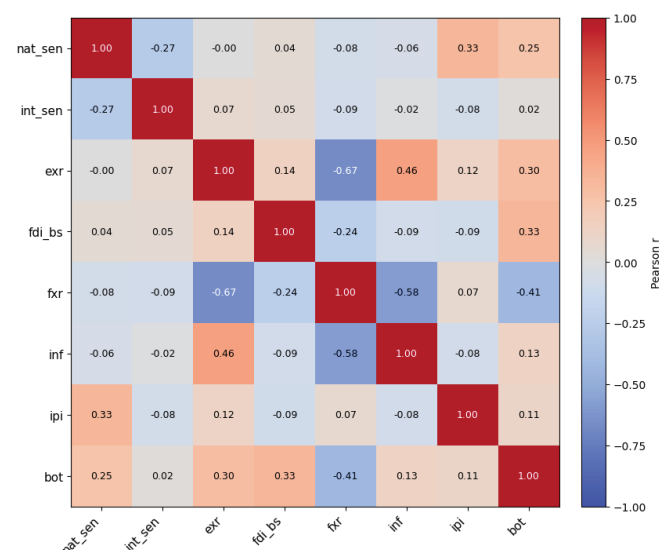


Figure 6: Heatmap of Pearson correlations between national sentiment (Mr4 PhoBERT), international sentiment (FinBERT), and six macroeconomic indicators from January 2020 to January 2025. The score ranges from -1 (perfectly negatively related) to +1 (perfectly positively related), and 0 shows non-correlation. National sentiment exhibits relatively stronger positive correlations with IPI (0.33) and BoT (0.25), while both sentiment variables show weak correlations with most other macroeconomic indicators.

As shown in Figure 6, both sentiment variables exhibit weak or negligible correlations with most macroeconomic indicators, with coefficients ranging between -0.09 and 0.07. National sentiment shows relatively stronger positive correlations with IPI (0.33) and BoT (0.25). Stronger relationships also emerge within the macroeconomic indicators themselves. Positive correlations include EXR-INF (0.46), EXR-BoT (0.30), and FDI-BS-BoT (0.33). Negative correlations include EXR-FXR (-0.67), FXR-BoT (-0.41), and FXR-INF (-0.58). Given the focus of the paper on BCA in Vietnam, the discussion primarily interprets the relationship between national sentiment, IPI, and BoT, which is supported by qualitative observations.

Nat_sen and IPI: National sentiment (-0.2 to +0.9) and IPI (-10% to +22%) show the widest fluctuations in their first year interval. At the same time, Vietnam's DAR ranked 10th globally: On-chain value and retail value received ranked the second highest, while the numbers of on-chain deposits (44th)

and P2P exchange trade volume (81st) remain low. This discrepancy among the sub-indices signals high value flows due to transfer activities, but the grassroots in exchange and wallet engagement are not yet mainstream.

The May 2020 directive from the Prime Minister instructing the SBV to study blockchain utility suggests the exploratory and cautious state of adoption. However, as DAR reaches the first place in the following years amid surges in P2P trade volume and DeFi protocols, national sentiment (-0.2 to +0.7) and IPI (-10% to +12%) both rebound and steadily increase.

In the NRI context, Vietnam scores well above its corresponding GDP per capita. Strong sub-pillar, including individuals and the economy, helps Vietnam outperform in digital readiness compared to similar-income-level countries. Ongoing policies toward consumer protection may have fueled this development. A legal entity for blockchain established in March 2022 sets a new milestone for adoption.

The grassroots technology infrastructure continues to expand, accompanied by improvements in NRI ranking from 62/131 countries in 2022 to 45/133 in 2024. While DeFi and centralized exchanges remain active, DAR declines to third and fifth place. During this period, there is a broader decline in P2P trading and a hiatus in BC policies.

The drafting of the crypto framework in February 2024 and Resolution No. 57-NQ/TW, passed later that year, coincide with temporary dips in national sentiment and IPI at the beginning of both years, followed by upward trends later in the year. This dynamic shows an annual cycle where confidence gradually reduces early uncertainty through improvements in NRI performance and renewed policy support. This cycle also supports the moderate relationship between nat_sen and IPI.

Nat_sen and BoT: The graph of BoT exhibits a pattern similar to IPI, and certain outliers and trends align with movements in national sentiment. There were alternating surpluses and deficits across 2020, an era where the world experienced a pandemic. The COVID-19 lockdown precipitated major bottlenecks in logistics and hindered production rate, thereby supporting the extensive volatility in both exports and imports. Media tone also reflects the downturn, where the rhythm of low optimism (below 0.2) preceding high optimism (0.9) took place throughout that year. Blockchain was yet to be an anchor because the adoption status was high value but low diffusion, given the uneven statistics of the 2020 DAR. In early 2021, national sentiment dropped below neutrality, and BoT recorded a deficit of 2 billion USD. P2P trade volume soars dramatically. However, it appears as a hedge against fluctuations in monetary tenets (e.g., currency devaluation and higher inflation rates), rather than a cue for rejuvenating the economy. The absence of a clear regulatory framework evokes uncertainty. It was not until the announcement that the BC association promised to nurture the cryptocurrency environment in March 2022 that imports exceeded exports by nearly 4 billion USD in mid-2022. This is parallel to the rise of bullish sentiment in media coverage, performing consistently from 0.5 to 0.8.

National sentiment falls short in late 2023 and quarter 3 of 2024. BoT is observed to fall short in quarter 1 and late 2024. This lag implies that shifts in sentiment may influence trade

performance. Neither the policy timeline nor NRI explains this delayed correlation. However, we hypothesize that it stems from weakening demand in export markets of Vietnam, rising costs of imports, or depreciation of the dong, which would make Vietnamese exports cheaper relative to foreign goods.

Although Pearson correlation is useful for drawing qualitative observations, it only provides linear relationships and does not account for statistical significance or predictive interactions. Therefore, to further investigate whether these relationships remain after controlling for statistical effects, regression analysis is conducted. The results are presented in Tables 1 and 2 below.

Table 1: Regression Analysis for National Sentiment (nat_sen). National sentiment has a significant positive relationship with IPI and BoT, while no significant associations are observed for EXR, FDI-BS, FXR, and INF.

VARIABLES	(1) EXR	(2) FDI-BS	(3) FXR	(4) INF	(5) IPI	(6) BoT
nat_sen	-102.471 (388.611)	76.550 (324.767)	-2,315.285 (3,793.814)	-0.337 (0.770)	9.460** (4.293)	1,502.355* (752.143)
Constant	23,729.296*** (237.349)	649.182*** (198.285)	92,473.952*** (2,333.646)	3.213*** (0.420)	0.099 (2.372)	701.928 (448.583)
Observations	60	60	60	60	60	60
R-squared	0.001	0.001	0.005	0.005	0.112	0.062

Robust standard errors in parentheses

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

Table 1 reports the results of the regression analysis of the association between the national media sentiment (nat_sen) (independent variable) and six macroeconomic variables (dependent variable): exchange rate (EXR), foreign direct investment in blockchain-related sectors (FDI-BS), foreign exchange reserves (FXR), inflation rate (INF), industrial production index (IPI), and balance of trade (BoT).

The coefficients provide us with an idea about the direction and magnitude of the association between the sentiment and the six macroeconomic factors. A positive coefficient suggests that an increase in national sentiment is associated with an increase in the relevant macroeconomic indicator, while a negative coefficient suggests the opposite. Robust standard errors are used to evaluate statistical significance at the 1% (***), 5% (**), and 10% (*) levels.

The evidence shows that national sentiment (nat_sen) has a statistically significant and positive impact on the Industrial Production Index (IPI) at a 5% significance level ($\beta = 9.460$, $p < 0.05$). The results indicate an improved attitude in national media and an increase in industry activity and output. This shows that higher national media sentiment is connected with increased industrial activity and productivity. One possible reason could be that favorable news and opinions may boost trust in technological progress and economic development, which may help sustain industrial expansion.

A similar finding is obtained for the Balance of Trade (BoT), where national sentiment is positively related at a 10% significant level ($\beta = 1,502.355$, $p < 0.10$). This conclusion implies that an increase in domestic sentiment may help achieve better trade performance, possibly through the channel of improved confidence in economic activity and technical progress. The data do not support any statistically significant correlations between national sentiment, exchange rates, blockchain-related foreign direct investment, foreign currency reserves, or inflation.

These findings indicate that the direct effect of media attitude on monetary and financial variables may be limited, as such variables are more likely to be influenced by wider macroeconomic conditions and policy issues.

Table 2: Regression Analysis for International Sentiment (int_sen). None of the estimated coefficients is statistically significant. Rather, there is a weak association between international media sentiment and economic conditions in Vietnam.

VARIABLES	(1) EXR	(2) FDI-BS	(3) FXR	(4) INF	(5) IPI	(6) BOT
int_sen	423.962 (740.529)	246.676 (481.235)	-6,053.806 (6,154.353)	-0.085 (1.097)	-4.908 (7.340)	179.070 (1,448.299)
Constant	23,679.825*** (108.515)	690.619*** (81.848)	91,231.860*** (1,139.451)	3.039*** (0.164)	4.938*** (0.998)	1,478.091*** (208.709)
Observations	60	60	60	60	60	60
R-squared	0.004	0.003	0.008	0.000	0.007	0.000

Robust standard errors in parentheses

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

Table 2 reports the regression results of the relationship between international media sentiment (int_sen) (explanatory variable) and six macroeconomic indices (dependent variable). The results indicate that none of the estimated coefficients is statistically significant. Rather, there is a weak association between international media sentiment and economic conditions in Vietnam.

One reason is that international media may focus on global issues and external perspectives, which may not have a direct impact on Vietnam's domestic economy. The local media sentiment, on the other hand, could better capture country-specific developments and public perceptions regarding Vietnam's economy.

Regression analysis is helpful to find associations between sentiment and macroeconomic variables, but it does not tell us whether one variable can predict changes in another variable in the future. Therefore, Granger causality analysis is applied to study the predictive relationships between these variables.

Table 3: Granger Causality Test between Sentiment Variables and Macroeconomic Indicators. There is a statistically significant relationship between national sentiment and investment, trade, and inflation activities, and between international sentiment and broader financial and production indicators.

Sentiment	Equation	Excluded	chi2	Prob>chi2
National	exr	nat_sen	0.039	0.981
	nat_sen	exr	3941	0.139
	fdi_bs	nat_sen	13.769	0.017**
	nat_sen	fdi_bs	4.215	0.519
	fxr	nat_sen	0.8934	0.981
	nat_sen	fxr	3.2374	0.198
	inf	nat_sen	10.609	0.031**
	nat_sen	inf	2.2869	0.580
	ipi	nat_sen	4.413	0.110
	nat_sen	ipi	3.513	0.173
International	bot	nat_sen	12.323	0.055*
	nat_sen	bot	12.212	0.057*
	exr	int_sen	2.1887	0.728
	int_sen	exr	9.8956	0.078*
	fdi_bs	int_sen	0.7812	0.677
	int_sen	fdi_bs	0.9871	0.610
	fxr	int_sen	1.2755	0.735
	int_sen	fxr	12.254	0.007***
	inf	int_sen	13.939	0.007***
	int_sen	inf	3.4617	0.4842
	ipi	int_sen	3.5884	0.058*
	int_sen	ipi	3.8984	0.048**
	bot	int_sen	0.5509	0.759
	int_sen	bot	5.3106	0.070*

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

Table 3 presents the results of the Granger causality test between sentiment variables and macroeconomic indicators. We use the Granger causality test to check whether lagged sentiment is able to forecast changes in macroeconomic indicators, and vice versa. The results indicate that for national sentiment (nat_sen), FDI-BS ($\chi^2 = 13.769$, $p < 0.05$), inflation ($\chi^2 = 10.609$, $p < 0.05$), and balance of trade ($\chi^2 = 12.323$, $p < 0.10$) significantly Granger-cause national sentiment. This suggests that past changes in these economic variables may be useful for predicting future changes in national sentiment. However, exchange rate, foreign exchange reserves, and industrial production are not strong predictors of national sentiment. It also finds a bi-directional relationship between trade balance and national sentiment. This suggests that trade performance affects sentiment, and sentiment may be helpful in predicting future trade performance. The results underscore the tight link between national sentiment and domestic economic conditions, especially investment, trade, and inflation activities.

The exchange rate is an important predictor of international sentiment (int_sen) at the 10% level ($\chi^2 = 9.896$, $p < 0.10$). Foreign exchange reserves and inflation significantly predict international sentiment at a 1% significance level. Besides, industrial production is also a predictor of international sentiment at the 10% level. The results also indicate that international sentiment is an important predictor of foreign exchange reserves, industrial production, and balance of trade. The bi-directional link between international sentiment and industrial production points to the possibility of an interaction between the variables across time.

In conclusion, the results of the Granger causality tests show that the sentiment and the macroeconomic indicators are related over time and not in a simple one-way causality. Domestic economic activity is more correlated with national sentiment, and broader financial and production indicators are more correlated with international sentiment.

■ Discussion

Limitations:

The methodology has inherent limitations that may potentially undermine the reliability of the findings. Collecting articles is challenging. Different media outlets have different HTML structures, and scraping features, such as APIs, are not readily accessible. The dataset also poses caveats. The titles from articles are varied, but sources can publish overlapping content, necessitating an intensive manual check. Biases in translation, sentiment scoring, and categorization systems by libraries are inevitable. Because the timelines of indicators are mostly disjointed, the time series is restricted to five years. Given the exploratory nature of the research, our rationale for correlations can be subjective and does not purport to be causations. More sophisticated econometric techniques could be implemented in future research to enhance the validity of the correlations. Last but not least, the lack of data-driven infrastructure in Vietnam continues to constrain empirical studies on the early impact of BCA.

Future Directions:

The research frontier can be expanded to address data issues as mentioned earlier. Broadening blockchain-related keywords and extending the timeline beyond the current span enables the enrichment of the dataset. Advanced methodologies such as the Autoregressive Distributed Lag (ARDL) model, machine learning techniques, and the Vector Error Correction Model (VECM) can introduce temporal lag structures, long-run equilibrium relationships, and predictive or non-linear interactions between sentiment and macroeconomic indicators. Comparative studies across ASEAN economies and sectoral analyses could offer distinctive research angles, further strengthen the findings, and comprehensively contextualize BCA in Vietnam.

Conclusion

In emerging markets, scalability and interoperability are essential to the rampant maturation of financial systems, monetary fundamentals, domain exchanges, and trustless transactions. The adoption of blockchain in Vietnam is no longer a discrete phenomenon—it is increasingly interwoven across various economic sectors, potentially reshaping conventional business infrastructures. Our paper calls attention to the emergence of blockchain and its economic implications by examining the relationship between media sentiment and macroeconomic indicators. To conclude the paper as a whole, we now attempt to answer the three guiding questions from the introduction based on our findings.

- RQ1: The paper measures sentiment by using NLP. There are notable correlations between news sentiment and macroeconomic indicators.

- RQ2: The findings suggest that shifts in Vietnamese media sentiment have a limited but noticeable relationship with blockchain-related economic activity. Pearson correlation, regression, and Granger causality yield relatively similar results, which could be plausibly supported by qualitative data to some extent.

- RQ3: The results indicate that the industrial production index (IPI) and balance of trade (BoT) exhibit significant relationships with national sentiment. In contrast, international sentiment does not show statistically significant relationships with the macroeconomic indicators examined.

All in all, our research is innovative and significant, yet proven. It contributes a valuable baseline to assessing the economic impact of blockchain adoption. It offers a synthesis of quantitative and qualitative datasets, redressing the fragmentation of existing research on this emerging technology and laying the ground for future work.

Acknowledgments

I would like to express my gratitude to Prof. Faisal Nawab and Prof. Abdullah Yalaman for their invaluable guidance and support throughout my research endeavors.

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