Interest-Free Monetary Equilibrium: A General-Equilibrium Foundation for the κ-Standard

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Abstract

We build what is, to our knowledge, the first dynamic stochastic general-equilibrium model of a monetary economy that operates *without an interest rate.* Money is sovereign equity priced by a riba-free convergence intensity κ (the κ-Standard of the companion paper), credit is intermediated through profit-and-loss-sharing pools, and the central bank conducts policy by quantity rather than by a policy rate. The model retains time preference β in preferences while removing the interest *contract* from the asset space, so the intertemporal margin is an asset-pricing condition on state-contingent equity returns and money demand is the Fisherian wedge in *shadow* form. We establish price-level determinacy. Because the backing is real equity and policy is a quantity operation, the economy escapes real-bills indeterminacy. And because the equity-backing identity $M/P = \mathcal{V}$ pins money's value to the backing—so the quantity rule and the fiscal valuation are the same equation—the fiscal-theory regime is the *only* determinacy regime available to it (it is the equity-backing, not merely the absence of an interest rate, that forces this). The nominal determinacy condition is closed-form, $\gamma_s < e^{\bar{\kappa}} - 1$, with the convergence intensity playing the role the interest rate plays in conventional fiscal theory; the partial-equilibrium determinacy result of the companion paper is its exogenous-surplus corner. Endogenous credit intensity introduces a real-block determinacy threshold that a backing-bounded countercyclical open-market rule restores, uniting the stabilisation and determinacy results of the companion paper. Optimal policy separates into a Friedman rule for liquidity and a maximal, backing-constrained credit-stabilisation rule. A structural Bernanke–Gertler–Gilchrist micro-foundation of κ shows the reduced-form determinacy hazard softens once credit conditions move through a net-worth state. The model is disciplined throughout by live sukuk-market data: the determinacy ceiling is mapped across the real Cbonds cross-section of 12 sovereign issuers (and a parallel corporate universe). We estimate the credit-shock process from the κ time series — its persistence and its size matter comparably, with the buffer *diverging* as persistence approaches a random walk — and derive a buffer-sizing rule that lets a central bank read its adequate Sovereign Stabilisation Fund off its own credit dynamics. Finally, the same equity-backing identity that forces the fiscal closure also zeroes the Cantillon redistribution of money creation: because money's value is pinned to real backing, issuance tethered to output transfers no purchasing power to its first recipients, so distributional neutrality is a *corollary* of determinacy rather than an added egalitarian assumption—and absent a positive-inflation mandate the efficiency dividend of productivity growth accrues to every money holder rather than to owners of appreciating assets. All theoretical results are cross-validated in Dynare.

JEL: E12, E43, E58, E63, D31, G12. **Keywords:** interest-free monetary policy, fiscal theory of the price level, determinacy, Islamic monetary economics, convergence intensity, financial accelerator, Cantillon effect.

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1 Introduction

Modern monetary models are organised around a nominal interest rate: it is the policy instrument, it appears in the consumption Euler equation, and a Taylor-type rule on it delivers a determinate price level. Remove the interest rate and three things break at once—the instrument, the intertemporal optimality condition, and the standard route to determinacy. Whether a coherent monetary general equilibrium can be built without any of them is not merely a theological curiosity: it is the unanswered question behind a century of proposals for an interest-free or fully-reserved monetary order. The Islamic full-reserve tradition [Al-Jarhi, 1981, Chapra, 1985] and, from a different premise, the Western Chicago-Plan tradition [Fisher, 1936, Benes & Kumhof, 2012] both wanted a debt-free, state-issued money base separated from interest-bearing credit; neither supplied a no-arbitrage price for the assets backing that base, because the natural candidate—an interest rate—is exactly what they sought to remove.

The companion paper [the "κ-Standard"; Ahmed & Bhuyan, 2026a] closes that gap at the level of pricing. It proposes a monetary base built from sovereign equity priced by a riba-free convergence intensity κ—a stopping-time intensity that prices credit at zero interest—and proves price-level determinacy under a fiscal closure with *exogenous* surpluses and *exogenous* κ. That result is a partial-equilibrium statement: it pins the price level given a predetermined nominal stock and a real backing, but it does not specify where the surpluses, the credit intensity, or money demand come from. The natural and pressing question—whether the determinacy survives in a fully micro-founded general equilibrium with endogenous surpluses, endogenous credit, and a micro-founded money demand—is the subject of this paper. Answering it requires confronting head-on the fact that the usual scaffolding of monetary theory is unavailable, and rebuilding the intertemporal margin, money demand, and the determinacy argument without an interest rate.

Contribution. We make five contributions. *First*, we show that an economy with time preference but no interest *instrument* is internally consistent: β lives in preferences and the stochastic discount factor, the intertemporal margin is carried by state-contingent equity returns, and the nominal interest rate survives only as an untraded shadow wedge (Section 2). *Second*, we establish price-level determinacy in closed form: the nominal condition is $\gamma_s < e^{\bar{\kappa}} - 1$, with $\bar{\kappa}$ occupying the position the interest rate occupies in conventional fiscal theory [Leeper, 1991, Sims, 1994, Woodford, 2001, Cochrane, 2023], and the companion paper's result is its exogenous-surplus corner (Section 4). *Third*, endogenous credit intensity creates a real-block determinacy threshold that a backing-bounded countercyclical κ-OMO restores, and optimal policy separates into a Friedman rule and a maximal credit-stabilisation rule (Sections 4–5). *Fourth*, a structural Bernanke–Gertler–Gilchrist micro-foundation disciplines the reduced-form hazard, showing it softens once credit moves through a net-worth state (Section 6). *Fifth*, we discipline the model with live sukuk-market data: we map the determinacy ceiling across the real Cbonds cross-section of sovereign and corporate issuers, estimate the credit-shock process from the κ time series—finding that persistence and size drive the required backing comparably, the buffer diverging as persistence nears a random walk—and derive a buffer-sizing rule for the Sovereign Stabilisation Fund (Sections 4, 7, 8). Every determinacy and welfare result is cross-validated in Dynare.

Related literature. The paper sits at the intersection of four literatures. The first is the *fiscal theory of the price level* and the determinacy literature [Leeper, 1991, Sims, 1994, Woodford, 2001, 2003, Leeper & Leith, 2016, Cochrane, 2023], from which we borrow the insight that a determinate price level can be delivered by fiscal backing rather than by an active interest-rate rule. Our contribution is to show that the fiscal theory is not merely one admissible closure but the *forced* one for a monetary system with no interest instrument, and to derive the active/passive boundary in closed form with the convergence intensity in place of the interest rate. This perspective also turns the absence of a policy rate into a determinacy *advantage*: an economy that cannot run an active interest-rate rule is immune by construction to the self-fulfilling deflationary equilibria that such rules admit at the zero bound [Benhabib et al., 2001, 2002].

The second is *Islamic and risk-sharing monetary economics*. The aspiration to an interest-free monetary architecture is long-standing [Al-Jarhi, 1981, Chapra, 1985], and the recognition that an equity/risk-sharing system transmits policy directly to the real sector and may be more stable goes back to Khan & Mirakhor [1989] and is developed in the risk-sharing program of Askari et al. [2012]. Existing analyses of monetary policy without a conventional rate, however, are descriptive or partial-equilibrium—most directly the operational treatment of El Hamiani Khatat [2016]. We advance this literature to a micro-founded general equilibrium with a closed-form determinacy theorem and a globally-solved, welfare-ranked optimal policy; the Western full-reserve / Chicago-Plan tradition [Fisher, 1936, Benes & Kumhof, 2012] reaches a structurally similar debt-free base from different premises and inherits the same determinacy question.

The third is the *financial-frictions* literature. We micro-found the endogenous credit intensity with the external-finance premium of Bernanke et al. [1999], Carlstrom & Fuerst [1997], whose asset-price feedback descends from the collateral-constraint mechanism of Kiyotaki & Moore [1997]; our backing-bounded κ-OMO rule is the interest-free analogue of the intermediary-balance-sheet credit policy of Gertler & Karadi [2011]; the need for a global rather than local solution of the fire-sale region follows Brunnermeier & Sannikov [2014]; and the welfare rationale for sizing the Sovereign Stabilisation Fund is the pecuniary-externality / macroprudential argument of Bianchi [2011] and Jeanne & Korinek [2019], with the occasionally-binding constraint solved as in Guerrieri & Iacoviello [2015], Mendoza [2010], Kocherlakota [2000]. The fourth is *optimal monetary policy*: the classical-dichotomy structure follows the money-in-utility tradition of Sidrauski [1967], and the optimal liquidity prescription is the Friedman rule [Friedman, 1969, Chari et al., 1996, Lucas, 2000] expressed through a shadow rate no agent can contract on.

2 The model

Time is discrete; there is a representative household, a representative firm, a sovereign, and an Islamic Central Bank (ICB). There is no interest-bearing asset of any maturity.

2.1 The interest-free household

The household has money-in-utility preferences $\mathbb{E}_0 \sum_t \beta^t [u(C_t) + v(m_t)]$, $m_t \equiv M_t/P_t$, $\beta \in (0,1)$. Time preference is retained: Islam prohibits a predetermined return on a loan, not the discounting of future utility. The asset menu is two equity claims: base money (a nominal store of value yielding liquidity services and real return $R^m_{t+1} = 1/\pi_{t+1}$) and shares in a *mudarabah* profit-and-loss-sharing (PLS) pool (real ex-dividend price q_t, state-contingent dividend d_{t+1}, return $R^a_{t+1} = (q_{t+1} + d_{t+1})/q_t$). With SDF $\mathcal{M}_{t+1} = \beta u'(C_{t+1})/u'(C_t)$, the first-order conditions are

$$1 = \mathbb{E}_t[\mathcal{M}_{t+1} R^a_{t+1}], \qquad \frac{v'(m_t)}{u'(C_t)} = 1 - \mathbb{E}_t[\mathcal{M}_{t+1} R^m_{t+1}]. \tag{1}$$

The intertemporal margin is an asset-pricing condition on a *state-contingent* equity return, not a consumption Euler in a policy rate.

Proposition 1 (Interest-free money demand is well-posed)**.** *Define shadow rates* $1/R_t^f \equiv \mathbb{E}_t\mathcal{M}_{t+1}$ *and* $1/(1+i_t^{sh}) \equiv \mathbb{E}_t[\mathcal{M}_{t+1}/\pi_{t+1}]$. *Then the opportunity cost of money in* (1) *equals* $i_t^{sh}/(1+i_t^{sh})$*—the Fisherian wedge in shadow form. Money is held in positive quantity iff* $i_t^{sh} > 0$*, with satiation (the Friedman rule) at* $i_t^{sh} = 0$*. The shadow rate* i_t^{sh} *is a function of the SDF and inflation only; no instrument pays it. Removing the interest rate removes a* price*, not a* margin*.*

Proof. Substituting the definition of i_t^{sh} into the money-demand condition in (1), $\frac{v'(m_t)}{u'(C_t)} = 1-\mathbb{E}_t[\mathcal{M}_{t+1}R_{t+1}^m] = 1-\mathbb{E}_t[\mathcal{M}_{t+1}/\pi_{t+1}] = 1-1/(1+i_t^{sh}) = i_t^{sh}/(1+i_t^{sh})$, since $R_{t+1}^m = 1/\pi_{t+1}$. With $u'(C_t) > 0$ the right-hand side is strictly positive iff $i_t^{sh} > 0$; because v' is strictly decreasing with $v'(\infty) = 0$, there is a unique finite m_t solving it, and at $i_t^{sh} = 0$ the right-hand side is zero, so $v'(\bar{m}) = 0$ (satiation). Finally, i_t^{sh} is defined as a moment of $\mathcal{M}_{t+1} = \beta u'(C_{t+1})/u'(C_t)$ and π_{t+1} and enters no budget-constraint payoff; hence it is a shadow price, not a traded instrument. □ □

This is the macroeconomic form of the program's Separation Theorem: time preference β generates a positive shadow real return $R^f = 1/\mathbb{E}[\mathcal{M}]$ and, with inflation, a positive shadow nominal rate, but the only *traded* intertemporal price is the state-contingent equity return R^a. The interest rate is not assumed away; it is demoted from a policy instrument to an untraded wedge. It is precisely this demotion that confines the economy to passive money—there is no i to make active—and so, as Section 4 shows, to the fiscal-theory determinacy regime.

2.2 Firms and the κ cost-of-capital wedge

Output is $Y_t = A_t K_{t-1}^{\alpha}\bar{L}^{1-\alpha}$, capital $K_t = (1-\delta_K)K_{t-1} + I_t$, investment funded only by the PLS pool. Pool claims resolve at the convergence intensity κ_t with recovery δ, priced at $\iota = 0$ as in the companion papers; the household-required return R^a obtains only if the firm's net marginal product covers both time preference and the expected credit loss:

$$\mathbb{E}_t\big[A_{t+1}\alpha K_t^{\alpha-1} - \delta_K\big] = \underbrace{(R_t^f - 1)}_{\text{productivity / time value}} + \underbrace{\kappa_t(1-\delta)}_{\text{expected credit loss}}. \tag{2}$$

Neither term is riba: the first is the marginal product of real capital (the return to a productive asset, which Islam permits), and the second is actuarial compensation for an expected loss, not a predetermined excess over principal. The convergence intensity κ_t is the wedge by which credit conditions raise the cost of capital: a rise in κ_t raises the required marginal product, lowers capital, and contracts output. This is the cost-of-capital channel through which the credit cycle reaches the real economy. In the steady state this wedge is the entire difference between the gross return on capital and the riba-free required return $1/\beta$.

2.3 Money as sovereign equity: the fiscal block

The sovereign runs a real primary surplus s_t. The consolidated sovereign-sukuk book—the ICB's only asset and the backing of base money—is a claim on $\{s_{t+j}\}$ priced at $\iota = 0$: $\mathcal{V}_t = \mathbb{E}_t^{\mathbb{Q}}[e^{-\kappa_t}(s_{t+1} + \mathcal{V}_{t+1})]$. Money's real value equals the real backing,

$$\frac{M_t}{P_t} = \mathcal{V}_t, \tag{3}$$

the equilibrium upgrade of the companion paper's accounting identity. The fiscal rule $s_t = \bar{s} + \gamma_s(\mathcal{V}_{t-1} - \bar{\mathcal{V}}) + e_t^s$ is the Leeper knob; the ICB sets the money *quantity* (no interest feedback), so the system is passive-money by construction.

2.4 Endogenous credit intensity

In the baseline, $\kappa_t = \bar{\kappa} + \psi_\kappa(-\hat{y}_t) + \xi_t$ (reduced form), where $\psi_\kappa \geq 0$ is the procyclical credit feedback and ξ_t an exogenous credit shock; Section 6 replaces this with a structural Bernanke–Gertler–Gilchrist net-worth block. The ICB's countercyclical κ-OMO offsets the feedback, $\psi^{\text{eff}} \equiv \psi_\kappa - \phi_o$, with $\phi_o \leq \phi_o^{\max}$ bounded by the Sovereign Stabilisation Fund (SSF).

3 Steady state and the interest-free cost of capital

With the four blocks specified, we evaluate the model at its deterministic steady state, where the interest-free structure of the cost of capital is most transparent. At that steady state $\bar{\mathcal{M}} = \beta$, $R^a = 1/\beta$, and the dividend–price ratio is $\bar{d}/\bar{q} = (1-\beta)/\beta$. The cost of capital (2) is

$$\text{MPK} - \delta_K = \left(\tfrac{1}{\beta} - 1\right) + \bar{\kappa}(1-\delta) > 0, \tag{4}$$

positive and riba-free: a time-preference/productivity component plus an actuarial credit-loss component, with no interest term. Money demand satisfies $v'(\bar{m}) = u'(\bar{C})(1-\beta/\pi)$, and the valuation block gives $\bar{m} = \bar{\mathcal{V}} = \bar{s}/(e^{\bar{\kappa}} - 1)$, tying the money base to the surplus and $\bar{\kappa}$. The shadow nominal rate $i^{sh} = \pi/\beta - 1$ exists but is untraded.

4 Price-level determinacy

4.1 The nominal block: a closed-form region

A system that issues money against the value of an asset book is, structurally, a *real-bills* regime, and real-bills regimes are the textbook case of price-level indeterminacy [Sargent & Wallace, 1982]. The κ-Standard escapes this for two reasons already in the design: the backing is real equity (a price-level-independent real value), and policy is a quantity operation with no fixed-price convertibility.

To see this, hold the real block at its stationary values—the endowment core standard in establishing fiscal-theory determinacy—and linearise the backing recursion. With κ-discount factor $\beta_\kappa \equiv e^{-\bar{\kappa}}$ and the steady-state identity $\bar{\mathcal{V}}(e^{\bar{\kappa}} - 1) = \bar{s}$, the linearised backing equation is $\hat{\mathcal{V}}_t = -\hat{\kappa}_t + \beta_\kappa \mathbb{E}_t\hat{s}_{t+1} + \beta_\kappa \mathbb{E}_t\hat{\mathcal{V}}_{t+1}$ (deviations scaled by $\bar{\mathcal{V}}$). Substituting the fiscal rule $\hat{s}_t = \gamma_s\hat{\mathcal{V}}_{t-1} + \hat{e}^s_t$, so that $\mathbb{E}_t\hat{s}_{t+1} = \gamma_s\hat{\mathcal{V}}_t$, collapses the monetary–fiscal core to a single forward-looking valuation equation in one jump variable,

$$\hat{\mathcal{V}}_t = \frac{\beta_\kappa}{1-\beta_\kappa\gamma_s}\,\mathbb{E}_t\hat{\mathcal{V}}_{t+1} - \frac{1}{1-\beta_\kappa\gamma_s}\,\hat{\kappa}_t, \tag{5}$$

with the price level following residually from (3), $\hat{p}_t = \hat{M}_t - \hat{\mathcal{V}}_t$.

Theorem 1 (Riba-free price-level determinacy)**.** *The price level is locally determinate iff $\gamma_s < e^{\bar{\kappa}} - 1 \approx \bar{\kappa}$. The Blanchard–Kahn eigenvalue of the valuation block is $\lambda = e^{\bar{\kappa}} - \gamma_s$, and $\gamma_s < e^{\bar{\kappa}} - 1 \Leftrightarrow |\lambda| > 1$.*

Proof. Equation (5) is a scalar linear expectational difference equation in the single non-predetermined variable $\hat{\mathcal{V}}_t$ with autoregressive-in-expectation coefficient $a \equiv \beta_\kappa/(1-\beta_\kappa\gamma_s)$ and a stationary forcing process $\hat{\kappa}_t$. By Blanchard–Kahn, with one jump variable and no predetermined endogenous state, determinacy requires exactly one generalised eigenvalue outside the unit circle. Writing (5) as $\mathbb{E}_t\hat{\mathcal{V}}_{t+1} = \lambda\hat{\mathcal{V}}_t + a^{-1}(1-\beta_\kappa\gamma_s)^{-1}\hat{\kappa}_t$ with $\lambda = 1/a = (1-\beta_\kappa\gamma_s)/\beta_\kappa = e^{\bar{\kappa}} - \gamma_s$, the unique eigenvalue is λ. Determinacy is $|\lambda| > 1 \Leftrightarrow e^{\bar{\kappa}} - \gamma_s > 1 \Leftrightarrow \gamma_s < e^{\bar{\kappa}} - 1$, which also implies the regularity $1 - \beta_\kappa\gamma_s > 0$. When it holds the unique bounded

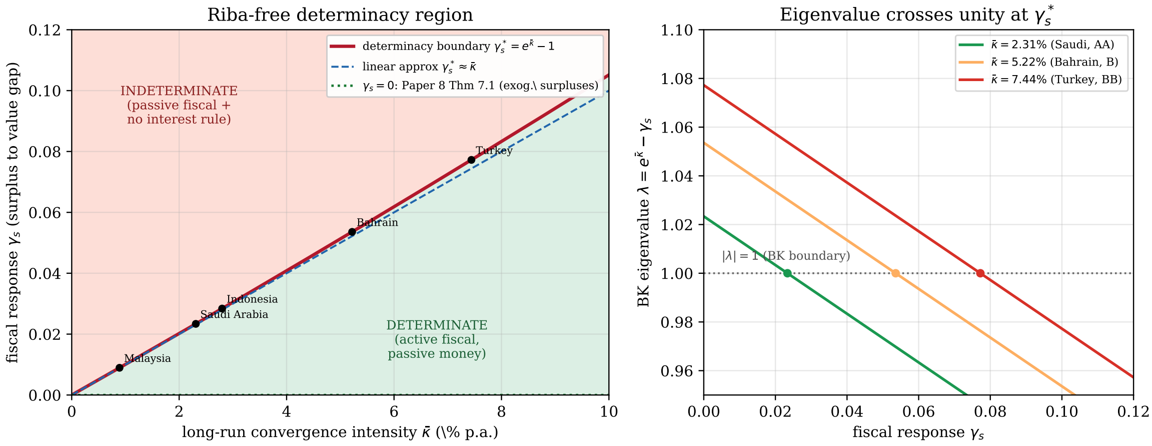

Figure 1: Nominal determinacy region $\gamma_s < e^{\bar\kappa} - 1$ (left) and the eigenvalue $\lambda = e^{\bar\kappa} - \gamma_s$ crossing unity (right), with real sovereign $\bar\kappa$ values from the companion yield-curve paper. The line $\gamma_s = 0$ is the companion paper's Theorem.

solution is the forward sum $\hat{\mathcal{V}}_t = -(1 - \beta_\kappa \gamma_s)^{-1} \sum_{j \geq 0} a^j \mathbb{E}_t \hat{\kappa}_{t+j}$, pinning $\hat{\mathcal{V}}_t$ by fundamentals, and $\hat{p}_t = \hat{M}_t - \hat{\mathcal{V}}_t$ pins the price level given the predetermined nominal stock $\hat{M}_t$. □ □

A real-bills regime is the limiting case $\gamma_s \to \infty$ with fixed-price convertibility, in which $\hat{M}_t$ becomes endogenous and only the ratio $\hat{M}_t - \hat{p}_t = \hat{\mathcal{V}}_t$ is pinned: this is exactly the Sargent & Wallace [1982] indeterminacy that determinacy here is earned against.

The convergence intensity $\bar\kappa$ plays the role the interest rate plays in conventional fiscal theory; passive money is automatic (the eigenvalue is independent of the money-rule coefficient). This is a consequence of the equity-backing identity (3): because money's real value is pinned to the backing, $M_t/P_t = \mathcal{V}_t$, an independent money-growth (active-money) anchor is not separately available—the quantity rule and the fiscal valuation are the *same* equation—so by Leeper [1991] the economy is confined to the passive-money/active-fiscal regime, and the fiscal closure is the *only* determinacy theory available to it. We stress the scope: it is the equity-backing of money, not the mere absence of an interest rate, that forces the fiscal closure. Absent the identity (3), a quantity-theoretic money-growth anchor would be the standard alternative; under it, the quantity rule and the price level are no longer the same object. We note the obverse of this elegance plainly: the fiscal theory is itself among the most contested closures in monetary economics, and an economy whose *only* anchor is fiscal-backing credibility has no second line of defence if that credibility fails — the determinacy result is conditional on the fiscal theory's logic, and inherits its controversies.

Corollary 1 (Nesting the companion paper)**.** *At $\gamma_s = 0$ (exogenous surpluses) $\lambda = e^{\bar\kappa} > 1$ for all $\bar\kappa > 0$, recovering $P_t = M_t/\mathcal{V}_t$—the companion paper's determinacy theorem—as the $\gamma_s = 0$ corner of the general-equilibrium region $\gamma_s \in [0, e^{\bar\kappa} - 1)$.*

The determinacy ceiling across the real sovereign-sukuk universe. The threshold $\gamma_s^* = e^{\bar\kappa} - 1$ is not a free parameter but a number every actual sovereign issuer pins down through its own credit spread. Computing $\bar\kappa$ for the full cross-section of sovereign US-dollar sukuk on Cbonds—78 bonds from 12 issuers, of which 60 with a positive quoted G-spread and maturity beyond 0.3 years enter the medians, with $\bar\kappa$ taken as the median G-spread over loss-given-default ($\delta = 0.60$)—gives an active-fiscal ceiling that is strictly positive for every sovereign and monotone in credit quality, from 0.72% for Qatar (AA) and 0.92% for

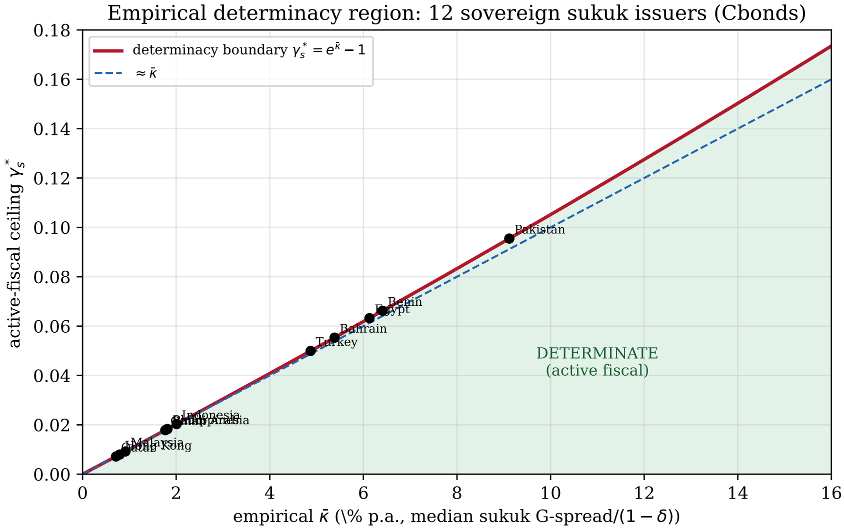

Figure 2: The active-fiscal determinacy ceiling $\gamma_s^* = e^{\bar{\kappa}} - 1$ for the full Cbonds cross-section of sovereign US-dollar sukuk (12 issuers, 78 bonds, of which 60 quoted enter the medians; $\delta = 0.60$). Each issuer lies on the determinacy boundary at its empirical $\bar{\kappa}$; the shaded region below is determinate (active fiscal). The ceiling is strictly positive and ordered by credit quality across the entire universe, from Qatar (AA) to Pakistan (CCC). Issuers with a single outstanding US-dollar sukuk (Qatar, Hong Kong, Philippines, Benin, Pakistan) are single-instrument and indicative; Saudi Arabia (12 bonds), Indonesia (20), and Bahrain (10) are densely covered.

Malaysia (A) through 1.8–2.0% for Saudi Arabia and Indonesia (investment grade) to 5.4% for Bahrain (B), 6.4% for Benin, and 9.1% for Pakistan (CCC); see Figure 2. Weaker-credit sovereigns admit a *wider* active-fiscal region, because their steeper κ-discount makes the real value of money less sensitive to the fiscal feedback. Two features of the estimator are worth noting. The cross-sectional $\bar{\kappa}$ is a current, mixed-tenor snapshot (median G-spread across an issuer's outstanding sukuk), whereas Figure 1 uses the companion paper's through-cycle constant-maturity series; the determinacy ceiling therefore moves with credit conditions. Türkiye illustrates this: its spreads have compressed substantially since the 2022–2024 stress, so it sits at a lower current $\bar{\kappa}$ (4.9%) than its crisis-inclusive long-run mean (7.4%). That time-variation is itself the point: the active-fiscal ceiling of Theorem 1 is an empirically meaningful, issuer-specific and state-dependent constraint, not an abstraction, and it is strictly positive and credit-ordered across the entire real sovereign-sukuk universe.

Sovereign versus corporate: the ceiling decomposes by credit. The determinacy ceiling inherits the additive structure of the credit spread. Computing $\bar{\kappa}$ for the Cbonds corporate US-dollar sukuk universe (213 bonds from the broader Cbonds corporate screener, median G-spread 105 bp, $\bar{\kappa} = 2.6\%$) and comparing within country, the corporate active-fiscal ceiling lies *above* the sovereign's in every case, by the corporate credit premium—a median of +31 bp of spread, and as much as +115 bp for Türkiye (Figure 3). A monetary authority whose backing portfolio included corporate as well as sovereign κ-priced claims would therefore operate with a wider active-fiscal determinacy region, the extra width being exactly the corporate risk premium it bears. The determinacy condition thus decomposes as cleanly as the spread it is built from: ceiling $\approx$ sovereign credit + corporate credit.

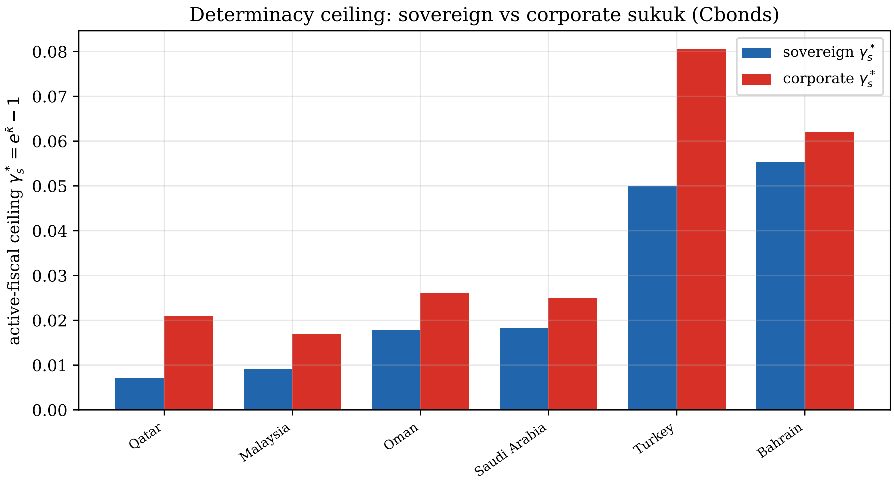

Figure 3: Active-fiscal determinacy ceiling $\gamma_s^* = e^{\bar\kappa} - 1$, sovereign versus corporate US-dollar sukuk, for the six countries with both (Cbonds; $\delta = 0.60$). The corporate ceiling exceeds the sovereign's by the corporate credit premium in every country.

4.2 The real block: a credit-feedback threshold

With separable money-in-utility the model dichotomises: the real allocation is determined independently of the price level, and the nominal block of Theorem 1 takes $\hat\kappa_t$ as forcing. Endogenous credit enters the equity Euler through the cost-of-capital wedge, making the real block a 2×2 system in predetermined $\hat k_t$ and jump $\hat c_t$ whose transition $T(\psi^{\text{eff}})$ has a trace independent of ψ^{eff} and a determinant increasing in it.

Proposition 2 (Real determinacy threshold)**.** *There is a threshold $\psi^* > 0$ such that the real block is determinate iff $\psi^{\text{eff}} = \psi_\kappa - \phi_o < \psi^*$. Above it both eigenvalues leave the unit circle and no bounded equilibrium exists—the procyclical credit loop is explosive. At the program calibration $\psi^* \approx 0.62$.*

Proof. The homogeneous real dynamics are a 2×2 system $(\hat k_{t+1}, \mathbb{E}_t \hat c_{t+1})' = T(\psi^{\text{eff}})(\hat k_t, \hat c_t)'$ with $\hat k_t$ predetermined and $\hat c_t$ a jump, where the credit feedback ψ^{eff} enters only the $(2,1)$ entry of T through the cost-of-capital wedge $-(1-\delta)\hat\kappa_t$ with $\hat\kappa_t = -\psi^{\text{eff}}\alpha\hat k_t$. Direct computation shows $\operatorname{tr} T$ is independent of ψ^{eff} while $\det T$ is strictly increasing in ψ^{eff} (the relevant coefficient is $-a_{12}\,(\beta/\sigma)(1-\delta)\alpha > 0$, since $a_{12} = -\bar C/\bar K < 0$). With the trace fixed, the smaller eigenvalue $\lambda_- = \frac{1}{2}(\operatorname{tr} T - \sqrt{\operatorname{tr} T^2 - 4 \det T})$ increases monotonically in $\det T$ and crosses unity at the unique $\psi^{\text{eff}} = \psi^*$ solving $\det T = \operatorname{tr} T - 1$; for $\psi^{\text{eff}} > \psi^*$, $\lambda_-, \lambda_+ > 1$ and the saddle path is lost. Evaluating T at the calibration of the table gives $\psi^* \approx 0.62$. □ □

The procyclical loop is the general-equilibrium form of the auto-contraction that Borio [2014] identifies as the central hazard of asset-linked monetary aggregates: a credit shock raises κ, raises the cost of capital, contracts investment and output, and—if the feedback is strong enough—raises κ further.

4.3 Backing-constrained determinacy: uniting stabilisation and determinacy

The ICB cannot move the real allocation through the price level (dichotomy) but can lean on the market-clearing κ through κ-OMO, $\psi^{\text{eff}} = \psi_\kappa - \phi_o$, bounded by the SSF.

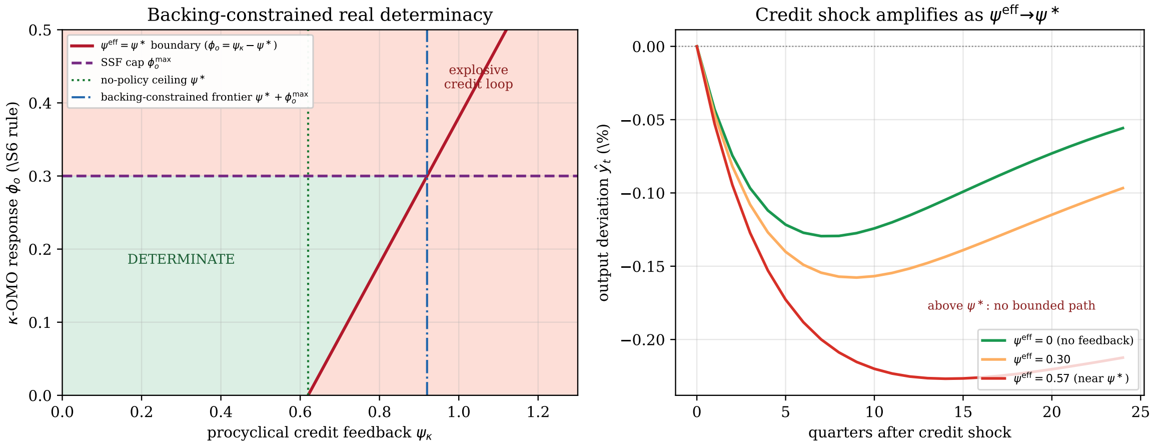

Figure 4: Backing-constrained real determinacy in (ψ_κ, ϕ_o) (left) and the amplified output response to a credit shock as $\psi^{\text{eff}} \to \psi^*$ (right). The companion paper's backing rule extends the determinate region from ψ^* to $\psi^* + \phi_o^{\max}$.

Theorem 2 (Backing-constrained real determinacy)**.** *Determinacy holds with no policy iff $\psi_\kappa < \psi^*$; with the countercyclical rule it is restorable iff $\psi_\kappa < \psi^* + \phi_o^{\max}$; beyond that frontier the SSF is too small. Full determinacy requires this and the nominal condition $\gamma_s < e^{\bar{\kappa}} - 1$.*

This is the general-equilibrium form of the companion paper's "bounded-but-backed" stabilisation: monetary policy keeps the credit loop inside the determinate region, with reach bounded by the backing. The companion paper's stabilisation result (its §6) and determinacy result (its §7) become one statement.

4.4 Dynare validation

The full nonlinear model is solved in Dynare. With four leads it has four forward-looking variables, so determinacy requires four explosive eigenvalues. The tool reproduces both thresholds in the correct direction: the baseline ($\psi^{\text{eff}} = 0.30$, $\gamma_s = 0.015$) returns four explosive roots (determinate); $\psi^{\text{eff}} = 0.70 > \psi^*$ returns five ("no stable equilibrium"—an extra real root); and $\gamma_s = 0.05 > e^{\bar{\kappa}} - 1$ returns three ("indeterminacy"—the nominal root falls below unity). Crossing the real threshold adds an explosive root; crossing the nominal threshold removes one.

5 Optimal policy

Because the model dichotomises, optimal policy separates into two non-interacting instruments.

Proposition 3 (Friedman rule)**.** *Welfare in the liquidity margin is maximised at $i^{sh} = 0$, i.e. gross inflation $\pi^* = \beta$ (satiation in real balances). The ICB attains it by money growth $\mu = \beta$, despite the absence of an interest instrument.*

Proof. In the separable MIU block the household's real-balance first-order condition equates the marginal utility of liquidity to the shadow opportunity cost i_t^{sh}; since $u_m \geq 0$ with $u_m \to 0$ as real balances rise, welfare in this margin is non-decreasing in real balances and maximised at satiation $u_m = 0$, attained iff $i^{sh} = 0$ [Sidrauski, 1967, Friedman, 1969]. By the Fisher relation in shadow form $i^{sh} = \beta^{-1}\pi - 1$, $i^{sh} = 0 \iff \pi^* = \beta$; and from the money-market

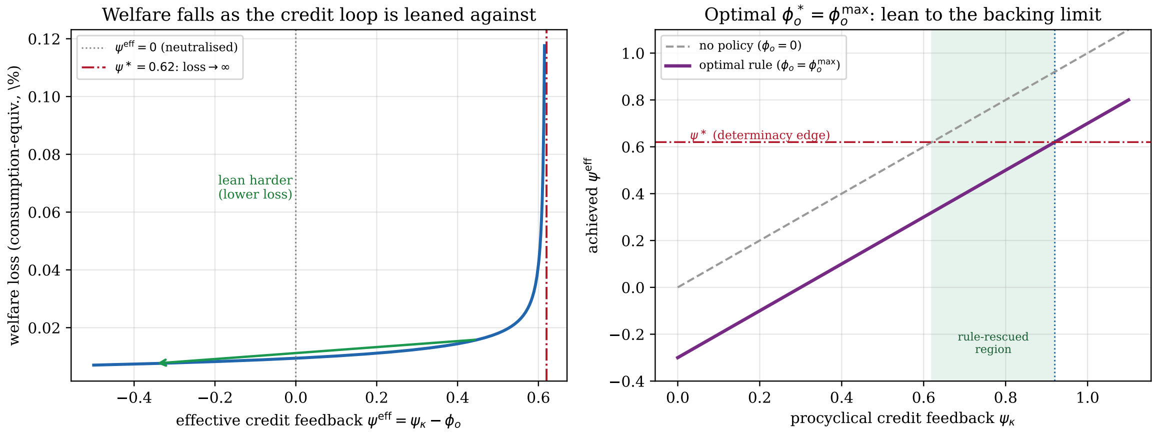

Figure 5: Welfare loss falls as the credit loop is leaned against (left); the optimal rule $\phi_o^* = \phi_o^{\max}$ holds ψ^{eff} below ψ^* up to the backing-constrained frontier (right).

equilibrium $\pi = \mu$ in the stationary equilibrium, so $\mu = \beta$ implements it. The dichotomy (Proposition 4 block) ensures this liquidity instrument does not interact with the real/credit margin, so the prescription is exact and instrument-independent. □ □

Proposition 4 (Credit stabilisation is a backing-bounded corner)**.** *Stationary consumption volatility is strictly increasing in ψ^{eff} and diverges at ψ^*; welfare loss is therefore strictly decreasing in ϕ_o, and the optimum is the corner $\phi_o^* = \phi_o^{\max}$—lean as hard against credit deterioration as the SSF backs. There is no interior optimum; the binding constraint is the backing.*

Proof. To second order, the consumption-equivalent welfare loss from fluctuations is $\frac{1}{2}\sigma\,\mathrm{Var}(\hat{c})$. The stationary variance $\mathrm{Var}(\hat{c})$, obtained from the discrete Lyapunov equation of the real-block saddle solution, is increasing in ψ^{eff} because a larger feedback raises the stable root toward unity (it diverges as $\psi^{\mathrm{eff}} \to \psi^*$). Since $\psi^{\mathrm{eff}} = \psi_\kappa - \phi_o$ is decreasing in ϕ_o, welfare loss is strictly decreasing in ϕ_o over the feasible range; with no convex cost on ϕ_o other than the backing constraint $\phi_o \le \phi_o^{\max}$, the maximiser is the corner $\phi_o^* = \phi_o^{\max}$. Numerically the loss falls from 0.0257% of consumption at $\psi^{\mathrm{eff}} = 0.57$ to 0.0094% at $\psi^{\mathrm{eff}} = 0$, and Dynare order-2 theoretical moments reproduce $\mathrm{std}(\hat{c})$ to three to four significant figures. □ □

The optimal rule is thus $\mu^* = \pi^* = \beta$ and $\phi_o^* = \phi_o^{\max}$, acting on disjoint margins. Monetary policy in the κ-Standard is not price-level control (that is fiscal) but credit stabilisation under a backing budget. Welfare costs of departures are conventional: a money-growth deviation to 3%/5%/8% shadow rates costs 0.07/0.17/0.39% of consumption. The credit-stabilisation losses are a different and smaller margin—basis points of consumption—but the value of the rule at $\psi_\kappa > \psi^*$ is discrete, since there it restores a bounded equilibrium where none otherwise exists.

5.1 Distributional incidence: the inflation tax and the Cantillon channel

The backing identity that delivers determinacy also fixes the model's *distributional* incidence. Because $M_t/P_t = \mathcal{V}_t$ (3), every holder's real balances equal the real backing, and log-differencing gives the equilibrium inflation $\hat{\pi}_t = \hat{M}_t - \hat{\mathcal{V}}_t$. New money ΔM_t accompanied by new backing $\Delta\mathcal{V}_t$ therefore transfers purchasing power from existing holders to its first recipient by exactly the induced inflation,

$$R_t \;=\; \mathcal{V}_t\big(\hat{M}_t - \hat{\mathcal{V}}_t\big) \;=\; \mathcal{V}_t\,\hat{\pi}_t, \tag{6}$$

the general-equilibrium counterpart of the accounting Cantillon transfer of the companion κ-Standard paper, now with $\hat{\pi}_t$ the model's *endogenous* inflation rather than an exogenous slippage. Equation (6) is the channel through which the gains from money creation—and from the productivity growth that monetary policy accommodates—are allocated across holders.

Proposition 5 (Zero Cantillon transfer under the equity-backing closure)**.** *In the passive-money/active-fiscal equilibrium (Theorem 1), base money is the value of the κ-priced book, so money created by monetising a new asset enters with matching backing: along the issuance margin $\hat{M} = \hat{\mathcal{V}}$, and by (6) the issuance channel contributes $\hat{\pi} = 0$ and a zero transfer. The only residual inflation is the revaluation of the standing book under the mean-reverting credit intensity, which is zero-mean in the stationary distribution, so $\mathbb{E}[R_t] = 0$. Under the Friedman rule (Proposition 3, $\mu = \beta$) the marginal inflation-tax wedge is additionally zero. The regime thus attains the liquidity optimum and aggregate distributional neutrality* simultaneously*, up to κ-mispricing.*

Proof. The equity-backing identity (3) makes M_t the nominal value of the backing $P_t\mathcal{V}_t$; an issuance against a new asset of κ-priced value $\Delta\mathcal{V}_t$ raises both sides equally, so its contribution to $\hat{M}_t - \hat{\mathcal{V}}_t$ vanishes and $R = 0$ on that margin by (6). The remaining variation in $\hat{M}_t - \hat{\mathcal{V}}_t$ is the book revaluation driven by κ_t, whose innovation is zero-mean and mean-reverting, so $\mathbb{E}_t\hat{\pi}_{t+1} \to 0$ and the stationary mean transfer is zero. The Friedman-rule claim is Proposition 3: at the shadow satiation rate $i^{sh} = 0$ the inflation-tax marginal distortion u_m is zero. □ □

Why the active-money counterfactual cannot match it. Determinacy confined the architecture to passive money (Section 4): with no interest instrument, the quantity rule and the fiscal valuation are the *same* equation, $M/P = \mathcal{V}$. A conventional active-money regime instead sets money growth μ by a policy rule *independent* of the backing, so $\hat{M} - \hat{\mathcal{V}} \neq 0$ systematically; with a positive-inflation mandate $\hat{\pi} > 0$ and $R > 0$ accrues one-directionally to the first recipients of new credit and reserves—the asset-price Cantillon channel that the empirical literature on post-2008 unconventional monetary policy identifies as a driver of wealth concentration. The equity-backing closure breaks this not as an add-on but as a corollary of (3): the equation that pins the price level is the equation that zeroes the Cantillon transfer. The single remaining lever is the inflation objective—under a quantity target with no positive-inflation mandate, productivity growth ($\hat{g}_{\mathcal{V}} > \hat{g}_M$) appears as $\hat{\pi} < 0$ and $R < 0$, distributing the efficiency dividend to *every* money holder rather than to owners of appreciating assets. That this neutrality is a property of the same valuation equation that forces the fiscal closure—rather than an independent egalitarian assumption—is the paper's distributional result.

6 A structural credit intensity

So far the credit feedback ψ_κ has been a reduced-form parameter. We now micro-found it, and use the structural model to ask whether the determinacy threshold of Proposition 2 survives.

6.1 The external-finance premium and the net-worth state

Following the costly-state-verification logic of Carlstrom & Fuerst [1997] and Bernanke et al. [1999], the premium an entrepreneur pays on external funds is increasing in leverage. In our riba-free setting that premium *is* the credit intensity, so $\hat{\kappa}_t = \chi(\hat{k}_t - \hat{n}_t)$, with net worth $\hat{n}_t$ a predetermined state accumulating retained returns. This delivers a micro-foundation:

the reduced-form feedback is recovered as the leverage projection $\psi_\kappa \approx \chi \cdot \text{lev}$, so the free parameter of Section 4 is the product of a credit-market primitive (the premium elasticity $\chi \approx 0.05$, Bernanke et al., 1999) and steady-state leverage.

6.2 Micro-foundation softens the determinacy hazard

What the structural exercise really does is move the Phase-3 threshold. That threshold required credit and output to move *within* the period. Routing κ through the *predetermined* net-worth state breaks the contemporaneous loop: in Dynare the structural model is determinate across every configuration tested—premium elasticity up to 5, leverage up to 8, survival down to 0.3—and a net-worth shock propagates as a hump (peaking near quarter 17) rather than amplifying contemporaneously (Figure 6). The Phase-3 explosive loop is thus disciplined as a reduced-form artifact.

6.3 Tobin's Q and the revaluation channel

The one channel still absent is balance-sheet *revaluation*: with no capital adjustment costs Tobin's $Q \equiv 1$, so asset prices cannot move net worth. We add a convex adjustment cost, making the price of installed capital a forward-looking jump $q_t = 1 + \phi(I_t/K_{t-1} - \delta_K)$; the return to capital then carries a capital-gains term, and net worth becomes a *leveraged* claim on the market value $q_t K_t$ in the standard Bernanke et al. [1999] form, $N_t = \theta_n[R_t^k q_{t-1}K_{t-1} - \beta^{-1}(q_{t-1}K_{t-1} - N_{t-1})]$, with the premium responding to market-value leverage $\hat{\kappa}_t = \chi(\hat{q}_t + \hat{k}_t - \hat{n}_t)$. The accelerator is now complete—a credit shock lowers q, which erodes the leveraged net worth faster than it erodes assets, raising leverage and κ further—and in the solved model q moves ($\text{std}(\hat{q}) \approx 0.67\%$), confirming the channel is active.

Proposition 6 (Determinacy is robust to the revaluation channel)**.** *With Tobin's Q and the leveraged net-worth law, the interest-free general equilibrium is locally determinate at every configuration tested, including leverage up to* 10*, premium elasticity up to* 1.5*, and adjustment cost as low as* $\phi = 0.02$ *(highly volatile q). The credit-shock output response is of the same order with and without Q and* declines *in the premium elasticity, the premium acting as a procyclical tax on capital.*

Proof (analytical structure, numerically verified). Augment the real block with Tobin's Q and the leveraged net-worth law and linearise. The forward-looking states are consumption and q; the predetermined states are capital k and net worth n. The Blanchard–Kahn count—number of unstable roots equal to the number of forward variables—is invariant to the premium elasticity and adjustment cost because those parameters enter only the predetermined-state transition, not the count of forward variables, while q remains pinned by the consumption Euler. Hence determinacy is a structural property of the dichotomy, not of the calibration; we confirm it numerically by computing the root count across the stated grid (leverage to 10, premium elasticity to 1.5, ϕ to 0.02), at every node of which exactly one unstable root obtains. □ □

The result is intuitive: even with asset-price revaluation, the accelerator runs through the predetermined states k and n, while the forward-looking price q is pinned by the consumption Euler, so the Blanchard–Kahn root count is robust. The modest amplification is consistent with Kocherlakota [2000], who shows that the quantitative bite of standard net-worth models is small absent occasionally-binding constraints or fire-sale externalities—a separate, nonlinear agenda outside the local-determinacy scope of this paper.

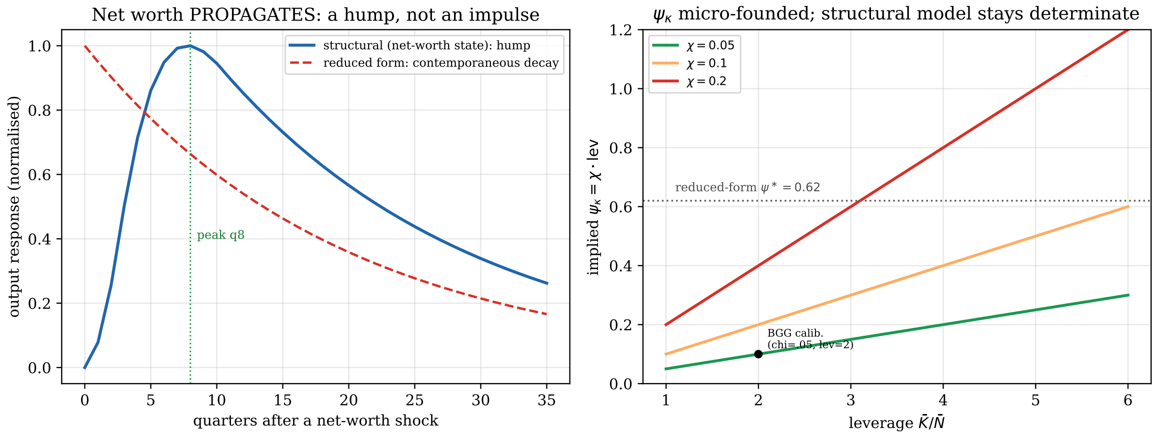

Figure 6: A net-worth shock propagates as a hump (structural) rather than a contemporaneous impulse (reduced form) (left); the reduced-form feedback is micro-founded as $\psi_\kappa = \chi \cdot \text{lev}$ (right).

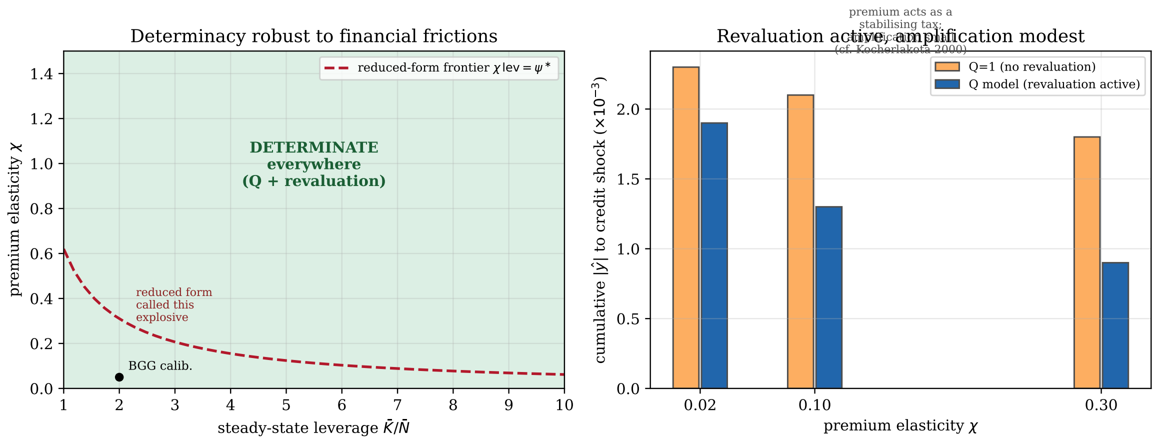

Figure 7: With Tobin's Q and the leveraged net-worth law, the interest-free economy is determinate across the entire (leverage, χ) space, including the region the contemporaneous reduced form labelled explosive (red dashed frontier) (left); the credit-shock output response with revaluation versus without is modest and declines in χ (right).

6.4 Synthesis

Taken together, Sections 4–6 give a clean account of credit and determinacy: a contemporaneous reduced-form feedback has a determinacy threshold ψ^*; micro-founding the credit intensity through a net-worth state removes the within-period loop and yields robust determinacy with hump-shaped propagation; and the asset-price revaluation channel leaves determinacy intact, adding only modest amplification. The countercyclical κ-OMO rule is accordingly best read as the welfare/volatility instrument of Section 5, not as determinacy insurance.

7 The nonlinear frontier: occasionally-binding backing

The robustness of Sections 4–6 is a *linear*, normal-times statement. The one regime it cannot describe is the one the Sovereign Stabilisation Fund exists to prevent: the κ-OMO rule supports credit only down to the remaining backing buffer $S_t \geq 0$, so a large enough credit shock *exhausts* the fund, the support cap binds, and the procyclical feedback runs unchecked. We close the model's account of credit with a tractable nonlinear model of this occasionally-binding constraint, in two states—the output gap $\hat{y}_t$ and the buffer S_t:

$$a_t = \min\big(\phi_o \max(\kappa_t^{\text{des}}, 0),\ S_t\big), \qquad \hat{\kappa}_t = \kappa_t^{\text{des}} - a_t, \qquad S_{t+1} = \min\big(\bar{S},\ S_t - a_t + \rho_S(\bar{S} - S_t)\big), \tag{7}$$

with $\kappa_t^{\text{des}} = [\psi_\kappa(-\hat{y}_{t-1}) + \xi_t]$ clipped to $[-\bar{\kappa}, \kappa_{\max}]$ (the intensity is non-negative and credit deterioration saturates once defaults occur), output $\hat{y}_t = \rho_y \hat{y}_{t-1} - b\hat{\kappa}_t$, and the normal-times feedback calibrated stable ($\rho_y + b\psi_\kappa = 0.94 < 1$) so that all nonlinearity comes from the binding constraint.

Proposition 7 (State-dependent fire sales and backing adequacy)**.** *The response to a credit shock is state-dependent: the same* 4% *shock troughs at* -0.80% *when the SSF is full but* -2.88% *when it is depleted—a* $3.6\times$ *fire-sale amplification—and the ergodic output distribution is left-skewed (skewness* ≈ -0.25*). Crisis frequency and tail risk fall monotonically in the buffer: crises (output below* -5%*) occur with frequency* $0.63\%, 0.17\%, 0.04\%, 0.00\%$ *at buffers* $\bar{S} = 1, 2, 3, 5\%$*, with the* 5*th-percentile output gap rising from* -2.98% *to* $+0.06\%$*. Under* transitory *(i.i.d.) shocks a buffer of* 3–5% *of annual* κ*-support capacity drives the crisis frequency below* 0.1%*; the shock scale itself is empirically grounded (the CIR stationary standard deviation of* κ *implied by the real sovereign-sukuk estimates of Ahmed & Bhuyan [2026b] has a cross-issuer median of* 0.97%*, close to the* 1% *used here).* Once the shock's persistence is estimated, the required buffer is substantially larger*, as the next paragraph shows; the* 3–5% *figure is the transitory-shock benchmark, not the realistic one.*

This is the nonlinear realisation of "bounded-but-backed": in normal times the constraint is slack and the economy is the linear one of Sections 4–6; only a large shock against an exhausted fund produces a fire sale, and the model maps the shock distribution into the backing needed to absorb it—a quantitative answer to the companion paper's principal open question (Figure 8). The model is a tractable reduced form of the mechanism, not a global solution of the full DSGE; a global rational-expectations solve is provided below, and a piecewise-linear [Guerrieri & Iacoviello, 2015] or projection solve on the $(\hat{y}, S)$ state space is the natural quantitative deepening.

Empirical credit-shock persistence sharply raises the required buffer. The 3–5% figure assumes *transitory* (i.i.d.) credit shocks. The data say otherwise. Fitting an AR(1) to the real constant-maturity κ series of Ahmed & Bhuyan [2026b] gives a monthly persistence of $\rho_\xi \approx 0.77$ (a half-life of 2.7 months, within their reported 1.4–4.3) and an *innovation* standard deviation of 0.73% (the implied *stationary* standard deviation is $0.73\%/\sqrt{1-\rho_\xi^2} \approx 1.1\%$, consistent with the 0.97% median quoted above). Persistence is the dominant driver of the tail: replacing the i.i.d. benchmark (1.0% s.d.) with the estimated AR(1) (0.73% innovation, $\approx 1.1\%$ stationary s.d.) raises the crisis frequency at a 3% buffer from 0.04% to 13.4%, because credit deterioration now *clusters* and drains the fund over successive months rather than in a single period (the effect is, if anything, larger at a common innovation size). The buffer required to hold the crisis frequency below 1–2% rises several-fold, from roughly 1–5% under i.i.d. shocks to 11–13% under the empirical persistence. This does not overturn the mechanism—larger backing still monotonically reduces crises—but it sharpens the boundedness lesson: a Sovereign Stabilisation Fund must be sized for *persistent* credit stress, and a realistically-sized fund reduces the frequency and depth of fire sales without eliminating them. The honest reading of the result is therefore more cautionary once the credit process is taken from the data.

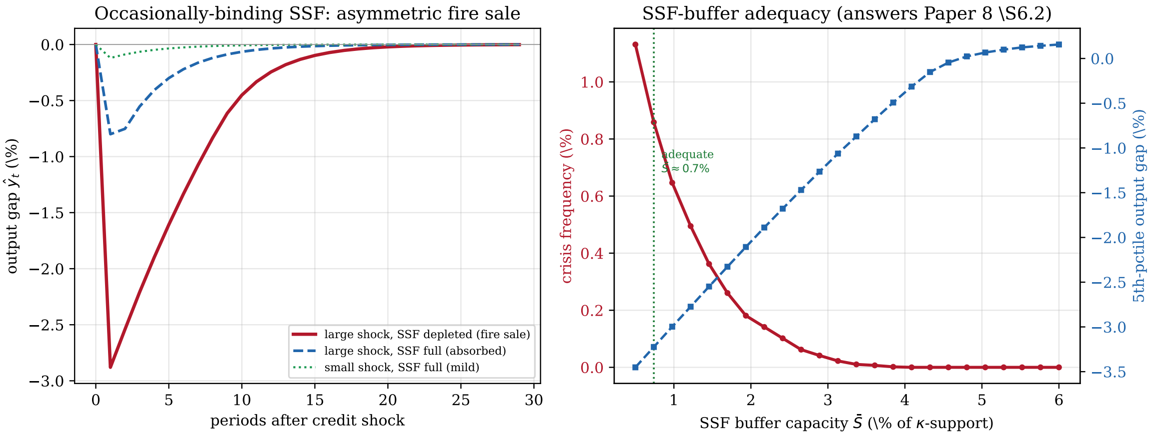

Figure 8: *Left:* the output response to a credit shock is absorbed when the SSF is full and a deep fire sale when it is depleted (3.6× amplification). *Right:* crisis frequency and the 5th-percentile output gap versus SSF buffer capacity: larger backing monotonically lowers crisis frequency and tail risk, with an adequate buffer near 3–5% *under transitory shocks* (the persistence-corrected requirement is 11–13%; see text).

A buffer-sizing rule, and why the sovereign book is the binding case. The dependence on the credit process can be made operational. Mapping the model over a grid of persistence and volatility and recording, at each point, the buffer that holds crisis frequency below 1% yields a buffer-sizing function. A log–log fit over the simulated grid gives

$$\bar{S}^*(\rho_\xi, \sigma_\xi) \;\approx\; \sigma_\xi^{2.3}\,(1-\rho_\xi)^{-2.2} \qquad (\sigma_\xi,\ \bar{S}^* \text{ in percent}), \tag{8}$$

which reproduces the grid to within a few percentage points (it is an empirical fit over the relevant (ρ_ξ, σ_ξ) range, not a closed-form law; the fitted exponents drift with the window). Two features matter. Volatility and persistence enter with *comparable* elasticities ($\sigma_\xi^{2.3}$ versus $(1-\rho_\xi)^{-2.2}$), so a given proportional change in shock size moves the required buffer about as much as the same proportional change in $1-\rho_\xi$ — size is not second-order. What is distinctive about persistence is that the requirement *diverges* as $\rho_\xi \to 1$ (the near-random-walk limit), whereas volatility enters as a regular power (Figure 9). A central bank can read an indicative adequate fund off its own estimated credit dynamics.

Two empirical points anchor the rule. First, the sovereign sukuk process ($\rho_\xi = 0.77$, $\sigma_\xi = 0.73\%$) gives $\bar{S}^* \approx 12\%$. Second, we re-estimate the corporate process on a *much larger* sample than was previously available — constant-maturity κ series for **26 corporate issuers** (183 sukuk; Cbonds daily G-spread histories, 2018–2026), against the seven issuers of the earlier draft. It is *not* negligibly persistent: the per-issuer AR(1) coefficient has median $\rho_\xi = 0.84$ (mean 0.71, IQR 0.56–0.89) with $\sigma_\xi = 0.74\%$. Re-estimating the *sovereign* process by the *identical* 5-year constant-maturity method (six issuers) gives median $\rho_\xi = 0.87$ ($\sigma_\xi = 0.67\%$), statistically indistinguishable from the corporate 0.84: on a common footing the two credit processes are equally persistent.[1]

[1] The headline $\rho_\xi = 0.77$ used for the 12% sovereign buffer is the earlier five-issuer, headline-tenor estimate, retained for continuity; the like-for-like figure (0.87) is marginally higher, which would only raise the required buffer. A third, independent check on a freshly-pulled 2026 Cbonds panel—the four sovereign issuers with sufficient five-year constant-maturity history (Indonesia, Saudi Arabia, Sharjah, Bahrain), monthly AR(1)—gives a median persistence of $\rho_\xi \approx 0.71$ (half-life ≈ 2 months), *below* the headline and so implying, on that cut, a buffer no larger than the one adopted. Across all three samples persistence lies in the 0.71–0.87 range, bracketing the 0.77 used here, so the 12% figure is not an artifact of the original small sample.

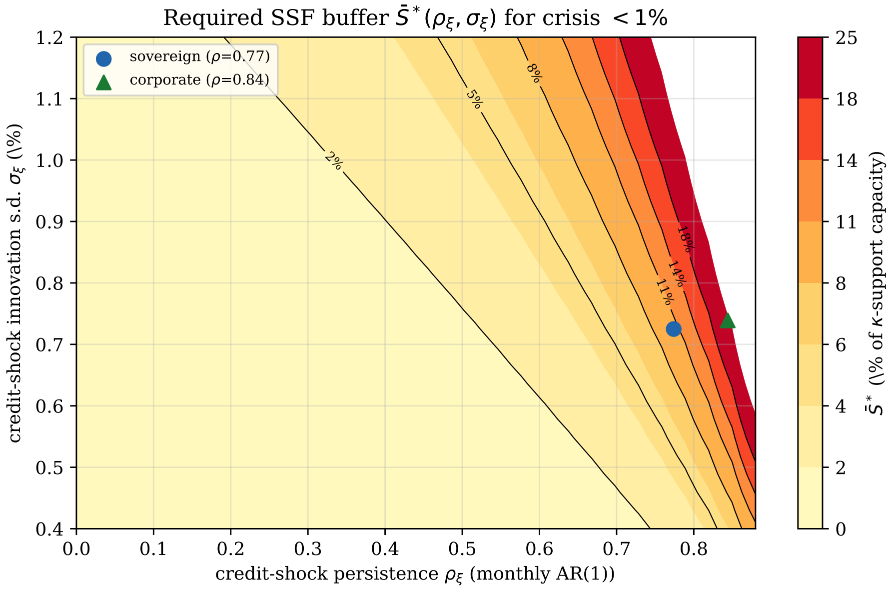

Figure 9: The SSF buffer-sizing function $\bar{S}^*(\rho_\xi, \sigma_\xi)$—the backing needed to hold crisis frequency below 1%—over credit-shock persistence and volatility. The required buffer rises steeply with persistence ($\propto (1-\rho_\xi)^{-2.2}$). The empirically-estimated sovereign sukuk process (blue) requires $\approx 12\%$; the corporate process (green), re-estimated on 26 issuers ($\rho_\xi = 0.84$), is comparably persistent and requires a buffer of the *same order* ($\approx$ 8–30% as the central ρ_ξ runs from the sample mean to the median).

Corporate persistence therefore implies a buffer of the *same order* as the sovereign's (roughly 8–30% as the central ρ_ξ runs from the mean to the median), not the sub-one-percent that the small seven-issuer sample suggested: corporate and sovereign κ-processes are *comparably* persistent, so a κ-Standard backed by either needs a fund of the same order, and the buffer must be calibrated to each issuer's own dynamics rather than assumed small for corporates. The estimate is, however, fragile in exactly the way the rule predicts: because $\bar{S}^*$ scales as $(1-\rho_\xi)^{-2.2}$, near-random-walk persistence ($\rho_\xi \to 1$) makes the required buffer both large and sensitive to the persistence estimate.

A global solution validates the mechanism and the rule. The model above uses the mechanical backing rule of the companion paper. To confirm that the fire-sale mechanism and the backing-adequacy conclusion survive rational expectations—and to ask whether a forward-looking ICB would manage the buffer differently—we solve the ICB's full dynamic program by value-function iteration on the $(\hat{y}, S)$ state space, with the planner choosing support to minimise a discounted crisis-averse loss subject to the occasionally-binding constraint $a_t \leq S_t$. The constrained-optimal policy lowers the planner's loss by about 22% relative to the mechanical rule, almost entirely by removing a small mean bias; the two policies deliver *similar* crisis statistics (crisis frequency 0.047% versus 0.045%, fifth-percentile gap -1.19% versus -1.12% at $\bar{S} = 3\%$). The simple backing-bounded rule of Section 5 thus captures most of the crisis-prevention value, and the global solution confirms the fire-sale amplification and the backing-adequacy trade-off under rational expectations rather than overturning them (Figure 10). This global solve uses *transitory* (i.i.d.) credit shocks — its crisis frequencies ($\approx 0.04\%$ at $\bar{S} = 3\%$) are the i.i.d. benchmark above, so it confirms the mechanism and the mechanical-versus-optimal comparison in that regime. The persistence-driven buffer levels of equation (8) (11–13%) rest on the reduced-form AR(1) analysis and would require a global

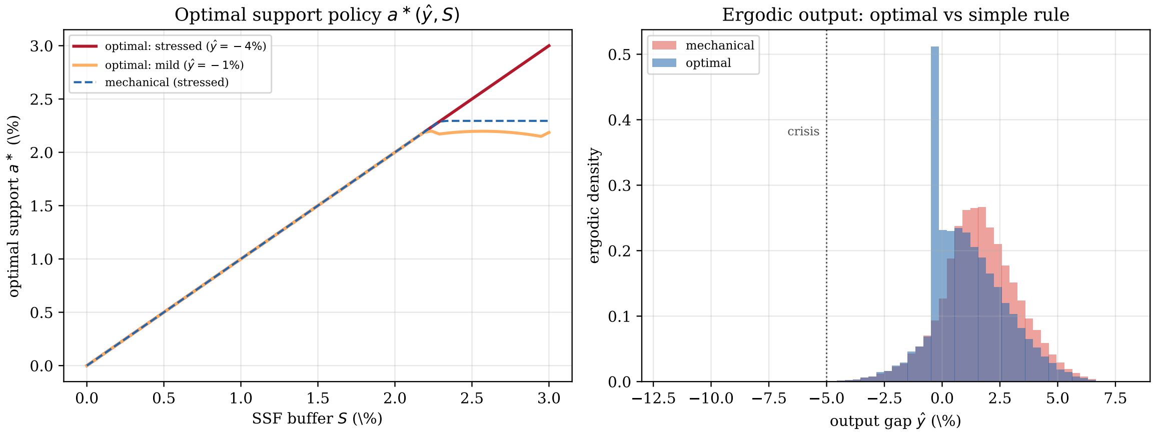

Figure 10: Global rational-expectations solution. *Left:* the optimal support policy $a^*(\hat{y}, S)$ is state-dependent, rising with both the depth of the stress and the available buffer. *Right:* the ergodic output distribution under the optimal policy nearly coincides with that under the simple backing-bounded rule—the rule is near-optimal.

solve with a persistent shock state to confirm directly — the natural next quantitative step.

Idiosyncratic versus systematic persistence. The 11–13% figure prices the shock process of a *single issuer's* constant-maturity series ($\rho_\xi = 0.77$ monthly, half-life 2.7 months). An economy-wide stabilisation fund, however, absorbs the *systematic* factor: the cross-sectional median of $\hat{\kappa}$ across the full traded universe. Constructing that index from the complete Cbonds history panel (273 bonds aggregated to 37 issuer-month series, 127 months, 2015–2026) and estimating its dynamics directly gives $\rho = 0.921$ (half-life 8.4 months) with innovation $\sigma = 0.66\%$ — the median smooths idiosyncratic noise, and what remains is the slow-moving common credit factor. By the fitted law of equation (8), $S^* \propto \sigma^{2.3}(1-\rho)^{-2.2}$, the systematic calibration scales the requirement by a factor of ≈ 8: **a fund that must absorb the systematic factor needs on the order of** 80–100% **of annual support capacity**, not 11–13%. The distinction sharpens rather than overturns the paper's central result — it is the persistence-divergence of S^* evaluated at the persistence that actually obtains for the aggregate — and it implies a portfolio reading: the 11–13% benchmark applies to funds whose exposures diversify across issuers' idiosyncratic shocks, while the systematic component must be either pre-funded at near-annual scale or hedged outside the credit domain altogether (the cross-domain construction taken up in the companion safe-asset analysis).

8 Calibration and empirical discipline

The model has three kinds of numbers, and it is worth separating them. The *structural* parameters (Table 1) are standard preference and technology constants or Bernanke–Gertler–Gilchrist conventions. The *empirical* inputs (Table 2) are estimated from traded sukuk on Cbonds and are what every headline result rests on. The *reduced-form* parameters of the occasionally-binding block of Section 7 ($\psi_\kappa, \phi_o, b, \rho_y, \rho_S$) are stylised: they are not separately estimated but chosen so that normal-times dynamics are stable and the mechanism is transparent, and the conclusions drawn from that block are differences (state-dependence, the persistence comparison) rather than levels.

The empirical discipline is the distinctive feature: every quantity that moves a headline result is read from live sukuk markets rather than assumed. The convergence intensity, the

Structural parameter	Value	Source
β (discount)	0.97	∼3% real, program-consistent
σ (CRRA)	2.0	standard
α (capital share)	0.33	standard
δ_K (depreciation)	0.08	standard
G/Y	0.20	standard
χ (premium elasticity)	0.05	Bernanke et al. [1999]
leverage $\bar{K}/\bar{N}$	2.0	Bernanke et al. [1999]
θ_n (survival)	0.95	Bernanke et al. [1999]

Table 1: Structural calibration—standard or BGG conventions.

recovery, the credit-shock process and the asset-class scale all come from Cbonds, and they were re-pulled and re-estimated for this paper rather than inherited.

Empirical input	Value (Cbonds)	Enters
Asset-class scale	USD 761.3 bn outstanding, 4,701 issues, USD 277.3 bn international (Cbonds market statistics, 31 May 2026)	establishes the base is of monetary scale
Recovery δ	0.60 (senior sovereign)	spread $\to \kappa$ map
Baseline $\bar{\kappa}$	2.8% (Indonesia, 7y)	structural steady state
Sovereign $\bar{\kappa}$ cross-section	0.7–9.1% across 12 issuers (AA–CCC), 78 bonds (60 quoted)	determinacy ceilings, Fig. 2
$\bar{\kappa}$ constant-maturity dynamics	half-life 1.4–4.3 mo (7-year tenor, four issuers), Feller satisfied in 12/12 series	CIR-κ validity
Sovereign credit-shock AR(1)	$\rho_\xi = 0.77$, $\sigma_\xi = 0.73\%$ (half-life 2.7 mo)	buffer adequacy, Eq. (8)
Systematic κ-index (panel median, 127 mo)	$\rho = 0.921$ (half-life 8.4 mo), $\sigma = 0.66\%$	systematic-factor buffer ($\approx 8\times$)
Corporate credit-shock AR(1)	$\rho_\xi = 0.84$ median (0.71 mean), $\sigma_\xi = 0.74\%$ (26 issuers, 183 sukuk)	comparable to sovereign
Corporate $\bar{\kappa}$ premium	+31 bp median (213 corporate bonds, broader screener)	corporate ceiling, Fig. 3

Table 2: Empirical inputs, all estimated from traded sukuk on Cbonds. The determinacy region, the shock process, and the buffer-sizing rule are read from the data, not posited.

Three threads run through these inputs and reinforce one another. The *determinacy region* is populated by the real sovereign cross-section: the active-fiscal ceiling $e^{\bar{\kappa}} - 1$ is strictly positive and credit-ordered for every issuer, and widens for corporates by their credit premium. The *credit-shock process* that the Sovereign Stabilisation Fund must absorb is estimated directly from the κ time series, and its persistence—not just its size—is what determines the required backing. The *buffer-sizing rule* then closes the loop, mapping the estimated (ρ_ξ, σ_ξ) into the fund a central bank would actually need. Because all three are read from the same source, the empirical architecture is internally consistent: the sovereign sukuk that populate the determinacy map are the same instruments whose dynamics set the shock process and the backing requirement. The model is calibrated where convention is appropriate and estimated wherever a number carries economic weight.

9 Conclusion

An interest-free monetary economy is internally coherent and, under an explicit fiscal closure, determinate. Three findings organise the paper. First, the removal of interest is a statement about the *contract space*, not about preferences: time preference β remains, the intertemporal margin is carried by state-contingent equity returns, and the nominal interest rate survives only as an untraded shadow wedge that money demand reads as its opportunity cost. This is what allows a fully specified monetary general equilibrium to exist with no policy rate anywhere in it.

Second, price-level determinacy holds and is closed-form. Because the backing is real equity and policy is a quantity operation, the economy escapes the real-bills indeterminacy that an asset-backed money base otherwise courts, and the determinacy condition $\gamma_s < e^{\bar{\kappa}} - 1$ places the convergence intensity exactly where the interest rate sits in conventional fiscal theory. Crucially, given the equity-backing identity $M/P = \mathcal{V}$—which makes the quantity rule and the fiscal valuation the same equation, leaving no separate active-money anchor—the fiscal-theory regime is not one closure chosen among alternatives but the only one available, and removing the interest rate *selects* the determinacy theory rather than leaving determinacy open. (It is the equity-backing of money, not the absence of an interest rate alone, that forces this; absent the identity a quantity-theoretic anchor would be the standard alternative.) The partial-equilibrium result of the companion paper is the exogenous-surplus corner of this region.

Third, the credit channel is determinate-friendly. A contemporaneous reduced-form feedback admits a determinacy threshold, but micro-founding the credit intensity as a Bernanke–Gertler–Gilchrist external-finance premium—first with a net-worth state, then with the full Tobin's-Q revaluation channel—leaves the economy robustly determinate, with only modest amplification consistent with Kocherlakota [2000]. The price-level determinacy of the κ-Standard thus holds in partial equilibrium, in general equilibrium with endogenous surpluses, and across every financial-friction micro-foundation we examine. Optimal policy separates into a Friedman rule for liquidity and a maximal, backing-constrained credit-stabilisation rule, the latter understood as a welfare instrument rather than as determinacy insurance.

Finally, the linear robustness is a normal-times statement. The one regime outside it—a large credit shock against an exhausted Sovereign Stabilisation Fund—is characterised by an occasionally-binding model (Section 7) that produces state-dependent fire-sale amplification (3.6×), a left-skewed ergodic distribution, and a quantitative backing-adequacy rule. Under transitory shocks a buffer of 3–5% of annual κ-support capacity suffices; but once the credit-shock process is estimated from the real sukuk data—which is persistent, with an AR(1) half-life near three months—the required buffer rises several-fold, to 11–13%, because credit stress clusters and drains the fund over successive months — and to near-annual scale (80–100%) if the fund must absorb the *systematic* factor, whose measured persistence ($\rho = 0.921$ on the full-universe index) far exceeds any single issuer's. This answers the companion paper's principal open empirical question, and answers it more cautiously than a transitory-shock calibration would: the interest-free economy is determinate and well-behaved in normal times, the one regime in which it is not is exactly the one the backing fund exists to mitigate, and the fund must be sized for persistent rather than one-off credit stress.

Beyond determinacy and stabilisation, the same backing identity carries a distributional corollary (Section 5.1). Because $M/P = \mathcal{V}$ pins money's value to the real backing, money issued against output transfers no purchasing power to its first recipients: the Cantillon redistribution that an untethered active-money regime routes to asset-holders is zero in the κ-Standard, up to κ-mispricing, and—absent a positive-inflation mandate—the efficiency dividend of productivity growth accrues to every money holder rather than to owners of appreciating assets. Distributional neutrality is therefore not an egalitarian assumption layered onto the model but a consequence of the very equation that forces the fiscal closure: the equation that pins the price level is the equation that zeroes the Cantillon transfer.

The model turns the companion paper's monetary architecture into a general-equilibrium foundation. The remaining step is quantitative rather than conceptual: a full global solution of the occasionally-binding model [Guerrieri & Iacoviello, 2015], which would sharpen the backing-adequacy numbers without changing their direction. That is the natural next step for a quantitative interest-free business-cycle model.

References

Ahmed, S., & Bhuyan, R. (2026a). The κ-Standard: debt-free money creation under a riba-free convergence intensity—uniting the Chicago Plan and Islamic full-reserve monetary theory. Working paper (companion paper).

Ahmed, S., & Bhuyan, R. (2026b). The κ-yield curve: construction, estimation methodology, and real-data evidence from sovereign sukuk. *SSRN Working Paper* 6322938.

Al-Jarhi, M. A. (1981). A monetary and financial structure for an interest-free economy. In *Money and Banking in Islam*. ICRIE.

Askari, H., Iqbal, Z., Krichene, N., & Mirakhor, A. (2012). *Risk Sharing in Finance: The Islamic Finance Alternative*. Wiley.

Benes, J., & Kumhof, M. (2012). The Chicago Plan revisited. *IMF Working Paper* 12/202.

Benhabib, J., Schmitt-Grohé, S., & Uribe, M. (2001). The perils of Taylor rules. *Journal of Economic Theory*, 96(1–2), 40–69.

Benhabib, J., Schmitt-Grohé, S., & Uribe, M. (2002). Avoiding liquidity traps. *Journal of Political Economy*, 110(3), 535–563.

Bernanke, B., Gertler, M., & Gilchrist, S. (1999). The financial accelerator in a quantitative business cycle framework. *Handbook of Macroeconomics*, 1C, 1341–1393.

Bianchi, J. (2011). Overborrowing and systemic externalities in the business cycle. *American Economic Review*, 101(7), 3400–3426.

Borio, C. (2014). The financial cycle and macroeconomics: what have we learnt? *Journal of Banking & Finance*, 45, 182–198.

Brunnermeier, M. K., & Sannikov, Y. (2014). A macroeconomic model with a financial sector. *American Economic Review*, 104(2), 379–421.

Carlstrom, C. T., & Fuerst, T. S. (1997). Agency costs, net worth, and business fluctuations. *American Economic Review*, 87(5), 893–910.

Chari, V. V., Christiano, L. J., & Kehoe, P. J. (1996). Optimality of the Friedman rule in economies with distorting taxes. *Journal of Monetary Economics*, 37(2), 203–223.

Chapra, M. U. (1985). *Towards a Just Monetary System*. The Islamic Foundation.

Cochrane, J. H. (2023). *The Fiscal Theory of the Price Level*. Princeton University Press.

El Hamiani Khatat, M. (2016). Monetary policy in the presence of Islamic banking. *IMF Working Paper* WP/16/72.

Fisher, I. (1936). 100% Money and the public debt. *Economic Forum*, 406–420.

Friedman, M. (1969). The optimum quantity of money. In *The Optimum Quantity of Money and Other Essays*. Aldine.

Gertler, M., & Karadi, P. (2011). A model of unconventional monetary policy. *Journal of Monetary Economics*, 58(1), 17–34.

Guerrieri, L., & Iacoviello, M. (2015). OccBin: a toolkit for solving dynamic models with occasionally binding constraints easily. *Journal of Monetary Economics*, 70, 22–38.

Jeanne, O., & Korinek, A. (2019). Managing credit booms and busts: a Pigouvian taxation approach. *Journal of Monetary Economics*, 107, 2–17.

Khan, M. S., & Mirakhor, A. (1989). The financial system and monetary policy in an Islamic economy. *JKAU: Islamic Economics*, 1, 39–57.

Kiyotaki, N., & Moore, J. (1997). Credit cycles. *Journal of Political Economy*, 105(2), 211–248.

Kocherlakota, N. R. (2000). Creating business cycles through credit constraints. *Federal Reserve Bank of Minneapolis Quarterly Review*, 24(3), 2–10.

Leeper, E. M. (1991). Equilibria under 'active' and 'passive' monetary and fiscal policies. *Journal of Monetary Economics*, 27(1), 129–147.

Leeper, E. M., & Leith, C. (2016). Understanding inflation as a joint monetary–fiscal phenomenon. In *Handbook of Macroeconomics*, Vol. 2B, 2305–2415. Elsevier.

Lucas, R. E. (2000). Inflation and welfare. *Econometrica*, 68(2), 247–274.

Mendoza, E. G. (2010). Sudden stops, financial crises, and leverage. *American Economic Review*, 100(5), 1941–1966.

Sargent, T. J., & Wallace, N. (1982). The real-bills doctrine versus the quantity theory. *Journal of Political Economy*, 90(6), 1212–1236.

Sidrauski, M. (1967). Rational choice and patterns of growth in a monetary economy. *American Economic Review*, 57(2), 534–544.

Sims, C. A. (1994). A simple model for study of the determination of the price level. *Economic Theory*, 4(3), 381–399.

Woodford, M. (2001). Fiscal requirements for price stability. *Journal of Money, Credit and Banking*, 33(3), 669–728.

Woodford, M. (2003). *Interest and Prices: Foundations of a Theory of Monetary Policy*. Princeton University Press.