# Monetary Policy Regulation under the BIS Framework: Toward a Safer and More Transparent Global Economic Governance in the Digital Currency Era

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## 1. Background

In recent years, monetary and exchange rate policies have increasingly evolved from purely economic instruments into geopolitical strategic tools, with monetary policy regulation becoming a core issue in global economic governance. As the "central bank of central banks," the Bank for International Settlements (BIS) occupies a unique position—it helps formulate global monetary rules, but is sometimes criticized for a lack of representation of developing countries. Structural tensions include: between quantitative easing in advanced economies and monetary stability in developing countries, between market-determined exchange rates and the boundaries of intervention, and between BIS influence and national sovereignty. Furthermore, with the advent of the digital economy, digital assets and cryptocurrencies have developed rapidly. As of June 2025, the global market capitalization of stablecoins reached USD 261.5 billion, with USDT and USDC accounting for more than 85% combined (CoinMarketCap, Q2 2025). However, digital assets lack intrinsic value and sovereign backing, posing considerable uncertainty and financial risk. The core contradiction behind this lies in the conflict between private monetary systems and public financial sovereignty. In May 2022, the crypto market experienced its own "Lehman moment" when

the TerraUSD (UST) stablecoin collapsed to zero within a week, dragging its associated token LUNA down by 99.9%, wiping out USD 60 billion in market value. In the context of increasingly digitalized global exchange rates and capital flows, traditional monetary monitoring tools such as deviations in the Real Effective Exchange Rate (REER) are no longer sufficient to assess new forms of intervention and risk that occur via digital channels. Especially in emerging markets, stablecoins have deeply penetrated payment systems, prompting central banks to intervene in exchange rates or implement stability measures on-chain rather than through traditional open market operations. These digital monetary behaviors often fall outside the existing BIS–IMF evaluation framework. This paper draws on theoretical analysis, case studies, and empirical modeling to propose improvements to digital currency monitoring mechanisms, aiming to enhance the BIS's role in promoting global financial stability.

The term "digital currency" as used in this paper refers to an alternative form of electronic money. It is a type of virtual currency based on a peer-to-peer network and cryptographic algorithms, typically issued and managed by developers and accepted by members of specific virtual communities. Its core characteristic is the absence of a central issuing authority, as its issuance is governed by open algorithms beyond the control of any individual or institution. The European Banking Authority defines virtual currency as a digital representation of value that is neither issued by a central bank nor pegged to fiat currency but is accepted by the public as a means of payment and can be transferred, stored, or traded electronically. The IMF adopts the term "crypto assets," viewing them as digital representations of value based on cryptography and distributed ledger technology, capable of peer-to-peer transfers without intermediaries. The BIS uses the term "digital asset" to refer to digital tools issued or represented using distributed ledger or similar technologies, also known as coins or tokens. Stablecoins are defined as digital currencies pegged to real-world assets, designed to maintain a stable value relative to a specific asset, asset pool, or basket of assets.

Central Bank Digital Currencies (CBDCs) are electronic forms of central bank money, denominated in the national currency, and available for use by households and businesses for payments and savings. They can be considered the digital equivalent of physical cash or commercial bank

reserves. CBDCs fall into two main categories: wholesale CBDCs, used for transactions between financial institutions and effectively functioning as tokenized central bank reserves; and retail CBDCs, directly endorsed by central banks for use by the general public, offering higher credit safety.

This research is conducted under the framework of the BIS. As the bank for global central banks, the BIS indirectly influences member behavior through data monitoring and policy coordination. Its monitoring mechanisms include: the Real Effective Exchange Rate (REER) database, which tracks trade-weighted exchange rates of 48 currencies; the Committee on the Global Financial System (CGFS) reports, which assess the impact of cross-border capital flows on exchange rates; data sharing with the IMF to support exchange rate manipulation assessments in the External Sector Report (ESR); and Project Atlas, which aggregates data from cryptocurrency exchanges and public blockchains to provide insights on crypto assets and DeFi markets for central banks and financial regulators. The BIS's policy coordination mechanisms include: the Basel Committee on Banking Supervision (BCBS), which sets capital, liquidity, and risk management standards for banks; the Financial Stability Board (FSB), which coordinates macroprudential stability policies; and the BIS Economic Consultative Committee and bimonthly governors' meetings, which discuss macroprudential frameworks and global macroeconomic policies. These mechanisms facilitate regular consultations and information sharing among regulators and enable rapid responses during periods of crisis.

## 2. Literature Review

### 2.1 Theoretical Evolution: Political Economy Controversies of Currency Intervention

Susan Strange (1971, 1988) proposed the concept of "structural power," emphasizing currency as a core resource of power within the international system, laying the foundation for the political economy of money. Eric Helleiner (1994, 2014) analyzed how states leverage monetary sovereignty to pursue geoeconomic objectives. Kirshner (1995, 2022) examined how exchange rate manipulation can function as a "soft balancing" tool to constrain the economic sovereignty

of target countries. Farrell and Newman (2019) introduced the theory of "weaponized interdependence," arguing that global financial infrastructures—such as SWIFT and the U.S. dollar clearing system—have become instruments of economic coercion by great powers. Rey (2015), through his "global financial cycle" framework, pointed out that emerging markets are often forced to intervene to withstand "dollar funding shocks." Drezner (2015, 2021) studied U.S. sanctions against Iran and Russia via SWIFT exclusion, finding that financial exclusion proved more effective than traditional trade sanctions. The IMF (2023), in its External Sector Report, introduced an index of "currency weaponization" , analyzing the impact of the US dollar hegemony on the intervention costs of emerging markets.

### 2.2 New Monetary Instruments: Challenges in the Digital Currency Era

Brunnermeier (2022) proposed the concept of "Digital Currency Areas," forecasting shifts in payment geography and calling for new regulatory coordination to prevent arbitrage. Brainard (2022) emphasized the need to integrate crypto and DeFi into macroprudential frameworks, focusing on leverage, liquidity mismatches, and links to traditional finance. Barr (2022) noted that while stablecoins can function as private currencies, they are vulnerable to run-pricing and systemic risk. Menon (2022) warned of crypto volatility and highlighted risks in stablecoin reserves, such as commercial paper. Beau (2025) cautioned that lacking a euro-based digital solution may fragment liquidity and weaken monetary sovereignty.

On the regulatory front, Corbet et al. (2019) identified crypto market manipulation and urged stronger KYC/AML compliance and on-chain analytics. FATF (2021) mandated VASPs to share transaction counterpart data, setting a global standard. Auer et al. (2022) proposed a regulatory "pyramid" for CBDCs. FSB (2023) called for cross-border coordination to counter DeFi regulatory arbitrage. The IMF (2023) advised incorporating digital currency interventions into its external imbalance assessments. The EU's MiCA regulation imposed transaction caps on non-euro stablecoins, requiring issuer registration and reserve transparency to safeguard monetary sovereignty. In the U.S., the GENIUS Act mandates stablecoin issuers obtain banking licenses, hold 1:1 USD

reserves, and undergo monthly audits. Hong Kong's Stablecoin Ordinance similarly requires fiat-backed issuers to be licensed and maintain fully audited 100

### 2.3 The BIS: Achievements and Limitations

The founding document of the BIS, the Hague Agreement, grants it extraterritorial privileges and immunities, enabling it to operate independently of any single national jurisdiction. Officially, the BIS presents itself as a technical, membership-based institution—owned by and serving central banks—committed to maintaining global financial stability through research, policy dialogue, and financial services. Under BIS leadership, the Basel Committee successively launched Basel I, II, and III capital and liquidity standards, which have been widely adopted as the foundation of national regulatory frameworks, significantly enhancing the resilience of the global banking system. Scholars including Schenk (2020), and Foster (2021) have recognized the BIS for the quality and impact of its research, praising its role in safeguarding global financial stability, while also criticizing its governance structure for lacking transparency and inclusiveness.

In recent years, the BIS has advanced digital currency research through a dual-track approach combining technical experimentation with policy-oriented analysis. The BIS Innovation Hub's Project Atlas has made breakthroughs in on-chain detection of stablecoin-based monetary interventions, addressing two major central bank challenges in DeFi oversight: data scarcity and verification difficulty. Project Pine explores the use of smart contracts to automate and enhance the efficiency of open market operations, reshaping the transmission mechanism of monetary policy. The core insights of BIS regarding digital currency research includes:

(1) Systemic Risk Warnings: The BIS has repeatedly warned of the volatility, operational fragility, and run risk associated with crypto-assets, and their broader threats to financial stability. It highlights that leverage in DeFi has high contagion potential, and the lack of circuit breakers in on-chain derivatives could trigger crises affecting both crypto and traditional finance. The BIS also emphasizes that cross-border flows of privately issued stablecoins may undermine monetary policy transmission, accelerate reserve depletion, and fuel "cryptoization" in emerging markets—posing

challenges to sovereign currencies.

(2)Regulatory Priorities: The BIS calls for an upgrade of global financial regulation, including uniform Basel III implementation and application of the "same risk, same regulation" principle to non-bank financial institutions (NBFIs). Key proposals include minimum haircut standards for securities financing, AML rules for stablecoins, and leverage containment. It recommends stablecoin issuers maintain a 150% Liquidity Coverage Ratio (LCR) to withstand redemption pressures. In collaboration with central banks, the BIS has developed Project Polaris, a stress test model simulating run and shock scenarios. The FSB mandates that stablecoins must be fully backed by high-quality liquid assets and provide real-time proof of reserves.

(3) Blueprint for the Future Monetary System: The BIS Annual Economic Report (2025) proposes tokenization as the foundation of next-generation monetary frameworks. It argues that a Unified Ledger can integrate central bank money, commercial deposits, and government securities, unlocking innovation without sacrificing trust. CBDCs are seen as systemically valuable—lowering service costs for the unbanked (over 1.7 billion people globally), enhancing cross-border payment efficiency, and improving the targeting of fiscal interventions. The BIS maintains that CBDCs must uphold central bank money's finality and legal tender status.

On the technological frontier, the BIS leads multilateral infrastructure innovation through the mBridge project and has issued a neutrality statement opposing "algorithmic monetary utopias," emphasizing that "the essence of money is trust, not code" (Carstens 2024).

### 2.4 Summary

Monetary policy regulation has expanded from traditional exchange rate politics into areas such as financial infrastructure, digital currencies, and the restructuring of global governance. The BIS is widely recognized for its policy leadership, the Basel framework, and its research on digital currencies. The cutting-edge research focuses on exploring and proposing ways to enhance the regulatory capabilities of BIS in the DeFi era.

# 3. Case Studies

## 3.1 digital Currencies and the Transformation of Traditional Safe-Haven Logic

In 2023, Argentina's inflation rate surged to 211%, while the Argentine peso experienced a nominal monthly depreciation of 56%, reaching historical lows. Amid this dramatic devaluation, Argentine citizens turned to stablecoins—pegged to the U.S. dollar—as a perceived safe haven, prompting a sharp increase in cryptocurrency purchases. According to BIS estimates, approximately USD 10.7 billion in assets—equivalent to 35% of the country's usable dollar reserves—were transferred via crypto channels. Notably, 92% of these capital outflows went into stablecoins (primarily USDT), while traditional safe-haven assets such as gold accounted for a much smaller share. Data from the Central Bank of Argentina (BCRA) indicated that daily trading volumes of stablecoins exceeded USD 63 million, 3.2 times greater than the country's underground gold market.

This phenomenon reveals a structural shift in safe-haven preferences under hyperinflationary conditions. Why did citizens prioritize stablecoins over gold as a hedge? Several factors explain this shift:

(1) Functional attributes: Gold is illiquid in crises, requiring authentication, storage, and central bank registration for private trades in Argentina. Home storage is unsafe, especially in poorer districts, while gold shops are limited to affluent areas. Physical settlement takes up to 72 hours—problematic during hyperinflation (World Gold Council, 2023). In contrast, stablecoins offer instant transfers over 3G networks, critical for peso holders facing devaluation. With gold's minimum unit (1g $\approx$ USD 70) unaffordable for low-income workers, stablecoins allow micro-denominated transactions (as low as 0.0001 units) (Chainalysis, 2024).

(2) Socio-cultural factors: On the policy side, the government bans private gold imports, drying up legal supply. Central bank gold pricing is 40% lower than black-market rates, and purchases over USD 1,000 trigger tax audits (AFIP Resolution No. 4712/2023). In the black market, gold vendors charge a 50% commission per gram, meaning buyers receive less than half the international gold price (BCRA market surveillance report). Price distortions and regulatory burdens

render the gold trade dominated by illicit networks. Citizens, especially the youth, have lost trust in the traditional financial system.

(3) Technological generational divide: Stablecoins bypass bank account restrictions, remittance controls, and cash transaction limits. Argentina's smartphone penetration stands at 92%, and a secondhand device suffices to access global crypto networks. In contrast, buying gold requires traversing the city to find a trustworthy dealer. Stablecoins are deeply embedded in the physical economy: over 38,000 physical outlets across the country—such as convenience stores and internet cafes—support USDT transactions. Approximately 90% of these are completed via QR code, five times faster than cash payments (BCRA, 2024). Cross-border settlement efficiency has also improved dramatically: converting USDT to Bitcoin and withdrawing cash from a bank in El Salvador via ATMs takes a median time of 9 minutes and 42 seconds, a 98% improvement over traditional remittances (BIS Project Atlas, 2023). This also circumvents Argentina's USD 200 annual foreign exchange purchase cap. Generation Z, empowered by mobile access, increasingly places trust in code. Citizens have even supported the "Bitcoin Freedom Bill" via on-chain voting, allowing firms to settle import-export transactions in BTC, and the national electricity company has begun accepting stablecoins for payment.

As a result, Argentina ranks sixth globally in cryptocurrency adoption and third in per capita intensity of crypto activity (Chainalysis 2024). The key driver of this shift is a "revolution in accessibility": instead of tolerating inflation, citizens can now use a USD 20 used smartphone to hold dollar-pegged assets. Compared to physical dollars, stablecoins dominate high-frequency hedging scenarios through efficiency advantages—enhancing financial availability for Argentines and expanding transaction possibilities for the broader economy

### 3.2 Global Trends in Digital Currency Adoption

The Argentine case illustrates that in emerging markets and developing economies (EMDEs), digital currencies may increasingly replace local currencies in both real and financial transactions. High inflation and weak confidence in domestic currencies have prompted users to view cryptocur-

rencies as substitutes for fiat. Similar dynamics have emerged across Africa. Of the continent's 54 countries, 33 are classified by the United Nations as Least Developed Countries (LDCs), and populations there have witnessed firsthand how inflation can quickly render paper money worthless. Traditional financial systems—requiring formal identification, fixed addresses, stable income, and credit history—are inaccessible to many, making stablecoins a viable alternative for value preservation.

Additionally, over 70% of African nations face chronic foreign exchange shortages. For businesses needing to import equipment, banks allocate limited monthly USD quotas. Conventional international transfers often involve high fees, intermediary verification, and take several days to complete. In contrast, stablecoins offer speed, affordability, visibility, and verifiability. Many firms, facing quota constraints, resort to over-the-counter exchanges to convert local currency into USDT for operational use. This high-efficiency, low-friction mechanism has made stablecoins an increasingly common tool for cross-border trade. According to Chainalysis, Sub-Saharan Africa has become the world's second-most active crypto region, with stablecoins accounting for 68.4% of all transaction volume. On-chain stablecoin transfers reached USD 28.7 billion. In countries where fiat has collapsed—such as Nigeria, where the naira depreciated 56%—stablecoins have become essential for corporate cross-border payments and payroll distribution.

Another major driver is the infrastructure gap in local payment systems. In Southeast Asia, a structural mismatch in financial systems has facilitated stablecoin adoption: bank cards failed to gain widespread usage, but QR-based mobile payments became ubiquitous. In Indonesia, nearly half of adults lack savings accounts, yet the national QRIS network has expanded to cover over 30 million merchants in just a few years, with annual transaction growth reaching 197%. Bitget Wallet was among the first to bridge stablecoin and local currency settlements. In collaboration with licensed fiat on-ramp providers, it built a backend system where users scan a QR code to pay, while the platform handles real-time conversion and settlement behind the scenes. This "invisible infrastructure" has gradually permeated savings, payments, and remittance channels throughout Southeast Asia.

In countries with high digital currency adoption potential, CBDC development and stablecoin regulation are becoming strategic priorities. Cambodia's central bank launched Bakong in 2020—the first operational CBDC project in Southeast Asia. By the end of 2024, it surpassed 200,000 active users and USD 500 million in annual transaction volume, reaching over 450,000 merchants. In South America, Brazil has piloted its digital real with Pix integration, covering 91% of adults and reducing cross-border settlement costs by 30%. The African Continental Free Trade Area (AfCFTA) has begun piloting tariff settlements using CBDCs, while Nigeria requires stablecoin issuers like Paxos to hold 150% reserve collateral.

In economies with advanced domestic payment systems, CBDC adoption is typically more measured and strategic. China enforces strict virtual currency regulations, cutting payment channels and targeting cross-border services (PBoC, 2021). The e-CNY, positioned as a cash complement, has been piloted in over 40 cities (PBoC, 2025). China's mature digital payment ecosystem supports a controlled CBDC rollout, including offshore trials in Hong Kong SAR—contrasting with the reactive deployments common in crisis-driven environments.

Similarly, India's Unified Payments Interface (UPI) already facilitates over 90% of domestic digital transactions, significantly reducing the urgency for widespread retail CBDC adoption. The Reserve Bank of India (RBI) prohibits the trading of foreign stablecoins(USDT/USD), permitting only rupee-pegged stablecoins (INR) to operate within regulatory sandboxes.

Moreover, foreign exchange reserves also play a critical role in shaping the trajectory of digital currency adoption. For instance, although corporate demand for USDC in Chile has been driven by the peso's high annual exchange rate volatility (18%) and the need for greater efficiency in export trade, the country's sizable foreign exchange reserves—amounting to 26% of GDP—have provided a buffer that tempers the momentum toward full-scale currency digitization. Consequently, the Chilean central bank focused on CBDC applications in bulk commodity settlements (e.g., lithium exports), rather than in retail contexts.

In monetary sovereign powers like the United States, which holds 58% of global foreign reserves, the strategy has been to integrate stablecoins into traditional finance to reinforce the dollar's

primacy. The GENIUS Act supports U.S.-based issuance of payment stablecoins while restricting issuance by foreign entities. Stablecoin reserve funds must be invested exclusively in USD-denominated U.S. assets, aligning with market preferences and helping maintain demand for U.S. Treasuries—thereby reinforcing a new "dollar-stablecoin-Treasury" monetary cycle.

In Europe, the growing dominance of electronic payments has sharply reduced eurozone cash usage. The EU seeks to enhance its role in digital payments by issuing a CBDC. The digital euro is envisioned as a daily payment tool for individuals and businesses, aimed at boosting payment efficiency, protecting user privacy, and mitigating financial risks. The ECB (2023) has stressed that the design of the digital euro must incorporate "sanctions compatibility" to protect the monetary sovereignty of the eurozone.

In petro-finance regions, the UAE became the first country to deeply integrate a CBDC—Digital Dirham—with oil trade. Its partners account for 70% of global oil importers. The Digital Dirham enables atomic swaps with the Indian rupee, Chinese e-CNY, and Russian digital ruble, bypassing the CHIPS system and reducing settlement time by 3–5 days.

Under BIS coordination, the mBridge project established a multilateral CBDC platform for efficient cross-border settlement. Over 26 states joined as observers. Using distributed ledger technology, it enables direct CBDC exchanges among central banks—cutting settlement time from 2–3 days to 30 minutes and reducing costs from USD 15 to USD 2. Exchange rate risk fell by 90%. This blockchain-based system avoids single-currency dominance, ensures regulatory compliance via smart contracts, and lays a new foundation for international trade.

In summary, the global trajectory of digital currency adoption follows several core patterns: adoption likelihood is positively correlated with monetary crises (inflation/devaluation) and inversely correlated with domestic payment efficiency and foreign reserve adequacy. Geostrategic considerations regarding monetary power also significantly shape national digital currency strategies. As a new multipolar currency trade ecosystem begins to emerge, blockchain technology is increasingly reconfiguring the global monetary order and reshaping the structure of the world economy.

### 3.3 Digital Currencies and the Amplification of Systemic Vulnerabilities

Although the Argentine case demonstrates that crypto assets have become a de facto hedging instrument under hyperinflation, stablecoins—while improving individual asset preservation—may simultaneously exacerbate systemic vulnerabilities and risks.

At the micro-level of credit risk, stablecoin reserves often lack transparency. A contradiction arises between the decentralized vision and centralized reliance: while users depend on centralized issuers like USDT, they effectively substitute sovereign currency risk with private-issuer credit risk. In 2021, 24% of Tether's reserves consisted of commercial paper, of which 65% was rated below A–, indicating potential risks of maturity mismatch, credit downgrades, and redemption pressure (NYAG 2021). Precedents already exist. In May 2022, the algorithmic stablecoin TerraUSD (UST) collapsed due to design flaws—its peg depended on arbitrage with LUNA and high-yield subsidies from the Anchor Protocol that exhausted reserves. Within 48 hours, UST and LUNA lost approximately USD 60 billion in combined market value, triggering a global run on stablecoins. In November 2022, FTX—the world's second-largest crypto exchange—was revealed to have misappropriated USD 8.13 billion in customer funds to support a related hedge fund, operating with a 1,200% leverage ratio. Its bankruptcy resulted in USD 8.7 billion in client losses.

Regulatory gaps in technical monitoring also enable regulatory arbitrage. According to the BCRA's 2023 compliance report, of 427,000 high-risk wallet addresses, only 53% had been flagged by exchanges. In terms of transaction obfuscation, the FATF's 2024 Risk Assessment of Virtual Asset Money Laundering confirmed that roughly USD 1.9 billion in annual mixer-related crypto transfers remain in regulatory blind spots. It warned that mixer technologies facilitate illicit flows. The BIS Project Atlas technical white paper noted that Argentina accounted for 9.2% (about USD 175 million) of such gray-market volume—unreported by the central bank. Atlas's tracking of self-custody wallets relies on IP correlation, but non-custodial wallets (like MetaMask) remain largely untraceable, contributing to a 28.6% on-chain data error rate in Argentina.

At the macro level of financial stability, decentralized over-the-counter (OTC) networks have emerged as new cross-border capital transfer mechanisms. Local nodes use platforms like Bi-

nance P2P to connect to global liquidity pools, forming closed-loop circuits of peso–USDT–dollar settlements. This accelerates reserve depletion: in Q3 2023, crypto outflows totaled USD 2.8 billion, reducing central bank dollar reserves by 19.3% and weakening the capacity for exchange rate intervention (IMF Argentina Country Report). Meanwhile, monetary policy transmission has weakened—correlation between M2 growth and inflation dropped from 0.79 to 0.41, indicating rising stablecoin preference over local currency (LSE Econometric Study, 2024).

Infrastructure dependency introduces additional fragility. In March 2024, a nationwide power outage in Argentina interrupted digital payments for 28 hours, exposing the crypto ecosystem's reliance on electricity and telecom infrastructure (LSE Crisis Report, 2024). El Salvador, which declared Bitcoin legal tender in 2021 and launched the official Chivo wallet, faced significant implementation issues: in the first month, the wallet crash rate was 37%, and 87% of businesses continued using USD.

These risks suggest that when reserves collapse or blockchain networks fail, the public could lose access to their final line of monetary defense. The long-term viability of digital currency hedging lies in the co-evolution of decentralized stabilization mechanisms (e.g., algorithmic stablecoins with physical collateral) and sovereign currency reform. The DeFi ecosystem urgently requires a globally coordinated regulatory framework to address cross-border risk transmission and data blind spots.

## 4. Recommendations for Monitoring Optimization

Building on the preceding analysis of cross-border risk transmission via digital currencies, this paper proposes a new structural indicator—the Digital Currency Resilience Ratio (DCRR)—as a supplementary quantitative monitoring tool. The DCRR is designed to assess a country's ability to withstand substitution pressure from stablecoins, capturing the balance between structural defense capacity within the domestic monetary system and external substitution shocks. It serves as an early-warning threshold and policy guidance mechanism for central banks, offering a forward-looking and structure-sensitive assessment framework that complements the BIS's existing moni-

toring toolkit.

### 4.1 Model Formula and Definition

The DCRR model incorporates "defensive variables" (domestic digitalization level D and FX reserve coverage R) in the numerator and "substitution variables" (inflation rate I and stablecoin penetration S) in the denominator. All four are transformed using a natural logarithmic function to reflect diminishing marginal effects—i.e., marginal risk increases rapidly with rising inflation or stablecoin usage, while the marginal defensive benefit of reserves or digital infrastructure decreases as they grow. The formula is as follows:

$$E^* = \frac{\alpha \cdot \ln(1+D) + (1-\alpha) \cdot \ln(1+R)}{\beta \cdot \ln(1+I) + (1-\beta) \cdot \ln(1+S)} \tag{1}$$

Where $\alpha$ and $\beta$ are weight parameters (default: 0.5 under neutral assumption).

This model is grounded in three economic theories:

• Currency substitution theory (Calvo, 1985): High inflation and exchange rate volatility drive domestic currency holders toward foreign or digital dollar assets. Variables I and S reflect substitution motives and channels.

• Economics of payment networks (Katz & Shapiro, 1985): The more developed the local payment system, the lower the marginal utility of switching to stablecoins. Variable D captures this structural stickiness.

• Reserve buffer theory (Jeanne & Rancière, 2011): FX reserves serve as macroprudential buffers, strengthening market confidence and providing structural resilience.

Table 1: Variable Definitions

| **Variable** | **Definition** |
|---|---|
| $D$ | Share of digital domestic payments (reflects payment system efficiency) |
| $R$ | FX reserves as % of GDP (resilience against capital flight & currency shocks) |
| $I$ | Annual inflation rate (proxy for purchasing power erosion) |
| $S$ | Stablecoin share of M2 (measure of external substitution pressure) |

This structure is both intuitive and expandable—other factors such as transaction costs or interest differentials can be added if needed.

### 4.2 Empirical Results and Validity

To test its empirical viability, the DCRR was calculated for five representative emerging market economies in 2023—Egypt, Nigeria, Argentina, Turkey, and Vietnam—based on data from central bank reports, IMF WEO, and Chainalysis.

Table 2: Estimated DCRR Values for Selected Emerging Markets (2023)

| **Country** | **D (%)** | **R (%)** | **I (%)** | **S (%)** | **DCRR** $E^*$ |
|---|---|---|---|---|---|
| Egypt | 18.0 | 15.3 | 32.5 | 8.2 | 0.855 |
| Nigeria | 9.0 | 8.7 | 21.0 | 11.0 | 0.575 |
| Argentina | 7.0 | 6.5 | 60.0 | 23.0 | 0.193 |
| Turkey | 21.0 | 12.2 | 40.0 | 15.0 | 0.642 |
| Vietnam | 38.0 | 24.6 | 3.1 | 3.8 | 7.991 |

These results align well with observed substitution dynamics:

Argentina scores the lowest, highlighting substantial risk from high inflation and substitution.

Vietnam scores highest, confirming its robust reserves, efficient payment system, and low inflation.

Nigeria sits near the risk threshold (0.5), suggesting potential fragility.

Egypt and Turkey exhibit moderate resilience.

The DCRR effectively integrates domestic digitalization, macro fundamentals, and external stablecoin pressure. Its logarithmic design captures marginal policy impacts more realistically—for instance, inflation rising from 10% to 30% triggers a sharper risk signal than from 30% to 50%, mirroring real-world policy effectiveness.

### 4.3 Significance and Applicability

As a supplement to the BIS's current toolkit, DCRR offers the following advantages:

- **Clarity and operability**: Transparent logic, accessible data sources (e.g., central banks, IMF, Chainalysis), and real-world feasibility.
- **Empirical support**: Verified across country cases with interpretable thresholds for cross-country comparisons and policy simulations.
- **Integration potential**: Can be embedded in BIS Project Atlas, FSB's risk tiering framework, and Basel IV's regulatory schemes to inform stablecoin classification and central bank response.

Its practical implications include:

- **Early warning on monetary sovereignty**: $E^* < 0.5$ suggests high substitution risk and weak FX/payment resilience.
- **Complement to REER**: Unlike the Real Effective Exchange Rate, DCRR incorporates blockchain flows and stablecoin pressure.
- **Tailored to EMDE contexts**: Especially useful in countries where stablecoin usage is high but data transparency is limited.

Based on empirical findings, DCRR values can be classified into three policy-responsive zones:

- **High risk** ($E^* < 0.5$): Trigger emergency interventions such as capital controls, restrictions on stablecoin use, and wallet surveillance.
- **Moderate risk** ($0.5 \leq E^* < 0.7$): Promote CBDC adoption and strengthen domestic digital infrastructure.
- **Low risk** ($E^* \geq 0.7$): Maintain monitoring and disclosure.

From a cautious perspective, the model has the following limitations:

(1) Relies on four core variables, excluding key factors like fees, interest differentials, or FX expectations; interactions are not modeled.

(2) Stablecoin penetration ($S$) depends on local exchange and blockchain data availability, with blind spots in some developing countries.

(3) Ignores substitution effects from non-stable crypto assets (e.g., BTC, ETH).

(4) Static design—does not account for dynamic effects such as inflation inertia or FX reserve trends.

(5) Thresholds lack statistical backtesting and require panel regression or ROC analysis for calibration.

## 5. Conclusion

The rapid rise of digital currencies is reshaping the global monetary landscape. Their application is expanding rapidly—particularly in cross-border trade—blurring the boundaries with traditional financial systems. In emerging economies, digital currencies have become critical tools for hedging against high inflation and volatile local currencies. However, their unique mechanics also pose new challenges to financial stability: DeFi introduces asymmetries in information, impairs monetary policy transmission, and contributes to the "cryptoization" of fragile economies. As DeFi grows and becomes increasingly entangled with traditional finance, regulators and international bodies must design prudent yet flexible frameworks that balance innovation and systemic safety.

The BIS has responded proactively with technological initiatives (e.g., Project Atlas) and coordination frameworks (e.g., the FSB regulatory architecture). However, its existing monitoring infrastructure has blind spots in tracking on-chain activity and lacks sensitivity to the structural conditions of emerging markets.

This paper proposes the Digital Currency Resilience Ratio (DCRR) as an innovative enhancement to the BIS framework. By quantifying the structural balance among payment efficiency, reserve buffers, inflationary pressure, and stablecoin penetration, the DCRR helps address the monitoring gap in digital dollarization. It offers a structured assessment tool for policymakers and enables early warning of monetary substitution risks—especially in vulnerable economies like Argentina—while validating the strength of strong resilient Countries.

The BIS could incorporate this index into its on-chain monitoring tools, creating a complementary layer alongside traditional indicators like REER. As a technical enhancement to financial reports and intervention design, the DCRR supports tiered response mechanisms and offers a new pathway for multilateral monetary governance in the digital age. Coordinating monetary policy with stablecoin regulation becomes not just a priority, but a necessity.

Only through technological empowerment and multilateral cooperation can we achieve the vision of "safe and transparent global governance in the digital currency era", and safeguard the long-term balance between sovereign monetary systems and financial stability.

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