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Cryptocurrency's Inflation Tax and the Black Banking Solution: An OLG Approach

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Abstract

This paper develops an overlapping generations model to analyse the inflationary consequences of introducing cryptocurrency alongside fiat money in an economy with fixed real resources. We demonstrate that cryptocurrency introduction acts as a transfer mechanism from existing fiat holders to cryptocurrency creators, with inflation serving as the implicit tax that facilitates this transfer. Critically, we show that this welfare loss depends on institutional quality: while cryptocurrency imposes deadweight costs in strong-institution economies, it can provide genuine insurance value in jurisdictions experiencing hyperinflation or institutional failure. The paper then formalises Fischer Black's (1970) uncontrolled banking model and demonstrates how it can deliver all purported benefits of cryptocurrency without creating inflationary transfers through private seigniorage. We show that any genuine technological advantages of cryptocurrency can be achieved through competitive financial intermediation using existing units of account, eliminating the wealth transfer from fiat holders to cryptocurrency creators identified in the OLG cryptocurrency model. The analysis reveals cryptocurrency's dual nature: unnecessary rent extraction in high-quality institutional environments where superior alternatives exist, yet potentially welfare-improving in low-quality institutional settings where it serves as second-best protection against government predation.

Keywords: Cryptocurrency, Inflation tax, Private seigniorage, Overlapping generations, Uncontrolled banking.

JEL Classification Codes: E42, E52, G21, D82 , O33.

1 Introduction

When Bitcoin emerged in 2009, it promised a revolution in money: decentralised, inflation-proof, and free from government control. Today, thousands of cryptocurrencies claim similar benefits. But what actually happens when we introduce a new form of money alongside existing currency?

This paper answers that question using two complementary frameworks. First, we employ an overlapping generations (OLG) model to demonstrate a counterintuitive result: introducing cryptocurrency creates inflation in the traditional currency, effectively taxing existing money holders to benefit cryptocurrency creators. This isn't a bug—it's the core business model.

Second, we resurrect Fischer Black's neglected 1970 insight about "banking without money" to show that every legitimate benefit attributed to cryptocurrency—programmability, 24/7 operation, cross-border efficiency—can be achieved without creating new money at all. The implication is stark: cryptocurrency represents unnecessary rent extraction disguised as innovation.

2 Literature Review

Our paper contributes to several strands of literature: monetary theory applications to cryptocurrency, private money and currency competition, welfare analyses of digital currencies, and the revival of Fischer Black's uncontrolled banking framework. We demonstrate that cryptocurrency represents an unnecessary private seigniorage extraction mechanism when all its purported benefits can be achieved through competitive banking without new money creation.

2.1 Theoretical Foundations of Cryptocurrency Economics

The theoretical analysis of cryptocurrency has primarily built upon two foundational approaches in monetary economics. The Samuelson (1958) overlapping generations framework, developed by Wallace (1980) and extended by Tirole (1985) for asset bubbles, provides the backbone for understanding how intrinsically worthless assets can maintain positive value in equilibrium. Recent applications to cryptocurrency include Schilling and Uhlig (2019), who model Bitcoin alongside the US dollar in an endowment economy, demonstrating that cryptocurrency can sustain positive value in equilibrium despite lacking fundamental worth. However, their analysis focuses on equilibrium existence rather than welfare implications. Biais et al. (2023) extend this by incorporating mining economics in a continuous-time

model, finding multiple equilibria including a zero-value equilibrium that aligns with our welfare conclusions.

The search-theoretic approach, pioneered by Kiyotaki and Wright (1993) and unified by Lagos and Wright (2005), offers an alternative framework. Fernández-Villaverde and Sanches (2019) apply this to analyse currency competition with cryptocurrencies, concluding that price stability remains elusive even with competitive private money—a finding that complements our demonstration of cryptocurrency's inherent inefficiency. Their work shows that Hayek's vision of stable private money fails even under ideal conditions, while we go further to show that the entire enterprise of private money creation is unnecessary given Black's banking solution.

2.2 Private Money Creation and Seigniorage

The literature on private money creation provides crucial context for understanding cryptocurrency as a modern incarnation of historical phenomena. Cavalcanti and Wallace (1999) model private bank-note issue in a random matching framework, identifying conditions for efficient private money. Gorton (1999) examines the US free banking era empirically, documenting substantial inefficiencies from private note issue—evidence that history offers little support for unregulated private money creation.

Our contribution extends this literature by explicitly characterizing cryptocurrency as a sophisticated mechanism for private seigniorage extraction. While the traditional seigniorage literature, including modern treatments by Schmitt-Grohé and Uribe (2011), focuses on optimal government money creation, we demonstrate how cryptocurrency enables private actors to capture seigniorage rents traditionally reserved for sovereign authorities. This represents not innovation but rather a wealth transfer from existing money holders to cryptocurrency creators.

The stablecoin literature, particularly Gorton and Zhang (2023), reinforces our critique by drawing parallels between modern stablecoins and historical wildcat banking. Their call for narrow banking regulation aligns with our Black banking solution, though we go further in arguing that properly implemented competitive banking eliminates the need for any new monetary instruments, stable or otherwise.

2.3 Welfare Economics and Network Effects

The welfare implications of cryptocurrency adoption have received increasing attention, though often without explicit recognition of the seigniorage transfer mechanism. Cong, Li, and Wang (2021) develop a dynamic model of token adoption incorporating network effects,

arguing that tokens can facilitate platform development. Sockin and Xiong (2023) model cryptocurrency as membership in decentralised networks, emphasizing coordination benefits. However, both analyses fail to consider whether identical benefits could be achieved without new money creation.

Our paper fills this gap by demonstrating through Proposition 3 that cryptocurrency introduction cannot achieve Pareto improvement when it functions as a pure bubble asset. The network effects and platform benefits emphasised in the tokenomics literature, what we formalise as the technological benefits set B, can be fully realised through Black's competitive banking model without the deadweight loss of private seigniorage extraction. Budish (2018) approaches welfare from a different angle, analyzing the fundamental economic limits of blockchain security through proof-of-work. His demonstration of inherent inefficiencies in mining complements our broader critique: not only is the security mechanism wasteful, but the entire monetary innovation is unnecessary.

2.4 Fischer Black's Uncontrolled Banking: The Road Not Taken

Our contribution is reviving and applying Fischer Black's (1970) vision of banking without money creation—a framework surprisingly absent from cryptocurrency discussions despite its direct relevance. Black demonstrated that competitive banking could provide all payment system functions without any outside money, government or private. Fama (1980) independently developed similar insights, while Cowen and Kroszner (1994) synthesised this "New Monetary Economics" approach.

We extend Black's framework to show that every purported benefit of cryptocurrency decentralization, programmability, immutability, 24/7 operation, cross-border efficiency, and transparency—can be achieved through competitive financial intermediation using existing units of account. This isn't merely a theoretical possibility; current developments in banking APIs, real-time payment systems, and structured finance demonstrate the feasibility of Black banking in practice.

The central bank digital currency (CBDC) literature, including Brunnermeier, James, and Landau (2019) and Auer and Böhme (2020), explores digital money implementation, though typically assuming government issuance. Our Black banking approach suggests that CBDCs with open APIs could enable competitive provision of payment services without either government or private money creation—achieving the benefits while avoiding the costs identified in our OLG analysis.

Black's vision was part of a broader intellectual movement in the 1970s and 1980s exploring electronic payment systems without traditional money creation. Fama (1980, 1983)

independently developed the "New Monetary Economics," demonstrating that competitive payments systems could operate using purely inside money with a separated unit of account. His work on the "Banking in the Theory of Finance" showed that the accounting system of exchange could function without government currency, anticipating many features of modern electronic payment systems. Robert Hall (1982, 1983) extended these insights by proposing concrete electronic trading mechanisms. His work on "The Monetary System in the Year 2000" remarkably anticipated networked electronic transfers, automated clearing, and what we would now recognise as smart contract functionality, all operating with existing units of account rather than new currencies. Hall explicitly addressed the technological feasibility of electronic funds transfer systems that would eliminate the need for physical money while maintaining price stability through competitive provision of payment services.These early contributions are particularly striking because they envisioned the technological benefits now claimed by cryptocurrency, instant settlement, programmable money, reduced transaction costs, but recognised these could be achieved without creating new outside money. The tragedy is not that these ideas were wrong, but that they were forgotten when blockchain technology emerged, allowing cryptocurrency advocates to present rent extraction as innovation.

2.5 Fiscal and Monetary Policy Implications

The interaction between cryptocurrency and traditional monetary-fiscal policy extends the classic Sargent and Wallace (1981) "unpleasant monetarist arithmetic" in novel directions. While Sargent-Wallace focused on fiscal dominance of monetary policy, we identify what we term "unpleasant cryptocurrency arithmetic"—private money creation that generates inflation regardless of government policy, reduces sovereign seigniorage capacity, and potentially necessitates higher conventional taxation.

This connects to the broader literature on monetary policy effectiveness in the presence of currency substitution. Aiyagari and Gertler (1985) analyse government budget constraints with money, while more recent work examines how digital currencies affect monetary transmission mechanisms. Our contribution shows that cryptocurrency doesn't merely complicate monetary policy but actively worsens fiscal dominance problems by enabling private seigniorage extraction that provides no offsetting fiscal benefit.

2.6 Empirical and Experimental Evidence

While our theoretical analysis demonstrates cryptocurrency's inefficiency, empirical and experimental work provides supporting evidence. Garratt and Wallace (2018) conduct labo-

ratory experiments with multiple private currencies, finding inherent instability and coordination failures—results consistent with our theoretical predictions. Athey et al. (2016) empirically model Bitcoin adoption, finding that network effects drive value, though these same network effects could support Black banking solutions without new money creation. The growing literature on cryptocurrency's actual use reveals limited legitimate transaction demand relative to speculation. This empirical reality aligns with our Proposition 7's characterization of cryptocurrency as primarily a rent-extraction mechanism rather than a genuine monetary innovation.

2.7 Positioning Our Contribution

Our paper makes four distinct contributions to this literature. First, we provide the first explicit formalization of cryptocurrency as a private seigniorage extraction mechanism, demonstrating through an OLG model how this creates an inflation tax borne by existing money holders. Second, we uniquely apply Black's (1970) uncontrolled banking framework to show that all technological benefits attributed to cryptocurrency can be achieved without new money creation. Third, we extend the Sargent-Wallace fiscal dominance framework to incorporate private money creation, revealing how cryptocurrency worsens rather than alleviates monetary-fiscal tensions. Fourth, we provide a concrete implementation blueprint for achieving cryptocurrency's benefits through competitive banking. While Fernández-Villaverde and Sanches (2019) show that private currency competition cannot deliver price stability, we demonstrate the stronger result that private money creation is entirely unnecessary. Where Schilling and Uhlig (2019) focus on equilibrium existence, we emphasise welfare implications. Unlike the tokenomics literature that takes new token creation as given, we question this fundamental premise. Our analysis suggests that the persistence of cryptocurrency despite its inefficiency reveals not market failure but successful rent extraction by early adopters—the inflation tax we identify is not a bug but the central feature of the cryptocurrency phenomenon.

3 The Basic Economic Problem

Consider an economy that produces a fixed amount of goods each period—say, 100 units of output. This output must be divided between young workers (who produce it) and retirees (who saved when young). The monetary system facilitates this intergenerational transfer: young workers accept money for their production, expecting to spend it when retired.

In equilibrium with traditional fiat money:

- Young generation produces 100 units
- They consume 60 units, save 40 units (as money)
- Old generation spends their money to consume 40 units
- Total consumption: $60 + 40 = 100$ (market clears)

Now suppose cryptocurrency is introduced. Young workers can now save in two forms: traditional dollars and Bitcoin. But here's the crucial point: **the economy still only produces 100 units of goods**. What changes? The price level must adjust. If young workers collectively hold \$40 in dollars plus \$10 worth of Bitcoin (at current exchange rates), they're trying to claim the same 40 units of future consumption. When they retire and try to spend these savings, there are still only 100 units available. The result: prices rise by 25% (from \$40 of money to \$50 of total monetary assets chasing the same goods).

When cryptocurrency is introduced alongside fiat money in an economy with fixed real resources, the monetary expansion can generate inflationary pressures. This paper formalises this intuition using an overlapping generations (OLG) framework, revealing how cryptocurrency introduction engineers transfers through the inflation tax mechanism. Fischer Black's seminal insight was that optimal monetary arrangements could emerge through competitive banking without government money creation or control. Applied to the cryptocurrency debate, this framework reveals that all legitimate benefits of cryptocurrency could be achieved without creating new outside money and its associated inflation tax.

4 OLG Model

4.1 Basic OLG Setup with Dual Currencies

Consider a simple two-period OLG model where each generation lives for two periods (young and old), with population normalised to 1 per generation. Young agents receive endowment y of the consumption good. Old agents receive no endowment. Agents have regular, time separable utility function: $U(c_t^y, c_{t+1}^o) = u(c_t^y) + \beta u(c_{t+1}^o)$. Available assets in the economy are fiat money M_t with price level P_t (price of goods in fiat) and cryptocurrency with supply K_t and exchange rate Q_t (units of fiat per cryptocurrency).

The young agent maximises lifetime utility subject to budget constraints:

$$\max_{c_t^y, c_{t+1}^o, M_t^d, K_t^d} \quad u(c_t^y) + \beta u(c_{t+1}^o) \tag{1}$$

subject to:

Period t (young):

$$c_t^y + \frac{M_t^d}{P_t} + \frac{Q_t K_t^d}{P_t} = y \tag{2}$$

Period $t+1$ (old):

$$c_{t+1}^o = \frac{M_t^d}{P_{t+1}} + \frac{Q_{t+1} K_t^d}{P_{t+1}} \tag{3}$$

The optimization yields the following first-order-conditions:

For fiat money holdings:

$$u'(c_t^y) = \beta u'(c_{t+1}^o) \frac{P_t}{P_{t+1}} \tag{4}$$

For cryptocurrency holdings:

$$u'(c_t^y) = \beta u'(c_{t+1}^o) \frac{Q_{t+1} P_t}{Q_t P_{t+1}} \tag{5}$$

The market equilibrium conditions are:

Goods market: With fixed real resources y:

$$c_t^y + c_t^o = y \tag{6}$$

Money market equilibrium:

$$M_t^d = M_t \tag{7}$$

cryptocurrency market equilibrium:

$$K_t^d = K_t \tag{8}$$

In the steady state where $M_t = M_{t-1} = M$, $K_t = K_{t-1} = K$, and prices are constant, the first-order conditions imply equal returns across assets:

$$\frac{Q_{t+1}}{Q_t} = 1 \tag{9}$$

The total real value of assets held by the young equals their savings[1]:

$$\frac{M + QK}{P} = y - c^y \tag{10}$$

[1]For standard parameter values (e.g., when the elasticity of marginal utility is less than unity), the monetary equilibrium is unique and exhibits saddle-path stability. We omit the formal stability analysis as it follows standard results in the OLG literature.

4.2 Dynamic Adoption Path

While the steady-state analysis above assumes cryptocurrency has achieved some equilibrium acceptance, we must address how cryptocurrency transitions from zero to positive value. We incorporate a simple acceptability dynamics that captures the coordination nature of monetary adoption without the full complexity of search models.

Let $\alpha_t \in [0, 1]$ denote the fraction of the young generation willing to accept cryptocurrency at time t. The evolution of acceptability follows:

Adoption dynamics:

$$\alpha_{t+1} = \alpha_t + \lambda[\mathcal{V}(\alpha_t) - c]_+ \tag{11}$$

where $\mathcal{V}(\alpha_t) = \alpha_t^\gamma$ represents network value ($\gamma > 1$ captures increasing returns), c is the cost of adoption (technical, cognitive, or regulatory), λ is the speed of adjustment, and $[\cdot]_+ = \max(\cdot, 0)$.

Effective cryptocurrency supply in circulation:

$$\tilde{K}_t = \alpha_t K_t \tag{12}$$

Only the fraction α_t of total cryptocurrency supply K_t effectively circulates as money.

Modified young agent's problem:

The young agent now faces uncertainty about cryptocurrency acceptability when old:

$$\max u(c_t^y) + \beta \mathbb{E}[u(c_{t+1}^o)] \tag{13}$$

Subject to:

$$\text{Period } t: \quad c_t^y + \frac{M_t^d}{P_t} + \frac{\alpha_t Q_t K_t^d}{P_t} = y \tag{14}$$

$$\text{Period } t+1: \quad c_{t+1}^o = \frac{M_t^d}{P_{t+1}} + \frac{\alpha_{t+1} Q_{t+1} K_t^d}{P_{t+1}} \tag{15}$$

The crucial feature is that cryptocurrency is only useful to the extent it's accepted (α_{t+1}).

Price level dynamics:

The price level now evolves according to:

$$P_t = P_{\text{pre-crypto}} \times \frac{M_t + \alpha_t Q_t K_t}{M_t} \tag{16}$$

This shows the inflation tax emerges gradually as adoption spreads:

- When $\alpha_0 = 0$: No inflation effect

- As $\alpha_t \to \alpha^*$: Full inflation tax as in equation (13)

4.3 Multiple Equilibria and Bootstrap Problem

The adoption dynamics generate multiple equilibria:

Proposition 1 (Extended - Dynamic Adoption)**.** *For $c < 1/\gamma$, the dynamic system has:*

1. *A stable no-adoption equilibrium: $\alpha = 0$, $Q = 0$*
2. *A stable positive equilibrium: $\alpha^* > 0$, $Q^* > 0$*

The positive equilibrium satisfies:

$$\alpha^* = \left[\frac{1 + \sqrt{1 - 4c/\gamma}}{2}\right]^{1/(\gamma-1)} \tag{17}$$

Bootstrap mechanisms: Proposition 1 establishes the existence of both zero and positive equilibria, but leaves open how the economy might coordinate on the latter. In practice, cryptocurrency escapes the zero equilibrium through several channels. Ideological adopters serve as the initial spark—early users who derive non-monetary utility from cryptocurrency adoption, such as participants in darknet markets or those motivated by libertarian ideology. Speculative bubbles provide momentum, as agents buy based on expected future appreciation rather than current utility. Finally, exogenous shocks can trigger the transition from the zero to positive equilibrium, particularly financial crises that reduce trust in fiat currency and create demand for alternative monetary arrangements.

4.4 Transition Path and Welfare Dynamics

The inflation tax identified in Lemma 1 now emerges dynamically:

Lemma 1 (Dynamic Capital Loss)**.** *At each time t with increasing adoption ($\alpha_t > \alpha_{t-1}$), existing fiat holders suffer a marginal loss:*

$$Loss_t = \frac{M}{P_{t-1}} \times \frac{(\alpha_t - \alpha_{t-1})QK}{M + \alpha_t QK} \tag{18}$$

The cumulative loss over the transition path from $\alpha = 0$ to $\alpha = \alpha^*$ equals:

$$Total\ Loss = \int_0^{\alpha^*} \frac{M}{P(\alpha)} \times \frac{QK\, d\alpha}{M + \alpha QK} \tag{19}$$

This reveals the inflation tax is not a one-time event but accumulates throughout the adoption process.

As $t \to \infty$, if the system converges to a steady state with $\alpha^* > 0$, we recover the steady-state analysis:

- Effective cryptocurrency in circulation: $\tilde{K} = \alpha^* K$
- Steady-state price level: $P^* = P_{\text{pre}} \times \frac{M+\alpha^* QK}{M}$
- Total transfer to cryptocurrency creators: $\frac{\alpha^* QK}{P^*}$

The key insight is that **even if cryptocurrency is fundamentally inefficient** (as we show via Black banking), it can achieve positive value through coordinated adoption, generating the welfare losses identified in our main analysis.

5 The Inflationary Effect

We can now present the main result of the first part of the paper.

Proposition 2 (Inflation from cryptocurrency Introduction)**.** *The introduction of cryptocurrency alongside fiat money leads to a proportional increase in the price level.*

Proof. Compare two economies:

Economy without cryptocurrency ($K = 0$):

$$\frac{M}{P_{\text{fiat only}}} = y - c^y \tag{20}$$

Economy with cryptocurrency ($K > 0$):

$$\frac{M + QK}{P_{\text{with crypto}}} = y - c^y \tag{21}$$

Since savings ($y - c^y$) is determined by preferences and returns, maintaining the same steady-state consumption allocation requires:

$$P_{\text{with crypto}} = P_{\text{fiat only}} \cdot \frac{M + QK}{M} > P_{\text{fiat only}} \tag{22}$$

□

When cryptocurrency is introduced at time $t = 0$, existing fiat holders experience a capital loss.

Lemma 2 (Capital Loss to Fiat Holders)**.** *The old generation at $t = 0$ suffers a real wealth loss equal to:*

$$Loss = \frac{M}{P_{pre}} - \frac{M}{P_{post}} = \frac{M}{P_{pre}} \left(1 - \frac{M}{M + QK}\right) = \frac{M}{P_{pre}} \cdot \frac{QK}{M + QK} \tag{23}$$

This loss exactly equals the real value of newly created cryptocurrency, representing a pure transfer from existing fiat holders to cryptocurrency recipients. The transfer can be characterised as an implicit tax:

Definition 1 (cryptocurrency-Induced Inflation Tax)**.** The tax rate on existing fiat holdings is:

$$\tau = \frac{P_{\text{post}} - P_{\text{pre}}}{P_{\text{post}}} = \frac{QK}{M + QK} \tag{24}$$

Key features of this tax: **Tax base:** All existing fiat money holdings; **Tax revenue:** $\frac{QK}{P_{\text{post}}}$ (real value of cryptocurrency); and **Tax recipients:** Initial cryptocurrency endowment holders (miners, developers, early adopters). The inflation from cryptocurrency introduction isn't neutral, it creates clear winners and losers. When cryptocurrency is introduced at time $t = 0$, anyone holding dollars suffers an immediate capital loss.

Example: Suppose you're retired with $1000 in savings when cryptocurrency is introduced. Before cryptocurrency, prices are such that your $1000 buys 40 units of goods. After cryptocurrency introduction raises prices 25%, your $1000 only buys 32 units. You've lost 20% of your purchasing power.

The total loss to existing money holders equals:

$$\text{Loss} = \frac{M}{P_{\text{pre}}} - \frac{M}{P_{\text{post}}} = \frac{M}{P_{\text{pre}}} \times \frac{QK}{M + QK} \tag{25}$$

This exactly equals the real value of newly created cryptocurrency! The winners from this tax are those who receives the cryptocurrency initially. These are miners, who receive new Bitcoin for validating transactions; developers who often pre-mine or reserve tokens; early adopters who buy at near-zero prices before widespread adoption; exchanges and intermediaries, who earn tokens through various mechanisms. These groups capture the real resources lost by existing money holders, a pure transfer.

6 Welfare Analysis

The welfare consequences of the above are very straightforward. Consider the Pareto implications:

Proposition 3 (No Pareto Improvement)**.** *If cryptocurrency provides no technological advantage over fiat (pure bubble asset), its introduction cannot achieve a Pareto improvement.*

Proof. The old generation at $t = 0$ strictly loses (capital loss on fiat holdings). Future generations achieve the same steady-state utility (same real allocations). Only cryptocurrency recipients gain, exactly offsetting losses to fiat holders

□

A striking paradox emerges. Cryptocurrency is often promoted as protection against fiat debasement, yet its introduction itself debases fiat through inflation protection only benefits early adopters who convert before price adjustment. Late adopters and persistent fiat holders bear the inflation cost.

The OLG framework reveals that introducing cryptocurrency alongside fiat money in an economy with fixed resources generates inflation through monetary expansion. This inflation acts as an implicit tax, facilitating transfers from existing fiat holders to cryptocurrency creators. The mechanism parallels traditional seigniorage but with private rather than public beneficiaries, potentially worsening fiscal dominance problems and creating distributional consequences that contradict cryptocurrency's stated purpose as inflation protection.

6.1 Institutional Quality and Welfare Heterogeneity

The welfare analysis above implicitly assumes stable institutions and credible fiat currency. However, cryptocurrency's welfare implications depend critically on institutional quality. Define parameter $\theta \in [0, 1]$ capturing rule of law, central bank credibility, and banking system soundness. This parameter affects two key dimensions: government inflation tax $\tau_{gov}(\theta)$ (rising as institutions weaken, reaching 50–100%+ in hyperinflationary episodes) and cryptocurrency's institutional insurance value $B_{trust}(\theta)$ (rising as institutions deteriorate, capturing protection from asset seizures, capital controls, and banking system collapse). Proposition 3's result that cryptocurrency cannot achieve Pareto improvement applies when θ is high—in strong-institution economies like Canada or Switzerland, where government inflation remains 2–3% annually and banking systems function reliably. However, for low-θ economies experiencing hyperinflation or banking crises, the welfare comparison reverses: cryptocurrency's 2–3% effective inflation tax becomes strictly preferable to government predation, and permissionless access provides the only viable escape when banking systems freeze deposits.

Empirical patterns support this institutional contingency. The Chainalysis Global cryptocurrency Adoption Index shows highest adoption in Nigeria ($\theta \approx 0.35$), Vietnam ($\theta \approx 0.45$), and Philippines ($\theta \approx 0.50$), all countries with weak banking systems, high inflation,

or capital controls, while adoption remains minimal in high-θ jurisdictions despite greater wealth and technological sophistication. The cryptocurrency premium phenomenon provides further evidence: Bitcoin trades at 10–20% premiums in Argentina and Nigeria precisely because it provides escape from local currency collapse, while no such premium exists in stable currency zones. Our model predicts these patterns through the $B_{trust}(\theta)$ term, which captures genuine welfare gains from censorship resistance when θ is low. Critically, this doesn't rehabilitate cryptocurrency in high θ economies, it clarifies that our rent-extraction critique applies precisely where institutions function well enough to make alternatives feasible, as we demonstrate in Section 8 through Black's competitive banking framework.

This institutional heterogeneity has stark policy implications: optimal cryptocurrency regulation cannot be universal. For high-θ jurisdictions, our prescription will be to implement superior alternatives (detailed in Sections 8–11) and restrict cryptocurrency as speculative commodity since τ_{crypto} represents pure deadweight loss. For low-θ jurisdictions, attempting prohibition is both unenforceable and counterproductive when government fiat imposes inflation taxes orders of magnitude larger. The framework resolves the core tension in cryptocurrency debates: advocates point to Venezuela while critics analyse Canada, but both are correct within their institutional context. The fundamental insight that cryptocurrency's claimed benefits can be achieved without creating new outside money, applies when institutions enable such alternatives, but institutional quality itself varies dramatically across countries.

6.2 Dollarisation and Political Constraints

A natural question arises: why don't low θ economies simply dollarise rather than adopt cryptocurrency? While dollarization would theoretically dominate cryptocurrency (eliminating local inflation while avoiding cryptocurrency's volatility and inefficiency), it requires government cooperation that often does not materialise. Governments presiding over institutional failure are precisely those least willing to surrender monetary sovereignty. Venezuela discussed dollarisation for two decades while actively resisting implementation; Argentina has debated it since the 1989 hyperinflation without success; Lebanon's banking crisis continues without serious dollarisation efforts despite widespread unofficial dollar use. When dollarisation is most necessary (institutional failure), it is also least politically feasible. Then cryptocurrency's advantage is not economic efficiency but political feasibility, while dollarisation needs parliamentary approval, cryptocurrency adoption proceeds spontaneously through individual choice. Hence, in low θ economies, the relevant comparison is not between cryptocurrency and optimal alternatives like dollarisation or Black banking, but between cryp-

tocurrency and continuing to suffer under failed monetary institutions while waiting indefinitely for political reform. Cryptocurrency's role as accessible second-best protection becomes genuinely welfare-improving, even as our analysis confirms it would be unnecessary in well-functioning institutional environments where Black banking could flourish.

7 Cryptocurrency's Claimed Benefits

Proponents claim cryptocurrency provides:

Definition 2 (Technological Benefits)**.**

$$\begin{aligned}\mathcal{B} = \{&\text{Decentralization}, \text{Programmability}, \text{Immutability},\\ &\text{24/7 Operation}, \text{Cross-border efficiency}, \text{Transparency}\}\end{aligned}$$

We now show each element of $\mathcal{B}$ can be achieved without creating new outside money. Consider a network of competitive banks using distributed ledger technology:

Transaction recording:

$$T_{ij}^t = \text{Transfer from } i \text{ to } j \text{ at time } t \text{ in existing units} \tag{26}$$

Consensus mechanism:

$$V(T_{ij}^t) = \begin{cases} 1 & \text{if majority of nodes validate} \\ 0 & \text{otherwise} \end{cases} \tag{27}$$

Crucially, validation rewards are paid in **transaction fees in existing money**, not newly created tokens:

$$R_{\text{validator}} = \sum_{T \in \text{Block}} f(T) \tag{28}$$

where $f(T)$ is the fee for transaction T paid in dollars/euros, not in newly minted coins.

Next consider the role of smart contracts without new currency. Smart contracts can execute using existing monetary units:

$$S : \{X_t, \theta\} \to \{P_1, P_2, ..., P_n\} \tag{29}$$

where $X_t =$ State variables at time t; $\theta =$ contract parameters; and $P_i =$ payments in existing currency to party i.

Example: A decentralised exchange (DEX) can operate with dollar-denominated tokens:

$$\text{Trade: } \alpha \cdot \text{USD-Token}_A \leftrightarrow \beta \cdot \text{USD-Token}_B \tag{30}$$

there is no need for ETH or other native tokens - fees paid in USD-denominated stablecoins.

8 Connection to Fiscal Dominance Theory

8.1 Parallel to Seigniorage

The cryptocurrency-induced inflation parallels traditional seigniorage but with crucial differences:

Aspect	**Traditional Seigniorage**	**cryptocurrency Seigniorage**
Money creator	Government/Central Bank	Private actors
Revenue recipient	Government	cryptocurrency creators
Policy control	Monetary authority	Decentralised/None
Fiscal impact	Reduces deficit	No fiscal benefit

Following the Sargent-Wallace (1981) unpleasant monetarist arithmetic logic, cryptocurrency introduction creates what we term "unpleasant cryptocurrency arithmetic":

Proposition 4 (Unpleasant cryptocurrency Arithmetic)**.** *Private money creation through cryptocurrency:*

1. *Generates inflation regardless of government monetary policy*
2. *Reduces government seigniorage capacity*
3. *May require higher conventional taxes or debt issuance to maintain fiscal balance*
4. *Worsens the fiscal dominance problem (identified by Sargent and Wallace as non-Ricardian) by constraining monetary policy effectiveness*

Consider the parallel between QE and cryptocurrency introduction:

$$\Delta P = P \cdot \left(\frac{\Delta M_{\text{QE}} + \Delta(QK)}{M} \right) \tag{31}$$

Both QE-created reserves and privately-created cryptocurrency expand the effective monetary aggregate, but with different seigniorage beneficiaries. Following the extended Sargent-Wallace framework with investment quality θ:

$$\frac{P_{t+1}}{P_t} = \frac{1 + r(1-\mu)}{1+g} \cdot \frac{B_t + M_t + Q_t K_t}{M_t + Q_t K_t} \tag{32}$$

cryptocurrency introduction increases the denominator, potentially requiring higher μ (better investment quality) to maintain price stability.

9 Black's Uncontrolled Banking Model

In 1970, economist Fischer Black proposed a radical idea: we don't need money at all. His "uncontrolled banking" model shows how all payment system functions can work without anyone creating new money.

Following Black (1970), consider an economy with no government-issued outside money; competitive banks offering payment services; and a numeraire unit of account (could be gold, a commodity basket, or abstract unit, Black suggested a barrel of oil). There is complete freedom of financial contracting

In Black's model, without outside money, the payment system operates through:

Bank deposits serving as means of payment:

$$D_i^j = \text{Deposits of agent } i \text{ at bank } j \tag{33}$$

Clearing mechanism among banks:

$$\sum_i D_i^j = L^j + Z^j \tag{34}$$

where L^j represents bank j's loans and Z^j its capital.

Interest rate determination through competition:

$$r_d = r_l - m \tag{35}$$

where r_d is deposit rate, r_l is loan rate, and m is the competitive margin for payment services.

Proposition 5 (Black's Efficiency Result)**.** *In competitive equilibrium with uncontrolled banking:*

1. *The payment system operates without outside money*
2. *No seigniorage (public or private) is extracted*
3. *All gains from financial innovation flow to users*

4. The price level is determinate through the numeraire

In this model, competition ensures efficiency. With free entry in banking: innovation benefits flow to users (not seigniorage to money creators); payment services are priced at marginal cost; there is no inflation tax; and the price level is stable (determined by unit of account).

Competitive banks in Black's model clear all transactions immediately, eliminating the overnight money market and its associated inefficiencies:

$$\text{Settlement}_{ij}^{t}: \quad D_i^j(t) \to D_i^j(t^+) \text{ instantaneously} \tag{36}$$

Without settlement delays, there is no overnight funding requirement: $Reserves^{overnight} = 0$; no settlement risk premium in margin m; and no central bank liquidity provision is needed. This reduces the competitive margin to purely operational costs:

$$m = m_{operational} \text{ only, excluding } m_{settlement} + m_{reserves} + m_{risk} \tag{37}$$

The welfare gain from immediate clearing is:

$$\Delta W_{clearing} = \int_0^N (m_{traditional} - m_{Black}) \cdot D_i di > 0 \tag{38}$$

10 OLG Model with Black Banking

We now formalise our arguments. Here, we modify our earlier OLG framework to include Black's competitive banking:

Young agent's budget constraint:

$$c_t^y + s_t = y \tag{39}$$

where s_t represents savings through competitive banks (not money holding).

Old agent's consumption:

$$c_{t+1}^o = s_t(1 + r_{t+1}) \tag{40}$$

Market clearing:

$$c_t^y + c_t^o = y \tag{41}$$

In this economy, there is no exchange involving the intermediary of outside money. Agents engage in direct or indirect barter, facilitated by financial intermediaries (banks) that help

coordinate exchanges and manage credit.All transactions are credit-based. Banks are intermediaries: they record and clear obligations between agents. Prices exist, but they are not denominated in money; rather, they reflect relative values of goods/services.Markets clear via netting of obligations, not cash payments.

A parallel electronic ledger can be seen as a technological realisation of the record-keeping function that banks perform in Black's model. The ledger acts as a universal clearinghouse. The ledger replaces or augments the role of banks in recording obligations. Each agent has an account on the ledger, which tracks claims and liabilities (credit/debt positions) and ownership of goods (tokenised representations). Transactions are settled by updating these records, not by transferring money. Goods exchange takes place via smart contracts. Agents post offers to exchange goods or services. Matching algorithms (possibly decentralised) pair buyers and sellers. Smart contracts enforce the terms of trade, ensuring delivery and updating the ledger accordingly. Prices are expressed in numéraire goods or composite indices, not in money. The ledger can compute and update relative prices dynamically based on supply and demand, akin to a Walrasian tâtonnement process. Finally, the ledger can encode reputation systems or collateral mechanisms to manage credit risk. Agents can extend credit to each other, with the ledger tracking obligations and enforcing repayment via future claims on goods or services.

Proposition 6 (No Inflation Tax with Black Banking)**.** *Under Black's system:*

1. *Price level is stable (determined by numeraire)*
2. *No wealth transfer between generations*
3. *All technological benefits $\mathcal{B}$ are achieved*
4. *Welfare is weakly higher than with cryptocurrency*

Proof. No change in money supply $\Rightarrow$ no inflation. No seigniorage extraction $\Rightarrow$ no transfer. Competition ensures innovation benefits flow to users. This avoids the inflation tax $\Rightarrow$. Hence, there is a Pareto improvement over crypto. □

This shows that the unit of account function of money can be separated from the medium of exchange function, we can have price determination (through the numeraire) and payment services (through competitive banking) without anyone creating outside money.

Next we can make a direct welfare comparison. Let W^{crypto} and W^{Black} denote social welfare under each system, then

Proposition 7 (Welfare Dominance)**.**

$$W^{Black} \geq W^{crypto} \tag{42}$$

with strict inequality if cryptocurrency has positive market value.

Proof. Under cryptocurrency (from our earlier model):

$$W^{\text{crypto}} = W^{\text{autarky}} - \underbrace{\frac{QK}{P} \cdot L(P)}_{\text{Deadweight loss from inflation}} \tag{43}$$

Under Black's system:

$$W^{\text{Black}} = W^{\text{autarky}} + \underbrace{B(\mathcal{B})}_{\text{Benefits from innovation}} - \underbrace{0}_{\text{No inflation tax}} \tag{44}$$

Since $B(\mathcal{B}) \geq 0$ and the inflation tax is eliminated:

$$W^{\text{Black}} - W^{\text{crypto}} = B(\mathcal{B}) + \frac{QK}{P} \cdot L(P) > 0 \tag{45}$$

□

11 Implementation: Modern Black Banking

Fischer Black's vision of banking without money creation can be implemented using current technology. We outline pathways that achieve cryptocurrency's benefits without creating new outside money.

11.1 Network Coordination and Existing Monetary Conventions

Black banking achieves network effects without coordination costs by leveraging existing monetary conventions. While cryptocurrency must bootstrap acceptance of a new unit of account, requiring the complex dynamics described in Section 4.2, competitive banking simply offers improved services for units everyone already accepts. The coordination requirements differ fundamentally:

- **Cryptocurrency**: Must solve $\alpha_t = 0 \Rightarrow \alpha_{t+1} = 0$ through elaborate bootstrap mechanisms
- **Black banking**: Exploits existing $\alpha \equiv 1$ for established currency units

The network emerges through technical standardization (APIs, clearing protocols), not monetary coordination. This explains the rapid adoption of systems like India's UPI (10 billion monthly transactions within 7 years) compared to Bitcoin's slower monetary coordination.

11.2 The Competitive Advantage of Zero Seigniorage

The absence of seigniorage in Black banking creates a fundamental competitive advantage over cryptocurrency. Every cryptocurrency transaction implicitly pays for past and future seigniorage extraction. Bitcoin's $1 trillion market cap represents $1 trillion of purchasing power transferred from users to early adopters and miners. Black banking eliminates this deadweight cost entirely.

Consider the competitive dynamics: Two payment systems compete for a merchant's business:

- Cryptocurrency: 2-3% transaction fee + implicit seigniorage tax $\tau = \frac{QK}{M+QK}$
- Black banking: 0.1-0.5% transaction fee + zero seigniorage

The seigniorage burden compounds over time. Each new cryptocurrency user subsidises all previous adopters, making the system progressively less competitive as adoption grows—the opposite of typical network effects where costs decrease with scale. This leads to the inevitability of competitive displacement: in competitive markets, zero-seigniorage systems must eventually displace positive-seigniorage alternatives, just as index funds (low fees) inevitably displace actively managed funds (high fees) for comparable services. The only barrier is information asymmetry and coordination—precisely what Section 11.1's network discussion addresses.

11.3 Technical Architecture

A complete Black banking system requires three integrated layers, all operating with existing currency units. The base layer consists of digital fiat, whether implemented as a central bank digital currency or tokenised bank deposits, providing the foundation for all transactions. Built upon this foundation, a competitive services layer emerges where multiple providers offer smart contracts, programmable payments, instant settlement operating continuously, cross-border transfers, and varying degrees of transparency based on user preferences. The settlement layer completes the architecture through validation mechanisms funded entirely by transaction fees paid in existing currency, avoiding any new token creation while maintaining distributed consensus through mutual clearing among competitive banks. This architecture achieves decentralization through competition rather than blockchain consensus, programmability through open APIs rather than Ethereum's virtual machine, and efficiency through market forces rather than mining incentives. The key insight is that none of these features require creating new money; they simply require competitive provision of services denominated in existing units of account.

11.4 Reformed Stablecoin Networks

Current stablecoins partially implement Black banking through one-to-one fiat backing, where USDC and USDT maintain dollar reserves equal to their token supply. However, these systems suffer from requiring native blockchain tokens for gas fees, creating dual-layer rent extraction.[2] Users must hold volatile cryptocurrencies like ETH or SOL simply to pay gas fees when transferring stable dollars, generating forced demand for platform tokens beyond their monetary function.. A proper implementation would denominate all fees directly in the stablecoin itself, eliminating this hidden seigniorage tax while preserving blockchain's operational benefits. The equation becomes simply that total transaction costs equal fees paid in USD stablecoins, with no additional token requirements.

11.5 Real-World Implementation Paths

Several jurisdictions already demonstrate the feasibility of Black banking principles. India's Unified Payments Interface processes ten billion monthly transactions without creating new money, instead facilitating instant transfers between existing bank accounts. Brazil's PIX enables instant payments twenty-four hours a day using existing currency rather than cryptocurrency. The European Union's Payment Services Directive 2 mandates open banking APIs that could support Black-style competition among payment providers. In the United States, the Federal Reserve's FedNow system combined with open API requirements could provide the foundation for competitive payment services without new money creation. The transition to Black banking requires only regulatory enablement of open banking standards and API standardization across financial institutions. The technology exists and has been proven at scale. What remains missing is widespread recognition that payment innovation doesn't require monetary innovation. Black solved this problem in 1970, yet the cryptocurrency phenomenon represents not progress but rent-seeking regression, extracting private seigniorage under the guise of technological advancement. The persistence of this inefficiency when superior alternatives exist reveals the true nature of cryptocurrency as a transfer mechanism rather than a genuine innovation in monetary arrangements.

[2]Gas fees are transaction costs required on Ethereum and similar blockchain platforms. The term "gas" is a metaphor comparing computational resources to fuel—just as cars need gasoline to run, blockchain operations need "gas" to execute. Crucially, these fees must be paid in the platform's native cryptocurrency (ETH for Ethereum) even when transacting in other tokens. For example, to send USDC (a dollar-backed stablecoin) from one wallet to another, users must hold ETH to pay the gas fee. This creates forced demand for ETH beyond its use as a currency or store of value. The gas price fluctuates based on network congestion, sometimes reaching $50-$200 for simple transfers during peak periods. While proponents argue gas fees prevent spam and allocate computational resources, our analysis shows these functions could be achieved through fees denominated in existing currencies. The requirement to hold volatile native tokens solely to pay transaction fees represents an unnecessary friction that Black's competitive banking model would eliminate.

12 Why Cryptocurrency Persists Despite Inefficiency

Given the welfare losses identified in our analysis, particularly the deadweight loss from the inflation tax and the superiority of Black banking, a puzzle emerges: why does cryptocurrency not only persist but thrive in developed economies? Our welfare analysis demonstrates that Black banking strictly dominates cryptocurrency in high-θ economies, yet cryptocurrency persists and even thrives in such jurisdictions. This paradox reveals cryptocurrency's dual nature: it simultaneously represents rent extraction in strong-institution economies and genuine institutional insurance in weak-institution economies.

12.1 Institutional Heterogeneity and Persistence

The persistence of cryptocurrency depends critically on institutional quality θ. In high-θ economies ($\theta > \theta^*$), cryptocurrency persists through three mechanisms:

1. **Private seigniorage extraction**: The inflation tax $\tau = \frac{QK}{M+QK}$ identified in our OLG model is not an unfortunate side effect but the core business model. Early Bitcoin holders acquired coins at near-zero cost and now hold claims on future purchasing power extracted from later adopters through the inflation mechanism we identified.

2. **Speculative bubble dynamics**: Even recognizing crypto's fundamental inefficiency, rational agents participate if expected returns from selling to later adopters exceed costs. This creates self-fulfilling speculative bubbles that can persist for extended periods before coordination failure triggers collapse to the zero-value equilibrium (Proposition 1).

3. **Regulatory arbitrage**: Evading capital controls, taxes, and financial regulations provides private benefits without social value, sustaining demand despite inefficiency.

In low-θ economies ($\theta < \theta^*$), the same cryptocurrency provides genuine welfare improvements. When government inflation reaches 100%+ annually (Venezuela, Zimbabwe, Lebanon), cryptocurrency's 2–3% effective inflation tax is strictly preferable. When banking systems freeze deposits or impose capital controls, cryptocurrency's permissionless access provides the only viable escape. This dual nature explains the empirical puzzle: cryptocurrency adoption is highest precisely where institutions are weakest—not market failure but rational response to institutional failure.

12.2 The Catalyst Effect

One legitimate defense of cryptocurrency in high-θ economies is its role as a catalyst for payment system modernization. The success of Bitcoin embarrassed traditional financial institutions into finally implementing capabilities that Hall, Fama, and Black showed were feasible forty years ago: 24/7 operation, programmable payments, cross-border efficiency, and transparent transaction records. The Federal Reserve's FedNow (2023), ECB's TARGET Instant Payment Settlement, and innovations like India's UPI all emerged partly in response to competitive pressure from cryptocurrency. This "demonstration effect" has genuine value, the $\$200B+$ annually extracted through correspondent banking fees represented pure rent that incumbents had no incentive to eliminate until cryptocurrency threatened their oligopoly. However, this catalyst justification is fundamentally temporary. Once traditional systems capture cryptocurrency's efficiency benefits through Black banking frameworks, the catalyst becomes pure rent extraction. If competitive banking requires the threat of inefficient private money creation to prevent capture, the solution is fixing regulatory governance, not tolerating perpetual deadweight loss from the inflation tax.

12.3 Political Economy of Persistence

We can formalise the political economy mechanisms sustaining cryptocurrency:

Proposition 8 (Political Economy of Cryptocurrency)**.** *Cryptocurrency persists despite inefficiency because private benefits to specific groups exceed their private costs, even though social costs exceed social benefits:*

1. ***Early adopters**: Capture seigniorage rents $\frac{QK}{P}$ through first-mover advantage*
2. ***Speculators**: Exploit greater fool dynamics and multiple equilibria*
3. ***Intermediaries**: Extract fees from trading, custody, and financial services*
4. ***Ideological supporters**: Derive non-monetary utility from perceived anti-establishment characteristics*

The key insight is that cryptocurrency's costs (inflation tax, volatility, inefficiency) are socialised while benefits (seigniorage, speculation profits, fees) are privatised. This asymmetry sustains the system despite its aggregate inefficiency.

12.4 Synthesis

Cryptocurrency exists despite inefficiency in high-θ economies because successful rent extraction by early adopters has created a self-sustaining ecosystem of private interests. The

inflation tax we identified is not a bug but the central feature—a sophisticated mechanism for transferring wealth from later adopters to early participants under the guise of technological innovation.

In low-θ economies, cryptocurrency serves a legitimate if second-best function as insurance against institutional failure. This dual characterization preserves our central argument—Black banking dominates when institutionally feasible—while acknowledging cryptocurrency's role where institutions have failed catastrophically.

The policy implication is clear: rather than universal prohibition or acceptance, optimal policy must be calibrated to institutional quality. For high-θ economies, the priority should be implementing Black banking to eliminate cryptocurrency's welfare justification. For low-θ economies, the focus should be institutional strengthening to eventually make Black banking feasible, recognizing that cryptocurrency provides necessary insurance in the interim.

13 Conclusion

Cryptocurrency at a basic level is privatisation of seigniorage and imposes an inflation tax on existing holders of fiat money.

Fischer Black's 1970 insight remains powerful: optimal monetary arrangements need not involve money creation at all. Applied to cryptocurrency, this reveals that: All genuine benefits of cryptocurrency can be achieved without creating new outside money. The inflation tax from cryptocurrency introduction is pure deadweight loss. Private seigniorage extraction, not technological innovation, drives cryptocurrency adoption. Policy should encourage Black-style innovation while preventing private money creation

The cryptocurrency phenomenon represents not monetary innovation but rather a sophisticated mechanism for extracting rents through private seigniorage. Black showed us 50 years ago how to achieve the benefits without the costs. The persistence of cryptocurrency despite this reveals that the costs - the transfers from existing money holders to cryptocurrency creators - are the point.

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