FGV EUROPE THINK SERIES

THE DIGITAL ECONOMY AND SANCTIONS: HOW GEOPOLITICAL PRESSURE IS FUELING ALTERNATIVE ECONOMIC ECOSYSTEMS

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OVERVIEW

The *FGV EuropeThink Series* aims to promote high-level reflections on global transformations shaping the interface between economics, governance, and technology. Conceived as a space for academic rigor and strategic foresight, the series brings together research from scholars, practitioners, and policymakers dedicated to understanding how emerging trends redefine the balance of power in the international system.

This second edition of the *FGV Europe Think Series* presents the study "The Digital Economy and Sanctions: How Geopolitical Pressure is Fueling Alternative Economic Ecosystems". It examines how technological innovations — from blockchain and decentralized finance to central bank digital currencies — are transforming the foundations of global economic governance and the effectiveness of sanctions as instruments of foreign policy.

Combining insights from international relations, political economy, and digital finance, the study examines how technology and geopolitics converge to transform the foundations of global monetary power and enable the creation of alternative financial ecosystems beyond Western-controlled systems.

This work reflects FGV Europe's mission to act as a bridge between Brazil and Europe, drawing on the 80 years of expertise of Fundação Getulio Vargas, in the production of strategic knowledge and fostering dialogue on the most pressing issues of the global agenda.

As part of FGV's broader commitment to applied research and international cooperation, *FGV Europe Think Series* seeks to contribute to a more nuanced understanding of global transformations, their economic implications, and the policy responses they demand.

Finally, I would like to thank Emily Vartuhi Ekshian, responsible for the present study and participant of the Fellowship Program at FGV Europe, for her valuable work; Maria Cristina Terra, from ESSEC Business School, and Vera Thorstensen, from FGV EESP, for the academic review; Sara Pais, our International Manager; and Mariana Fleischhauer, our Manager and Coordinator of the Fellowship Program.

We invite readers to engage with this second edition as a timely contribution to the debate on digital sovereignty and the future of global financial governance.

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General Director, FGV Europe

ABSTRACT

Economic sanctions have long served as a cornerstone of modern statecraft, allowing powerful nations to exert pressure on adversaries without military intervention. Their effectiveness has historically depended on centralized global financial infrastructures - most notably the U.S. dollar, SWIFT messaging systems, and Western-dominated correspondent banking networks - that gave sanctioning powers unmatched leverage over global trade and capital flows. This study examines how digital technologies - including cryptocurrencies, decentralized finance systems, central bank digital currencies, tokenized commodities, and blockchain-enabled trade systems - are reshaping this dynamic. While large-scale sanctions evasion via crypto remains limited today, emerging digital infrastructures are laying the foundation for long-term erosion of sanctions' effectiveness, challenging U.S. dollar hegemony and transforming the future of global monetary power. Drawing on comparative case studies of Russia, China, Iran, Venezuela, North Korea, Nigeria, Turkey, the United Arab Emirates, and India, it is identified how both authoritarian and hybrid regimes are building parallel infrastructures to bypass Western financial chokepoints. These mechanisms range from domestic CBDCs and alternative messaging systems to peer-to-peer stablecoin networks and energy-backed tokens. While crypto-based sanctions evasion remains limited in scale today, the broader trajectory points toward an erosion of the U.S.-led financial order. The proliferation of digital monetary systems risks fragmenting global finance, weakening dollar hegemony, and reducing the long-term efficacy of sanctions. It also highlights gaps in global regulatory frameworks, the dual-use nature of digital tools, and the ethical dilemmas surrounding humanitarian aid versus illicit evasion. The study concludes with recommendations for adaptive governance, calling for smart sanctions, enhanced digital oversight, and collaborative frameworks that balance innovation with financial integrity and geopolitical stability.

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We are an institution of a technical, scientific, educational and philanthropic nature, founded on December 20, 1944, as a legal entity subject to private law. Our purpose is to act in the field of the social sciences, particularly economics and administration, as well as to contribute to environmental protection and sustainable development.

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FGV Europe GmbH is the institutional representation of Fundação Getulio Vargas (FGV) in Europe since 2016. Established as a German company, headquartered in Cologne with an office in Brussels, FGV Europe serves as a bridge between FGV and academic, governmental, and multilateral institutions across Europe and Africa.

FGV Europe develops applied research projects, institutional consulting, and international events, promoting the exchange of ideas, data, and experiences between Brazil, Europe and Africa. It also regularly publishes FGV Europe Think Series, offering analyses and reflections on strategic topics of the international agenda, including politics, economics, sustainability, agriculture, global trade, and regional integration. This publication aims to broaden understanding of the challenges and opportunities in the relations between Brazil, Europe, and Africa, providing technical and institutional input for public debate and policymaking.

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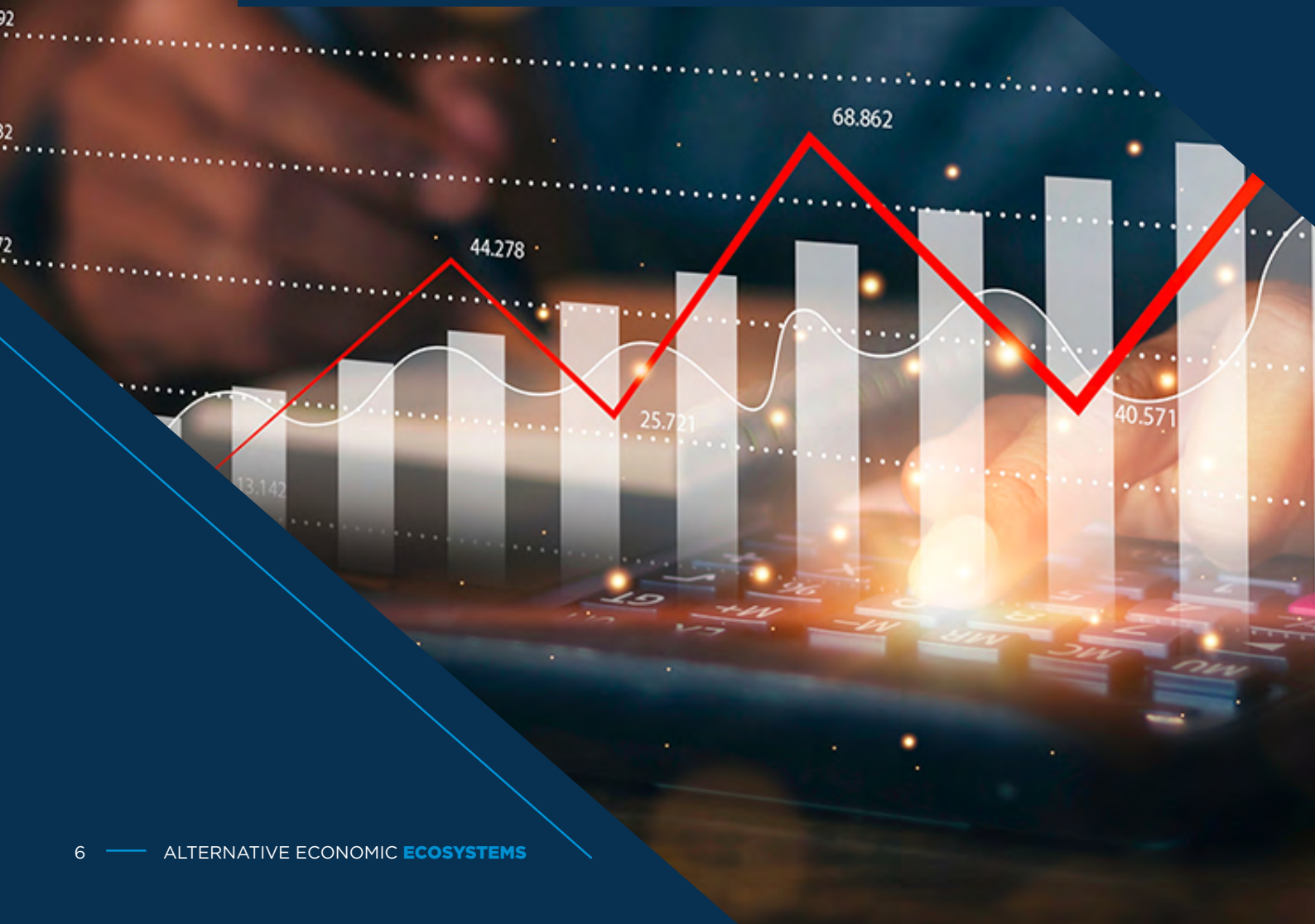
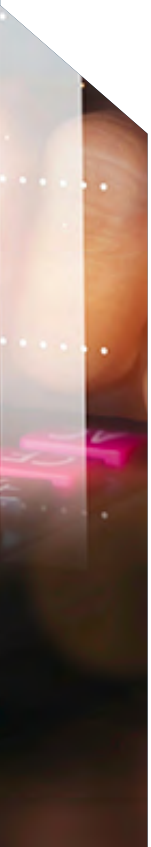
1. THE EMERGENCE OF SANCTIONS AS A TOOL OF FOREIGN POLICY



Economic sanctions have become one of the most powerful and frequently used tools of modern statecraft, enabling nations – particularly the United States and its allies – to project power, deter aggression, and punish violations of international norms without resorting to military force (Drezner 4; Zarate 12). Since their emergence in the early 20th century, sanctions have evolved from blunt trade embargoes to highly sophisticated, targeted measures that leverage the centralized architecture of the global financial system, including correspondent banking networks, U.S. dollar clearinghouses, and messaging platforms such as SWIFT (Farrell and Newman 14). This centralized system granted the United States and other sanctioning coalitions extraordinary extraterritorial reach, making compliance with sanctions not merely a matter of domestic law but a prerequisite for participation in the global economy (Eichengreen 88). Yet, over the past two decades, this dominance has faced growing challenges. In the aftermath of the 2008 global financial crisis and amid escalating U.S. sanctions on Iran, Russia, and other geopolitical rivals, targeted states have pursued strategies to reduce dependency on Western-controlled financial infrastructure (Helleiner 102). As global economic relations fragment and technology reshape value transfer, the very foundations of sanctions enforcement are increasingly under strain (Christensen 453).

The Convergence of Sanctions, Finance, and Digital Technology

The emergence of digital technologies – including blockchain, cryptocurrencies, decentralized finance (DeFi), central bank digital currencies (CBDCs), and tokenized commodities – has begun to erode the choke points on which sanctions rely (Marczak et al. 8). Blockchain facilitates peer-to-peer transactions without intermediaries, bypassing the banks that traditionally serve as enforcement nodes for sanctions compliance (Baker 107). CBDCs, developed by states such as China and Russia, offer programmable, state-backed alternatives to dollar settlement systems, potentially shielding trade flows from U.S. oversight (Auer et al. 5; Subacchi 134).



DeFi protocols allow cross-border swaps without identity verification, generating shadow liquidity pools outside regulated markets (FATF 13). This convergence of sanctions, finance, and digital technology signals a paradigm shift in the architecture of international economic power. What was once a unipolar system anchored in the dollar and Western governance is gradually transitioning toward a digitally fragmented, multipolar order in which sanctioned states – and even non-aligned economies – can construct parallel financial infrastructures resistant to external coercion (Farrell and Newman 42). Understanding this transformation is essential for policymakers, scholars, and technologists seeking to assess whether sanctions will remain viable as a tool of diplomacy and conflict management in the coming decades (Zarate 21).

Overreach and Blowback: The Weaponization of Finance

While sanctions have achieved certain policy goals – such as bringing Iran to the negotiating table over its nuclear program in 2015 – their overuse has created significant blowback. States increasingly perceive sanctions not as neutral tools of international governance but as instruments of U.S. geopolitical coercion (Drezner 98). Russia, China, and Iran have criticized secondary sanctions as violations of sovereignty and international law, arguing that they allow Washington to enforce its domestic policies extraterritorially (Helleiner 182).

This perception has accelerated efforts to de-dollarize trade and reduce reliance on U.S.-dominated payment systems. Russia and China have signed bilateral agreements to settle energy transactions in rubles and yuan, while many countries are diversifying their foreign exchange reserves away from the dollar in favor of gold or other currencies (Subacchi 134). The European Union has even explored developing its own financial channels, such as INSTEX, to bypass U.S. sanctions on Iran, though with limited success (O. Johnson 77).

Sanctions also impose massive humanitarian costs, particularly when applied comprehensively. In Iraq during the 1990s, sanctions contributed to famine and shortages of medical supplies, leading to hundreds of thousands of civilian deaths without achieving regime change (Gordon 112). In Venezuela, U.S. financial restrictions have exacerbated economic collapse, limiting access to food, medicine, and humanitarian aid (Weisbrot and Sachs 4). These consequences have undermined the legitimacy of sanctions as a moral foreign policy tool.

Furthermore, overreliance on sanctions risks fragmenting global financial governance. As countries build parallel institutions and networks to avoid U.S. leverage, the cohesiveness of the international monetary system is eroded, potentially reducing cooperation in areas like counterterrorism financing and anti-money laundering (Farrell and Newman 57).

The Shift Toward Digital Tools of Resistance

The backlash against sanctions has coincided with a technological revolution in global finance, offering new opportunities for targeted states to bypass restrictions. The

emergence of digital currencies, blockchain networks, and alternative payment systems is challenging the foundations of Western sanctions enforcement (Chiu and Koeppl 15).

Russia has developed the SPFS financial messaging system as a domestic alternative to SWIFT and is working with China's CIPS to facilitate cross-border payments in non-dollar currencies (Korhonen 22). China's Digital Yuan (e-CNY) project is particularly significant, aiming to provide a sovereign digital currency that can be used in international trade, reducing reliance on the dollar and bypassing U.S. intermediaries (Auer et al. 8). Other countries, such as Iran, Venezuela, and Nigeria, have experimented with central bank digital currencies (CBDCs) to strengthen monetary sovereignty and maintain trade flows despite sanctions pressure (Kosse and Mattei 34).

Cryptocurrencies and decentralized finance (DeFi) platforms also provide channels for sanctions evasion. Venezuela's Petro attempted to create a state-backed cryptocurrency to sell oil outside the U.S. financial system, though with limited uptake (Chohan 10). Iran has leveraged Bitcoin mining to monetize energy resources and fund imports, while North Korea's Lazarus Group has stolen billions in crypto assets through cyberattacks, laundering funds via mixers and privacy coins (FATF 2022, 19). These activities demonstrate that blockchain technology can be weaponized to acquire hard currency, move funds covertly, and undermine sanctions regimes.

Discussions among BRICS nations on gold- or commodity-backed stablecoins suggest an emerging blueprint for a sanctions-proof global payment system (Subacchi 145). Such systems, once matured, could enable large-scale trade outside of dollar-based finance, reducing the leverage that sanctions currently exert over international commerce.

In sum, digital innovation is reshaping the global financial order, creating alternative economic ecosystems that reduce Western control and effectiveness of sanctions. While these systems are still fragmented, their rapid development signals a future where the unilateral power of sanctions may be significantly diminished. The growing frequency, extraterritorial application, and humanitarian fallout of sanctions have sparked widespread resistance and fueled a shift toward building alternative economic infrastructures. States targeted by sanctions – along with major powers wary of overdependence on U.S.-controlled systems – are accelerating efforts to de-dollarize trade, establish parallel payment channels, and harness emerging technologies such as CBDCs, cryptocurrencies, and blockchain-based settlement systems to circumvent Western leverage. This dynamic signals the beginning of a fragmented, multipolar financial landscape, where traditional sanctions may lose much of their coercive power (Farrell and Newman 61).

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2. DIGITAL SOVEREIGNTY AND THE RISE OF THE DIGITAL ECONOMY

The globalization of finance in the 20th century created a tightly interconnected system dominated by Western institutions, the U.S. dollar, and centralized infrastructures such as SWIFT. This system enabled powerful states, particularly the United States, to impose sanctions, defined as coercive economic measures aimed at restricting or prohibiting financial and commercial relations with specific states, entities, or individuals to influence their behavior in line with foreign policy or international security objectives (Hufbauer, Schott, & Elliott, 2009).

However, technological innovation in the 21st century is challenging the very foundations on which sanctions have historically relied. The digital economy – composed of digital infrastructure, sovereign digital currencies, decentralized financial technologies, and regulatory havens – has created new pathways for sanctioned states to preserve access to global markets, bypass traditional chokepoints, and assert digital sovereignty (Zetzsche, Buckley, and Arner 9 -12). This section examines the structure of the digital economy, the rise of state-controlled central bank digital currencies (CBDCs), the disruptive potential of blockchain and decentralized finance (DeFi), and the role of regulatory arbitrage and permissive jurisdictions in undermining sanctions enforcement.

What is the Digital Economy? Infrastructure, Actors, and Platforms

The digital economy refers to the complex network of economic activities, transactions, and value creation processes that rely on digital technologies, data, and online connectivity (Bukht and Heeks 12-14). Unlike traditional economies that depend on physical financial institutions and manual clearing systems, the digital economy is built on digitally mediated infrastructures that allow instantaneous, borderless financial interactions. Its foundation includes high-speed internet, cloud computing, advanced data analytics, artificial intelligence, and a growing array of financial technology solutions that reduce friction in global commerce (OECD 6-9).

The key actors in this space include large technology firms (such as Amazon, Google, Alibaba), digital payment processors (PayPal, Stripe, Alipay), financial technology startups, blockchain networks, and an emerging class of state-sponsored digital platforms (Chinn and Frenkel 204-208). These actors leverage platforms such as online marketplaces, peer-to-peer payment systems, tokenized

asset markets, and open-source blockchain protocols to facilitate capital flows and economic exchanges in real time. The platformization of finance has eroded the dominance of traditional banks as sole gatekeepers of global capital flows, reducing the capacity of state actors like the United States to enforce sanctions through conventional intermediaries (Farrell and Newman 50-53).

In practical terms, this shift means that access to international trade and finance no longer depends exclusively on correspondent banking relationships or SWIFT membership. A country or entity excluded from Western networks can increasingly use alternative digital platforms to engage in cross-border commerce, whether through proprietary state systems, private fintech solutions, or decentralized blockchain-based mechanisms. This transformation lays the groundwork for new alternative economic ecosystems that exist parallel to, and at times beyond, the reach of sanctions regimes (Zhang and Livermore 115-118).

Central Bank Digital Currencies (CBDCs): A Sovereign Alternative

Central bank digital currencies (CBDCs) represent a state-driven evolution of money in the digital age, offering countries direct control over a digitized version of their fiat currency (BIS 3–5). A CBDC is a legal tender issued and regulated by a country's central bank, existing in digital form and designed to complement or replace physical cash and electronic bank deposits. Unlike cryptocurrencies such as Bitcoin, CBDCs maintain state backing and are integrated into national monetary policy frameworks.

For countries vulnerable to sanctions, CBDCs promise a strategic lifeline. China's Digital Yuan (e-CNY) is the most advanced example, tested extensively in domestic transactions and now entering cross-border pilots via the mBridge project, which connects central banks from Asia and the Middle East for real-time settlements (Auer et al. 17-19). Russia has accelerated its Digital Ruble project since its exclusion from SWIFT in 2022, aiming to settle energy trades with friendly nations without routing payments through U.S.-controlled intermediaries (Bank of Russia 8-9). Iran and several Latin American states have explored similar initiatives to maintain access to trade financing while under Western restrictions (Bains and Sugimoto 5-6). CBDCs offer several advantages (IMF 13-16):

1) Direct bilateral settlement: Bypasses U.S. correspondent banks and reduces exposure to dollar-based clearinghouses.

2) Reduced dependence on SWIFT: Domestic payment systems combined with CBDCs enable near-instant cross-border transfers on alternative networks.

3) Enhanced monetary sovereignty: States gain full visibility and programmable control over currency flows, minimizing capital flight and strengthening enforcement of domestic rules.

While most CBDCs are still in pilot phases, their geopolitical implications are profound, as they allow sanctioned or strategically autonomous states to build parallel infrastructures insulated from U.S. leverage, eroding the effectiveness of sanctions as a long-term policy tool (Arner, Auer, and Frost 24-26).

The Role of Blockchain, Crypto, and DeFi

Blockchain technology has introduced decentralized, permissionless financial systems that operate outside the control of any single government or institution. At its core, blockchain is a distributed ledger technology that records transactions across multiple nodes, making them transparent, immutable, and resistant to censorship (Catalini and Gans 256-258). This architecture has enabled the rise of cryptocurrencies (Bitcoin, Ethereum, stablecoins) and a burgeoning decentralized finance (DeFi) ecosystem that allows users to engage in lending, borrowing, trading, and investment without relying on traditional intermediaries.

For sanctioned states, blockchain presents new avenues to circumvent restrictions. Venezuela attempted to launch the Petro, a state-backed cryptocurrency pegged to oil reserves, to sell crude internationally without using dollar transactions (Booth 5-6). Iran has used Bitcoin mining to monetize surplus energy resources and import goods despite U.S. sanctions on its banking sector (Alizadeh and Ghasempour 311-314). North Korea's Lazarus Group has executed large-scale cyberattacks on crypto exchanges, stealing billions in digital assets and laundering funds via mixers, privacy coins, and decentralized exchanges to fund its weapons program.

Although cryptocurrencies have limitations - high volatility, transaction size restrictions, and increasing regulatory scrutiny - they remain a powerful tool for sanctions resistance, particularly in peer-to-peer transactions that avoid formal banking channels (Chainalysis 7-9). The DeFi space enhances this potential by enabling anonymous, automated financial activities that bypass both state and private sector oversight, further weakening the choke points that make sanctions enforceable in traditional systems.

Regulatory Arbitrage and the Role of Crypto Havens (UAE, Bahamas, Switzerland)

The uneven global regulatory landscape has given rise to jurisdictions that function as crypto havens, offering favorable or ambiguous legal frameworks that facilitate digital asset activity (Zetzsche, Buckley, and Arner 14-15). These havens often act as intermediaries for sanctioned actors, providing access to infrastructure and services unavailable in more strictly regulated Western markets.

The United Arab Emirates has rapidly positioned itself as a global crypto hub, particularly in Dubai and Abu Dhabi, offering comprehensive licensing regimes that attract exchanges and blockchain firms (FATF 22-24). Investigations have highlighted that some sanctioned Russian and Iranian entities have routed funds through UAE-based platforms, leveraging the country's neutral foreign policy stance and global financial reach. The Bahamas has pioneered one of the world's first CBDCs - the Sand Dollar - while maintaining a light-touch regulatory approach that historically attracted offshore exchanges (IMF 21-23). Its flexibility makes it a potential node for entities seeking to avoid the stringent compliance standards of U.S. and European jurisdictions. Switzerland's "Crypto Valley" in Zug similarly offers a favorable legal and tax environment for blockchain companies (OECD 15-17). While it adheres to FATF standards, Switzerland's tradition of financial privacy and its non-aligned position in global politics make it a convenient base for cross-border digital transactions that might otherwise face restrictions.

This regulatory arbitrage erodes the global coherence of sanctions enforcement. As long as certain jurisdictions remain permissive, sanctioned states and entities can exploit these regulatory gaps, maintaining access to international markets through intermediaries that operate beyond U.S. jurisdictional control.

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3. THE SANCTIONS-RESISTANCE ARCHITECTURE: A COMPARATIVE FRAMEWORK

Economic sanctions have traditionally relied on centralized chokepoints in the global financial system. These include U.S. dollar clearinghouses, SWIFT-based payment messaging networks, and the dominance of Western-led institutions like the IMF and World Bank (Hufbauer, Schott, and Elliott 3). However, as discussed in previous sections, the increasing frequency and extraterritorial application of sanctions have incentivized targeted states to seek alternative mechanisms for maintaining economic connectivity. The result is the emergence of sanctions-resistance architectures - deliberately constructed or opportunistically adopted systems that use digital technologies, alternative payment networks, and regulatory arbitrage to mitigate or evade the effects of sanctions.

Typologies of Digital Sanctions Resistance

Sanctions-resistance strategies can be grouped into three broad typologies based on their design, governance structure, and reliance on digital technologies: centralized state-controlled systems, decentralized public blockchain-based systems, and hybrid networks blending both approaches. Each typology reflects different levels of state involvement, technological sophistication, and long-term viability in evading sanctions.

a) Centralized: CBDCs and Digital Banking Systems

Centralized architectures are top-down solutions developed and managed by national governments, often through central banks or state-backed financial institutions. These include central bank digital currencies (CBDCs), domestic payment messaging alternatives to SWIFT, and government-operated settlement networks designed to process international transactions independently of U.S.-controlled systems. Russia's System for Transfer of Financial Messages (SPFS) and China's Cross-Border Interbank Payment System (CIPS) exemplify this approach, enabling domestic and bilateral trade settlement in local currencies without reliance on dollar clearing channels (Ballis 4). CBDCs such as the Digital Yuan (e-CNY) and Digital Ruble extend this logic further, offering programmable, sovereign-controlled digital legal tender that can potentially settle cross-border trades with friendly nations or within blocs like BRICS. The advantage of centralized architectures lies in their legal clarity, scalability, and state-backed legitimacy, but their effectiveness ultimately depends on uptake by trade partners and global market confidence in these alternative currencies (Satre 15-16).

b) Decentralized: Crypto, DeFi, and Peer-to-Peer Systems

Decentralized architectures leverage public blockchain networks and peer-to-peer (P2P) platforms that operate without intermediaries or centralized authorities. Bitcoin, Ethereum, stablecoins such as USDT or USDC, and decentralized finance (DeFi) protocols enable participants to store and transfer value globally without passing through regulated banks or SWIFT channels. Sanctioned actors can exploit this censorship-resistant infrastructure to conduct transactions outside state or institutional scrutiny (Werner et al. 10). Examples include Iran's use of Bitcoin mining to monetize energy exports, North Korean cyber operations stealing and laundering billions in digital assets, and Nigeria's P2P markets that bypass official currency restrictions. These decentralized networks provide flexibility, anonymity, and resilience, but face limitations such as price volatility, on-chain traceability, and eventual reliance on fiat off-ramps where regulators may intervene (Brownworth 7).

c) Hybrid: Mix of State and Non-State Networks

Hybrid models combine centralized and decentralized tools to create more robust, multi-channel sanctions-resistance ecosystems. States may unofficially tolerate or even encourage private crypto use while simultaneously developing CBDCs or bilateral clearing arrangements. Venezuela's economy illustrates this hybridization, where informal stablecoin markets thrive alongside attempts to issue the Petro, a state-backed cryptocurrency. Iran's oil-for-Bitcoin trades coexist with plans for a digital trial and barter systems with allied nations. These hybrid approaches allow sanctioned states to hedge against reliance on a single network, exploit regulatory gray areas, and maintain layered access to global markets through both state-sanctioned and informal channels. Hybrid systems tend to be more adaptive, resilient, and capable of withstanding targeted disruptions by sanctioning authorities (Abdulkarim et al. 260-61).

Factors Driving Adoption: Political, Technological, Economic, and Cultural

The adoption and effectiveness of digital sanctions-resistance architectures depend on a complex interplay of domestic and external factors, rather than purely on technological availability. Nations under severe, long-term sanctions (such as Russia, Iran, North Korea, Venezuela) face existential pressures to secure financial autonomy. Even non-sanctioned powers like China pursue alternatives to dollar hegemony out of fear of future financial coercion. Political alignment with other sanctioned or "non-aligned" states can facilitate the creation of alternative networks and cooperative CBDC corridors (Ballis 5).

Domestic capacity for fintech innovation, blockchain development, cybersecurity, and data management determines how quickly alternative infrastructures can be built. China's years of investment in digital finance have enabled rapid CBDC progress, while weaker economies often rely on open-source blockchain solutions due to limited resources for bespoke platforms. A country's economic profile - whether it is a major energy exporter like Russia or an import-reliant nation like Iran - shapes the architecture it adopts. Commodity exporters may use tokenized energy or gold-backed stablecoins to trade outside Western finance, whereas others prioritize stablecoin adoption for essential imports (Satre 22). Access to trade partners willing to transact outside the dollar system is also critical for scaling resistance strategies.

Population-level digital literacy, societal trust in state institutions, and grassroots familiarity with cryptocurrencies influence which models gain traction. Nigeria's young, tech-savvy population has fueled P2P crypto markets, while other regions depend on state-managed solutions due to lower public adoption of decentralized tools (Akinsola et al. 152). Together, these factors create varied digital sanctions-resistance ecosystems, demonstrating that technological capability alone is not enough; political will, economic necessity, and social conditions are equally decisive in shaping responses to financial coercion.

Mapping the Architecture of Digital Resistance

Sanctions-resistance architectures represent a deliberate restructuring of financial networks by states and actors seeking to escape Western economic coercion (Toohey 45). By leveraging both state-driven solutions (CBDCs, national payment systems) and decentralized blockchain tools (cryptocurrencies, DeFi, P2P transactions), sanctioned nations are creating parallel infrastructures that diminish reliance on dollar clearing and SWIFT-based messaging (Böhme et al. 92). These architectures are not monolithic but vary across centralized, decentralized, and hybrid models, each with distinct advantages, vulnerabilities, and long-term implications for sanctions enforcement.

The drivers behind these systems are multifaceted: political pressures to safeguard sovereignty, technological capabilities to innovate alternative rails, economic imperatives tied to trade and resource exports, and cultural familiarity with digital finance (Toohey 48). As these factors converge, a new financial geography is emerging - one where Western sanctions may no longer have universal reach. Instead, global finance is moving toward a fragmented, multipolar order, where competing digital ecosystems coexist, interact, and increasingly challenge the efficacy of sanctions as a foreign policy tool. Understanding this evolving architecture is crucial not only for policymakers seeking to adapt sanctions strategies but also for scholars analyzing how technology is reshaping the power dynamics of international economic governance.

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4. CASE STUDIES: DIGITAL RESISTANCE AND EVASION TACTICS

Sanctions historically relied on centralized financial infrastructure, but digital technologies now enable diverse evasion strategies that reshape governance, power, and economic sovereignty (Farrell & Newman, 54; Prasad, 178). These dynamics are evident in nine states - Russia, China, Iran, Venezuela, North Korea, Nigeria, Turkey, the UAE, and India - each combining geopolitical pressures, technological capacity, and policy choices to insulate against sanctions or preempt future coercion (Klein; Ng et al., 12). Across cases, three patterns emerge:

1) State-controlled alternatives to Western payment rails, including domestic messaging systems, CBDCs, and commodity-backed tokens.

2) Use of decentralized, unregulated channels - P2P stablecoin markets, mining, mixers, and DeFi - to bypass chokepoints.

3) Regional and bilateral "digital corridors" creating parallel trade ecosystems beyond Western enforcement reach.

Russia's MIR and SPFS networks illustrate a full-scale, infrastructure-heavy approach, complemented by tokenized commodities and cross-border stablecoin settlements, including a gold-backed currency with Iran (Connolly, 88; Chohan, 6). China's e-CNY, CIPS, and Digital Silk Road projects steadily expand yuan denominated trade and embed Chinese digital infrastructure abroad, challenging U.S. dollar primacy (Auer et al., 9; Rolland, 65). Iran leverages Bitcoin mining, stablecoins, and barter-based blockchain trade with sanctioned allies (Moshirian et al., 33; Bozorgmehr & Fassihi). Venezuela's Petro failed to gain legitimacy, but grassroots P2P crypto adoption thrives as a hedge against hyperinflation (Ellsworth, 47; Grauer et al., 19). North Korea's Lazarus Group exemplifies illicit, cyber-enabled crypto theft for sanctions evasion, funding nuclear programs through sophisticated laundering tactics (UN Panel of Experts, 2023; Prasad, 21).

Nigeria blends a state-led CBDC (eNaira) with high-volume P2P crypto markets, balancing innovation and AML/CTF compliance (IMF, 2022; FATF, 2023). Turkey serves as a regional intermediary, with high domestic crypto adoption and CBDC plans, while facilitating trade between sanctioned and non-sanctioned economies (OECD, 2023). The UAE, a major crypto hub, attracts sanctioned capital despite FATF grey-listing, leveraging its position as a neutral trade and finance center (IMF, 2022; FATF, 2022). India, though unsanctioned, builds alternative settlement systems and participates in BRICS digital finance projects, balancing Western ties with engagement in non-dollar trade (RBI, 2023; BRICS, 2023).

These cases show that digital sanctions resistance is varied but converges around reducing reliance on Western-controlled systems, expanding decentralized settlement options, and forming non-dollar trade alliances (BIS, 2023; FATF, 2023). Together, they signal a shift toward a multipolar digital financial order, where sanctions may lose their traditional coercive edge and power will hinge on regulating and countering decentralized, fragmented payment networks (OECD, 2023; World Bank, 2023).

Digital Sanctions Evasion: Mechanisms and Constraints

Economic sanctions have long depended on centralized financial infrastructure - U.S.-dollar clearinghouses, correspondent banking, and SWIFT - to enforce economic isolation (Liu, 12). The rise of digital finance is eroding these chokepoints, creating decentralized, borderless, and lightly regulated channels that sanctioned actors can use to sustain access to global markets (FATF, 7; Velde, 3). While crypto's limited liquidity and the traceability of most blockchain transactions currently constrain large-scale state-level evasion - especially in high-volume sectors like oil and gas - technological advances are steadily expanding these options (Chainalysis, 15; TRM Labs, 22).

Peer-to-peer cryptocurrency markets and mixers are a foundation of this shift. In places like Nigeria, Venezuela, and Iran, P2P stablecoin trading bypasses currency controls, while mixers such as Tornado Cash - employed by North Korea's Lazarus Group - launder stolen crypto by obscuring its origins (Houben & Snyers, 28; TRM Labs, 19). These informal, decentralized channels replicate the role of traditional money transfer networks without relying on banks that enforce compliance. Decentralized finance (DeFi) adds further complexity by enabling borderless lending, borrowing, and asset swaps without intermediaries or identity checks. Funds can be fragmented across blockchains via cross-chain bridges and converted into stablecoins, while discussions in Russia and Iran about tokenizing oil or gold reserves point toward new, blockchain-based trade instruments beyond dollar settlement systems (FATF, 14; Velde, 9).

Other methods adapt traditional laundering tactics to the digital sphere. NFTs can be minted, overvalued, and traded between affiliated parties as a cover for moving funds; shell wallets and offshore-registered crypto firms provide additional layers of anonymity (Kafteranis, 45; Painter & Johnson, 112). Some states are building longer-term resilience through treasury diversification. Crypto mining in Iran,

Russia, and Venezuela monetizes energy surpluses into Bitcoin for international trade, while proposals for gold-backed stablecoins among BRICS members seek to create parallel reserves and payment systems resistant to Western leverage (Model & Smith, 78; Toohey, 67). Even humanitarian blockchain initiatives - such as aid wallets in conflict zones - can become dual-use channels, where legitimate transfers coexist with covert transactions, complicating enforcement without impeding relief (Lee & Patel, 32; Manning, 149).

Collectively, these mechanisms replace the binary "on/off" isolation model of sanctions with a patchwork of alternative pathways - some lawful, others illicit - that keep targeted states connected to global trade and finance (Painter & Johnson, 118). As adoption deepens, sanctions policy will depend on the ability to regulate and counter a decentralized, fast-evolving financial order (Manning, 150).

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5. SANCTIONS-PROOF DIGITAL ECONOMIES: GLOBAL SHIFTS, RISKS, AND GOVERNANCE CHALLENGES

For decades, sanctions have been enforced through centralized infrastructures - U.S.-dollar clearing, SWIFT, and multinational banks - that allowed the United States and allies to cut targets off from global finance without force (Toohey, 15; Painter & Johnson, 107; Manning, 140). Now, sovereign digital currencies, blockchain settlement systems, tokenized commodities, and alternative payment networks are eroding these chokepoints (Kafteranis, 42; Model & Smith, 74). This shift signals a move toward a fragmented, multipolar monetary order in which sanctions lose much of their traditional leverage.

The dollar's role as the global anchor - cemented by Bretton Woods, the petrodollar system, and U.S. control over commodity pricing - is being challenged by CBDCs, gold-backed stablecoins, and multi-CBDC platforms like mBridge (Model & Smith, 78; Crypto Council for Innovation, 2025). Major exporters could increasingly price and settle trade outside U.S. rails, leading to regionalized settlement hubs and a possible "Bretton Woods II" with multiple reserve currencies (Painter & Johnson, 109). While current volumes of sanctioned trade in crypto remain small and volatile (Painter & Johnson, 114), the direction of travel undermines unilateral sanctions' reach.

Sanctions-resistant digital networks also create national security and systemic risks. State-backed hackers, ransomware groups, and illicit networks use mixers, DeFi protocols, and privacy coins to launder funds, finance weapons programs, and evade oversight (U.S. Treasury, 22; Kafteranis, 55). Parallel payment systems fragment liquidity, complicate regulation, and increase exposure to unregulated markets - mirroring pre-2008 shadow banking vulnerabilities (Toohey, 28). Regulatory arbitrage across permissive jurisdictions magnifies systemic fragility (U.S. Treasury, 24). Blockchain-based aid systems in sanctioned or fragile states - such as UNICEF's CryptoFund - offer speed, transparency, and direct delivery to recipients (Kafteranis, 61). Yet these same channels can be exploited for sanctions evasion, creating an ethical bind: tighten oversight and risk harming civilians, or allow loopholes that weaken sanctions (Manning, 154; Model & Smith, 87).

Institutions like FATF, IMF, and BIS struggle to apply legacy AML/CTF frameworks to peer-to-peer transfers, DeFi, and sovereign digital currencies designed to bypass Western oversight (FATF, 14; Roth). Enforcement gaps - such as the inability to fully police privacy coins, chain-hopping, or immutable smart contracts - create safe zones for illicit finance (Chainalysis, 22; Zetzsche et al., 309). Meanwhile, "digital non-alignment" by emerging economies—exemplified by the UAE, Nigeria, and

Brazil - reshapes governance debates, with Global South states framing Western-led standards as protectionist (Tooze, 219; Subacchi, 88).

Democracies may need to pivot to smart sanctions using blockchain analytics, on-chain digital IDs, and targeted wallet restrictions to minimize collateral harm (Zarate, 143; Rosenberg et al., 58). A multilateral "Digital Bretton Woods" could set baseline rules for CBDC interoperability, stablecoin reserves, DeFi compliance, and data-sharing, paired with equitable incentives for Global South participation (Arner et al., 75; Prasad, 183). Technologists should develop privacy-preserving compliance tools and cross-chain forensics to balance innovation with enforcement (Zetzsche et al., 65). Researchers should expand empirical study of regional digital corridors, CBDC adoption, and humanitarian crypto's dual-use risks.

Sanctions-proof digital economies redistribute monetary power, dilute the coercive effect of sanctions, and complicate global governance (Tooze, 33; Bowe, 227). Without coordinated adaptation, sanctions risk becoming symbolic, financial stability will be more fragile, and humanitarian oversight more complex. The future of economic statecraft hinges on whether policymakers can forge interoperable, inclusive, and enforceable digital finance norms that preserve security while accommodating a decentralized, multipolar financial reality (Zetzsche et al., 69; Gkritzalis et al., 325).

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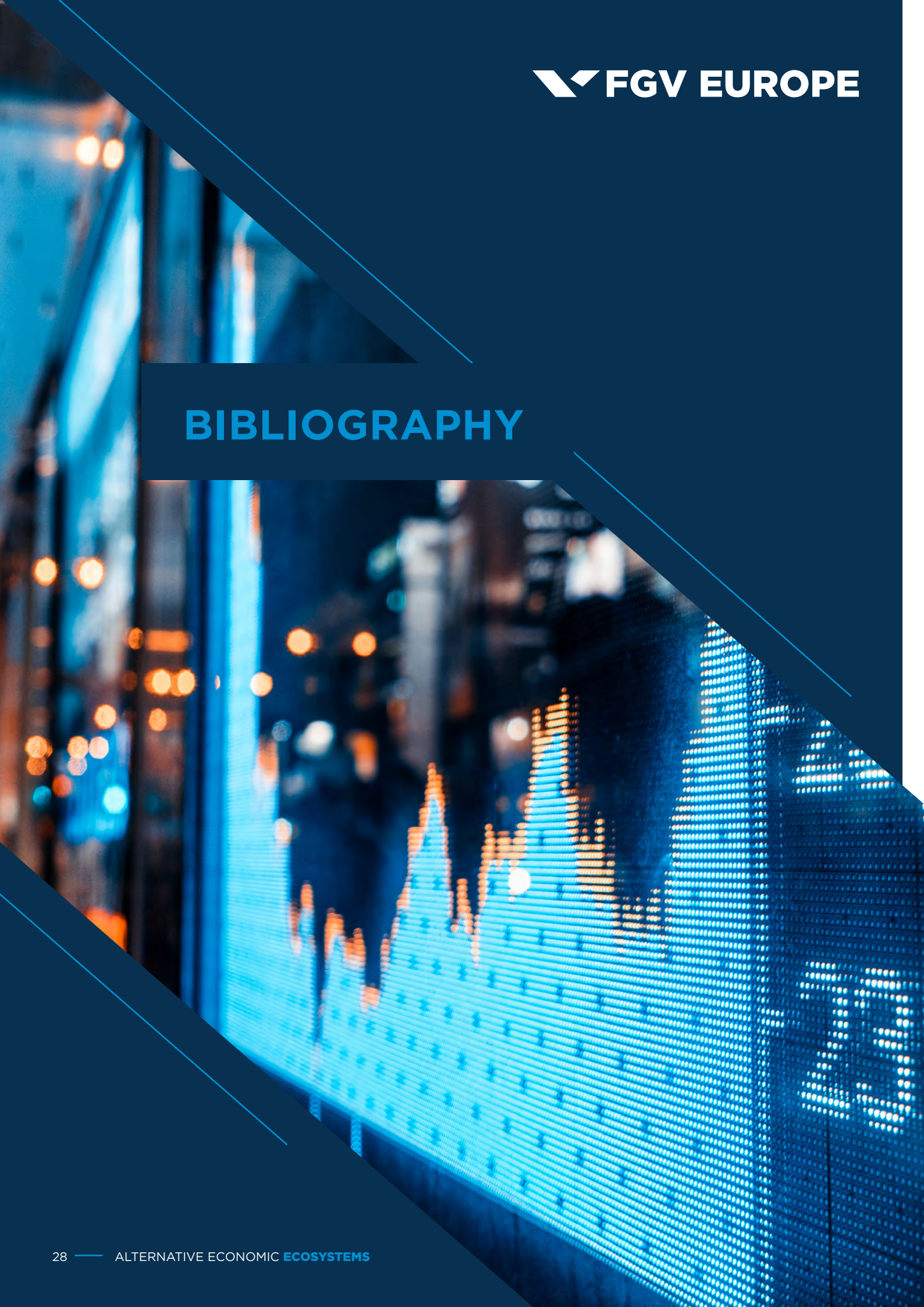

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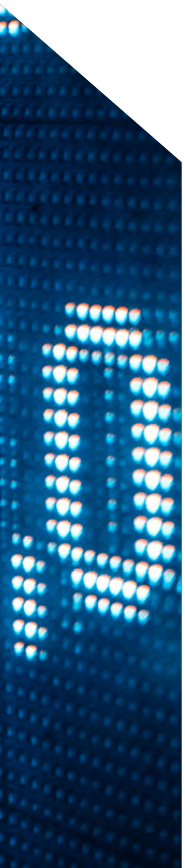

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