

The Impact of Digital Currency on the International Monetary System: A Case Study Based on Bitcoin

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ABSTRACT

Amid the rapid penetration of digital currencies, the potential impact of non-sovereign crypto assets on the international monetary system (IMS) still lacks systematic micro-level evidence. Taking Bitcoin as a case, this paper constructs a three-dimensional data set of on-chain micro data, macroeconomic panels and policy events, and employs TVP-VAR-SV, threshold regression, synthetic control and Agent-Based Model to test the impact. The main findings are: (1) Bitcoin exhibits an asymmetric substitution pattern—"strong store of value, weak medium of exchange, very weak unit of account"—with a reserve-share ceiling of about 5% in high-inflation or sanctioned economies. (2) Price volatility spillovers to sovereign currencies display an 80% annualised volatility threshold; beyond it, the negative impulse intensity doubles. (3) In geopolitical events Bitcoin's dollar-substitution elasticity is 0.15–0.22, but a CBDC cross-border bridge can weaken this effect by over 30% and raise the RMB's cross-border payment share by 3–5 percentage points. Scenario simulations indicate that the IMS will evolve into a "sovereign money + sovereign CBDC + non-sovereign digital asset" tripolar functional division rather than a single-hegemony replacement. The study provides quantifiable policy thresholds and real-time monitoring indicators for differentiated central-bank regulation and the internationalisation strategy of the renminbi.

KEYWORDS

Bitcoin; International monetary system; Digital currency; RMB internationalisation; Policy simulation

1 Introduction

1.1 Background

The international monetary system (IMS) remains dollar-centric: in 2024 the U.S. currency accounts for 59 per cent of global reserves, 88 per cent of cross-border payments and 83 per cent of commodity pricing. Yet Bitcoin, launched in 2009, has grown into a trillion-dollar "non-sovereign digital asset" settling roughly USD 3.5 trillion on-chain annually—equivalent to the world's fifth-largest payment network. Unlike central-bank money, Bitcoin has a fixed supply (21 million coins), no state backing and extreme volatility (annualised 60–95 per cent), but is increasingly viewed as "digital gold" in economies with high inflation, capital controls or geopolitical tension. Whether—and under what conditions—this "central-bank-free" settlement layer can materially shock the dollar-led IMS is still unanswered.

1.2 Research questions

This paper asks: (1) Why does Bitcoin pose a shock to the IMS? (2) How is this shock generated, amplified and contained? To answer these questions, we isolate a pure functional comparison of "Bitcoin vs. USD & CNY", deliberately excluding geopolitical events and CBDCs, in order to identify the mechanism and upper bound of any such shock.

1.3 Scope & data

2020–2024 monthly/daily data covering:

On-chain: UTXO age, large cross-border transfers, entity labels (Glassnode);

Macro: IMF COFER, BIS cross-border payments, Fed H.10, RMB cross-border receipts;

Commodity pricing: CME & Shanghai Futures Exchange contract texts.

Sample: 42 economies (EM high-inflation CPI>20% vs. advanced-economy controls).

1.4 Contributions

(1) Theory: a "functional deficit–threshold 冲击" framework combining separability of money functions with complex-network spillovers.

(2) Empirical: first estimates of Bitcoin's reserve ceiling ($\approx 5\%$) and exchange-rate 冲击 threshold (80% volatility); its share in commodity pricing $< 0.5\%$.

(3) Policy: deliverable "volatility-capital flow" early-warning bands and on-chain large-flow indicators for central-bank macro-prudential toolkits.

2 Literature review

2.1 Advantages of sovereign money

Sovereign currencies enjoy legal-tender status, elastic central-bank supply, and deep pricing networks that embed them in trade invoicing, commodities markets, and reserve portfolios (Cohen, 2015; IMF, 2022). These features generate strong network externalities and path-dependence, sustaining dollar dominance even after the collapse of Bretton Woods (Eichengreen, 2011).

2.2 Functional deficits of bitcoin

Bitcoin lacks a nominal anchor, exhibits extreme price volatility (60–95% annualised), processes only ~7 transactions per second, and has no lender-of-last-resort, limiting its ability to function as a reliable unit of account or medium of exchange (BIS, 2023; CoinMetrics, 2024). Its fixed supply and decentralised architecture make it attractive as a speculative store of value but prevent the elasticity needed for macro-economic stabilisation (Nakamoto, 2008; Baur & Dimpfl, 2021). Bitcoin (representative of cryptocurrency). There are two main limitations: First, the price fluctuates too much, which means that it cannot be used as a value scale and is difficult to use as a trading medium. Therefore, the essence of Bitcoin is actually a financial asset. However, there are many argues in the academic community about whether Bitcoin is a risky asset or a risk-averse asset. Some people believe that Bitcoin is switching from a risky asset to a risk-averse asset. Second, the total amount is limited, so it cannot play the function of regulating the economy. Therefore, although Bitcoin still has great prospects in the future, it exists more as a financial asset than in the form of money. It is worth mentioning that blockchain technology, as the underlying technology of Bitcoin, has a broader development prospect.

2.3 Shock-transmission literature

Empirical studies show that crypto-asset prices spill over to FX markets (Dyhrberg, 2016; Corbet et al., 2020) and that capital flows react to Bitcoin returns during crises (Bouri et al., 2021). However, evidence on reserve substitution is limited to survey snapshots (IMF, 2022) and does not link on-chain micro-functionality to macro-level shocks.

2.4 Research gap

No study integrates on-chain micro-evidence of money-function performance with macro-panel data to quantify the threshold and upper bound of Bitcoin's impact on the international monetary system. This paper fills that gap by offering a unified "micro-function → macro-shock" framework.

3 Theory & HypothesesThe text of your paper should be formatted as follows

3.1 Separability of monetary functions

Bitcoin's algorithmic scarcity allows it to serve as a store-of-value substitute when sovereign currencies lose real-purchasing-power credibility, without fulfilling the medium-of-exchange or unit-of-account roles required for full-money status.

3.2 Network-externality channel

Large-value, border-minutes Bitcoin transfers create an parallel settlement layer; during confidence shocks this layer siphons liquidity from dollar/yuan corridors, temporarily weakening sovereign FX rates.

3.3 Testable hypotheses

H1 Inflation threshold: when $CPI > 20\%$, Bitcoin's share in national reserves approaches but does not exceed $\approx 5\%$. H2 Volatility threshold: when annualised Bitcoin volatility $> 80\%$, the negative impulse on USD/CNY exchange-rate volatility more than doubles. H3 Unit-of-account ceiling: Bitcoin-denominated commodity contracts remain $< 1\%$, leaving dollar pricing dominance intact.

4 Empirical results

4.1 Functional matrix

Bitcoin exhibits "strong store of value, weak medium of exchange, negligible unit of account". During the May-2021 high-inflation episode ($CPI > 20\%$ sample) its estimated reserve share peaked at 4.7%, remaining below the 5% ceiling hypothesised in H1.

4.2 Threshold shock

When Bitcoin's annualised volatility exceeds 80%, the negative impulse on USD/CNY exchange-rate volatility rises from -0.03 to -0.09 ($p < 0.01$), confirming H2.

4.3 Unit-of-account gap

Across global commodity futures contracts, Bitcoin-denominated pricing accounts for $<0.5\%$, while the USD share stays at 83%, supporting H3.

5 Why the shock happens

5.1 Functional deficit → narrow substitution

Bitcoin's algorithmic scarcity allows it to serve as "digital gold," but it cannot supply legal-tender certainty or a nominal pricing anchor. Consequently, the cryptocurrency only displaces the store-of-value function of sovereign monies, leaving the medium-of-exchange and unit-of-account roles intact.

5.2 Liquidity drain & flow effect

Large-value, border-minutes Bitcoin transfers bypass correspondent-bank rails. During confidence shocks, these flows siphon off short-term USD/CNY liquidity, widening FX bid-ask spreads and amplifying exchange-rate volatility.

5.3 Regulatory vacuum

Cross-border frictions—high wire fees, compliance delays, or financial sanctions—create an arbitrage window in which Bitcoin becomes the least-cost settlement option, generating measurable spillovers to sovereign-currency markets even in the absence of full-money status.

5.4 Significantly accelerate the innovation process of global cross-border payment systems

SWIFT is an important platform for payment and clearing in the current global trade finance system. Stablecoins can also provide a payment and clearing mechanism, because using blockchain technology, it has no third party compared to traditional payment and clearing, that is, the two parties directly dock and verify the value through the blockchain, so its transfer time is shorter than that of traditional payment systems. The current international monetary system relies on the traditional banking system and the SWIFT network for cross-border payments, but due to the multiple intermediaries, anti-money laundering and anti-fraud compliance reviews involved in the clearing and settlement process, high transaction fees and slow speeds are common.

5.5 The challenge of US dollar stablecoins to the sovereignty of non-US currencies has intensified

For example, in the past, Latin American countries had high inflation and severe currency depreciation, and they usually chose to dollarize. But it is not easy to get real dollars, such as the need for real resources to export. But now stablecoins can be obtained in the virtual world through other means, and their functions are the same as those of the US dollar. This will create a new way of monetary substitution. To give an interesting example, there is a so-called "stablecoin premium" in the current market, that is, the price of stablecoins pegged to the US dollar 1:1 is actually a little more expensive than the US dollar itself, which reflects the strong willingness of micro entities in the market to obtain stablecoins.

5.6 It forms substantive competition with the development of central bank digital currency

For example, Nigeria restricted the use of all stablecoins in February 2021 and instead developed its own central bank digital currency, eNaira, to replace cryptocurrencies. But one year after its launch, about 98.5% of eNaira has been abandoned. From July 2022 to June 2023, Nigeria's cryptocurrency trading volume increased by 9% year-on-year to \$56.7 billion. Nigerian residents instead turn to cryptocurrencies as an alternative to storing and transferring assets.

5.7 Impact financial supervision

Stablecoins are not all good and bad. Under the premise of the massive use of stablecoins, after the emergence of coin mixers, many gray subjects no longer need to launder money through third parties, and only need to put stablecoins from different sources in the coin mixer for processing, and then their sources are difficult to trace, which brings great challenges to anti-money laundering operations. In addition, the misconduct of stablecoin issuers can also impact the monetary order.

6 Discussion & policy implications

6.1 Defending sovereign money

To neutralise Bitcoin's spillovers, central banks should: (i) cut cross-border payment costs through faster settlement and lower wire fees; (ii) enhance CBDC interoperability to provide a public, low-volatility alternative for digital value transfer; (iii) introduce a real-time "volatility-capital flow" early-warning band that triggers prudential tools when Bitcoin's annualised volatility exceeds 80 per cent.

6.2 International coordination

Supervisors should add large-value Bitcoin transfers to macro-prudential dashboards and adopt function-based regulation: permissive rules for store-of-value use, but stricter transparency and liquidity requirements when crypto-assets are used for payments or settlement, thereby preserving monetary sovereignty while harnessing technological efficiency.

7 Conclusion

The functional deficits of Bitcoin—extreme volatility, absence of a nominal anchor and limited transaction capacity—render its impact on the international monetary system "local, threshold-dependent and bufferable." Sovereign currencies retain decisive control over unit-of-account pricing and macro-liquidity elasticity, yet must guard against short-term liquidity-arbitrage risks during episodes of high crypto-volatility. The functional boundary and threshold parameters provided herein can be immediately embedded in central-bank early-warning systems and regulatory design to safeguard monetary sovereignty while accommodating financial innovation.

The Chinese government has clearly chosen the central bank digital currency among digital currencies. However, since the digital yuan currently only replaces M0 and can only be used for sporadic transactions between individuals and enterprises, the application scenarios are very limited, and it is difficult to promote its internationalization. The Chinese government should upgrade the scope of digital yuan replacement from M0 to M1 or even M2 as soon as possible, so as to comprehensively expand the application scenarios of digital yuan, promote the internationalization of the yuan and accelerate the use of digital currency bridges.

Although the Chinese government will not promote cryptocurrencies, there are huge opportunities for global cryptocurrency transactions and applications, which Chinese companies should not miss. For example, we can expand the R&D and application of crypto assets in Hong Kong, and these businesses can also consider experimenting in the Guangdong-Hong Kong-Macao Greater Bay Area or Hainan Free Trade Port. It is worth mentioning that the U. S. government has announced that Bitcoin is a strategic reserve asset, and Chinese investors also hold a large amount of Bitcoin.

A variety of digital currencies are blooming, which is better than the US dollar monopolizing the digital currency development track. e-SDR can expand the use of super-sovereign reserve currencies in the digital field and virtual space, and will also help promote the diversification of the international monetary system.

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