
Liquidity Preference, Credit Transmission, and Debt Sustainability: A Settlement-Gap Approach

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Abstract

Standard models treat liquidity preference as a portfolio allocation problem. This paper reframes it as the shadow price of settlement certainty in a credit-money economy. A structural settlement gap forces continuous new credit creation; higher liquidity preference simultaneously raises credit requirements and reduces credit effectiveness. The net effect on nominal growth is ambiguous and depends on a testable dominance condition. When credit effectiveness falls faster than credit creation rises, the economy enters a self-reinforcing Keynes-Minsky-Clower spiral. Outside money can break the spiral by substituting sovereign liquidity for private refinancing one-for-one.

Keywords: liquidity preference; settlement gap; credit money; debt sustainability; Minsky spiral

JEL codes: E12, E41, E44, E51, G01

1. Introduction

Standard monetary theory treats liquidity preference as a portfolio problem: agents hold money when the opportunity cost is low enough (Tobin, 1958; Hicks, 1967). The institutional fact that money in modern economies is created by private bank lending and extinguished by debt repayment drops out of this framing. Yet it has a structural consequence that standard models miss: contractual interest obligations grow the outstanding debt stock faster than the deposits originally created to finance it — a settlement gap. Closing it requires either new credit creation or sovereign liquidity injection.

This paper makes three contributions. First, we derive liquidity preference as the shadow price of a state-contingent settlement constraint rather than a portfolio preference: the liquidity premium is the marginal value of guaranteed settlement, rising with uncertainty over

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net inflows. Second, we show that in a pure credit economy the settlement gap generates an endogenous demand for money that is structural, not behavioural — it follows arithmetically from the interest rate on outstanding debt, independently of income distribution. Third, we derive an ambiguity theorem: higher liquidity preference simultaneously raises the credit volume required for settlement and lowers the share of credit converted into expenditure. The net effect on nominal demand growth is ambiguous and depends on a testable dominance condition. When credit effectiveness declines faster than credit requirements rise, the economy contracts, the debt ratio rises, and refinancing pressure pushes the liquidity premium further upward — a Keynes–Minsky–Clower spiral.

Our framework draws on four strands of the literature. The cash-in-advance tradition (Clower, 1967; Lucas and Stokey, 1987) establishes a transaction demand for money. Monetary circuit theory (Graziani, 2003; Parguez, 1996) emphasises the endogenous creation and destruction of bank money but conflates the settlement gap with income distribution. Stock-flow consistent accounting (Godley and Lavoie, 2012) provides balance-sheet discipline, and the institutional dimension of liquidity preference follows Marglin (2021). Financial fragility dynamics (Minsky, 1986) find formal analogues in the liquidity-spiral mechanism and the procyclical amplification models of Adrian and Shin (2010) and Brunnermeier and Sannikov (2014). Financial ‘liquidity spirals’ (Brunnermeier and Pedersen, 2009) can be viewed as the asset-market counterpart of the mechanism developed here, in which a higher liquidity premium reduces expenditure and amplifies settlement risk.

The results bear directly on policy. Global uncertainty shocks are empirically associated with subsequent declines in output and investment (Ahir, Bloom, and Furceri, 2022), consistent with a transmission through credit spreads (Gilchrist, Sim, and Zakrajšek, 2014). The mechanism proposed here interprets this as a higher liquidity premium compressing the expenditure share of new credit. Outside money then reduces private refinancing pressure one-for-one — a settlement-capacity result, not a demand-management one.

Section 2 develops the microfoundation. Section 3 presents the settlement-gap model and the ambiguity theorem. Sections 4–5 provide a numerical illustration and derive the Keynes–Minsky–Clower spiral. Section 6 draws policy implications. Section 7 concludes.

2. Liquidity Preference as a Settlement Shadow Price

An agent allocates nominal income y between expenditure x and money balances m carried forward, choosing to maximise expected utility:

$$\max U(x) + \mathbb{E}[\beta V(m, s')] \quad \text{subject to} \quad y = x + m \quad (1)$$

Future states s' are uncertain. The agent faces a forward-looking settlement constraint:

$$m + f(s') \geq \Omega(s') \quad (2)$$

where $f(s')$ is the nominal cash inflow received in state s' and $\Omega(s')$ is the nominal obligation falling due. Prior asset conversion is ruled out: only money balances and incoming cash flows count toward settlement.

Let λ denote the Lagrange multiplier on constraint (2). It is the marginal value of relaxing the settlement constraint by one unit — the shadow price of guaranteed settlement. Because money alone settles obligations instantly without prior conversion, λ captures a liquidity service distinct from the transactional convenience yield.

Proposition 1 (Microfoundation). *The liquidity premium is the shadow price of a state-contingent settlement constraint. It is increasing in the expected obligation $\mathbb{E}[\Omega(s')]$, the variance of net inflows $\Omega(s') - f(s')$, and the probability of settlement shortfall.*

For proof see Annex A1. Under standard aggregation (e.g. representative constraint or law of large numbers), λ_t summarises the distribution of individual shadow values. We assume that the aggregate economy λ_t summarises this shadow value across agents and depends on the expected future settlement gap and macro-financial uncertainty σ_t :

$$\lambda_t = \rho(\mathbb{E}_t(SG_{t+1}), \sigma_t), \quad \rho_1 > 0, \quad \rho_2 > 0 \quad (3)$$

3. The Ambiguity Theorem

Let M_t denote the total stock of liquid means of payment available for settlement in period t . It consists of inside money claims generated by bank lending (D_t) and outside money Z_t supplied exogenously. Outside money stands for central bank reserves, currency, net fiscal injections, and current account surplus.

$$M_t = D_t + Z_t \quad (4)$$

The change in money stock is:

$$\Delta M_t = \Delta D_t + \Delta Z_t \quad (4a)$$

Z_t denotes the stock of outside money available in period t , so that $\Delta Z_t = Z_t - Z_{t-1}$ is the net injection of outside money during period t .

Let the stock of outstanding private debt evolve as:

$$B_t = \mu_t B_{t-1} + N_t \quad (5)$$

where $\mu_t \in [0,1]$ is the rollover rate, N_t is gross new lending in period t , and μ_t is an exogenous parameter.

Settlement requirement

The gross contractual obligations falling due in period t are:

$$\Omega_t = (1 - \mu_t)(1 + r_{t-1})B_{t-1} \quad (6)$$

Let the lending rate on credit be:

$$r_{t-1} = i_{t-1} + E_{t-1}(\lambda_t) + \theta_{t-1} \quad (7)$$

where i_t is the policy benchmark rate and θ_t captures risk and intermediation costs. Contracts signed in $t - 1$ price expected settlement conditions in t , so that $r_{t-1} = i_{t-1} + E_{t-1}(\lambda_t) + \theta_{t-1}$. This is consistent with equation (3), where realised λ_t depends on the expected future settlement gap $E_t(SG_{t+1})$.

Settlement capacity

Available liquidity for settlement consists of new private credit N_t and net outside-money injection ΔZ_t . Hence:

$$\text{Settlement capacity} = N_t + \Delta Z_t \quad (8)$$

Settlement constraint

Settlement then requires that available liquidity covers obligations and desired hoarding H_t :

$$N_t + \Delta Z_t \geq \Omega_t + H_t \quad (9)$$

Rearranging gives the minimum credit required for settlement

$$N_t \geq \Omega_t + H_t - \Delta Z_t \quad (10)$$

The settlement gap is:

$$SG_t = \Omega_t + H_t - (N_t + \Delta Z_t) \quad (11)$$

If $SG_t > 0$: there is insufficient liquidity (true “gap”)

If $SG_t = 0$: the gap is exactly closed

If $SG_t < 0$: there is excess liquidity

Under binding settlement, the equilibrium condition is $SG_t = 0$, so that the model determines the required lending level $N_t = N_t^*$.

The minimum private lending required to close the settlement gap is:

$$N_t^* = \max\{0, [(1 - \mu_t)(1 + i_{t-1} + E_{t-1}(\lambda_t) + \theta_{t-1})]B_{t-1} + H_t - \Delta Z_t\} \quad (12)$$

Proposition 2 (Mixed closure with inside and outside money). In a pure inside-money economy ($Z_t = 0$), all additional settlement liquidity must be generated by new private credit. In a mixed economy, outside money reduces the refinancing pressure generated by the settlement gap.²

Following Biggs et al. (2010), and in line with the financial-frictions literature (Bernanke and Gertler, 1989; Greenwald and Stiglitz, 1993), we abstract from alternative sources of private finance and focus on bank credit. In the limiting case of a pure inside-money cash-in-advance economy with no rollover, all expenditure is financed by contemporaneous credit creation, so that $\chi(\lambda_t) = Y_t / N_t$.

More generally, aggregate nominal demand has two components: new private credit N_t , of which only the fraction $\chi(\lambda_t)$ generates net expenditure after settlement obligations are discharged within the lending flow, and after precautionary hoarding is taken into account, and net outside-money injections ΔZ_t , which enter demand with multiplier $\psi \in [0,1]$. The parameter ψ measures the demand effect of outside-money injections. Hence:

$$Y_t = \chi(\lambda_t) N_t + \psi \Delta Z_t, \quad \chi'(\lambda_t) < 0, \quad 0 \leq \psi \leq 1 \quad (13)$$

When the settlement constraint binds, $N_t = N_t^*$ and equations (12) and (13) jointly close the model.

χ is decreasing in λ_t because higher liquidity preference raises the settlement share of new lending and reduces discretionary expenditure from the remainder; in addition, it increases precautionary hoarding H_t , further lowering effective demand. This abstracts from the secondary recirculation channel whereby creditors (banks) who receive settlement may themselves re-spend recovered deposits.

Effect of liquidity preference on growth

Define the growth rate as $g_t = \frac{Y_t - Y_{t-1}}{Y_{t-1}}$. Under binding settlement ($N_t = N_t^*$):

$$g_t^* = \frac{\chi(\lambda_t) N_t^* + \psi \Delta Z_t - Y_{t-1}}{Y_{t-1}} \quad (14)$$

Differentiating with respect to λ_t :

$$\frac{\partial g_t^*}{\partial \lambda_t} = \frac{1}{Y_{t-1}} \left[\chi'(\lambda_t) N_t^* + \chi(\lambda_t) \frac{\partial N_t^*}{\partial \lambda_t} \right] \quad (15)$$

² This is the reverse of Bagehot's micro rule "lend freely but at a high rate". Here the macro rule is "lend freely because the rate is high".

The first term is unambiguously negative: higher liquidity preference reduces the expenditure share of any given volume of credit. The second term is unambiguously positive: higher liquidity preference increases the volume of credit required to close the settlement gap.

$$\frac{\partial N_t^*}{\partial \lambda_t} = (1 - \mu_t)B_{t-1} \cdot \frac{\partial E_{t-1}(\lambda_t)}{\partial \lambda_t} + \frac{\partial H_t}{\partial \lambda_t} - \frac{\partial \Delta Z_t}{\partial \lambda_t} \quad (16)$$

Under realised or rational expectations, the liquidity premium equals its previously expected value, implying $\partial E_{t-1}(\lambda_t) / \partial \lambda_t = 1$. Without policy reaction $\frac{\partial \Delta Z_t}{\partial \lambda_t} = 0$.

$$\frac{\partial N_t^*}{\partial \lambda_t} = (1 - \mu_t)B_{t-1} + \frac{\partial H_t}{\partial \lambda_t} > 0 \quad (17)$$

Theorem 1 (Dominance condition). *Liquidity preference reduces growth iff*

$$|\chi'(\lambda_t) N_t^*| > \left| \chi(\lambda_t) \frac{\partial N_t^*}{\partial \lambda_t} \right| \quad (18)$$

When (18) holds, $\partial g_t^* / \partial \lambda_t < 0$. When that fails, higher liquidity preference raises required credit creation faster than it reduces credit effectiveness, and nominal growth rises despite tighter financial conditions.

4. Numerical illustration of the dominance condition

Setting $\chi(\lambda) = \chi_0 \exp(-\alpha\lambda)$ simplifies condition (13) to:

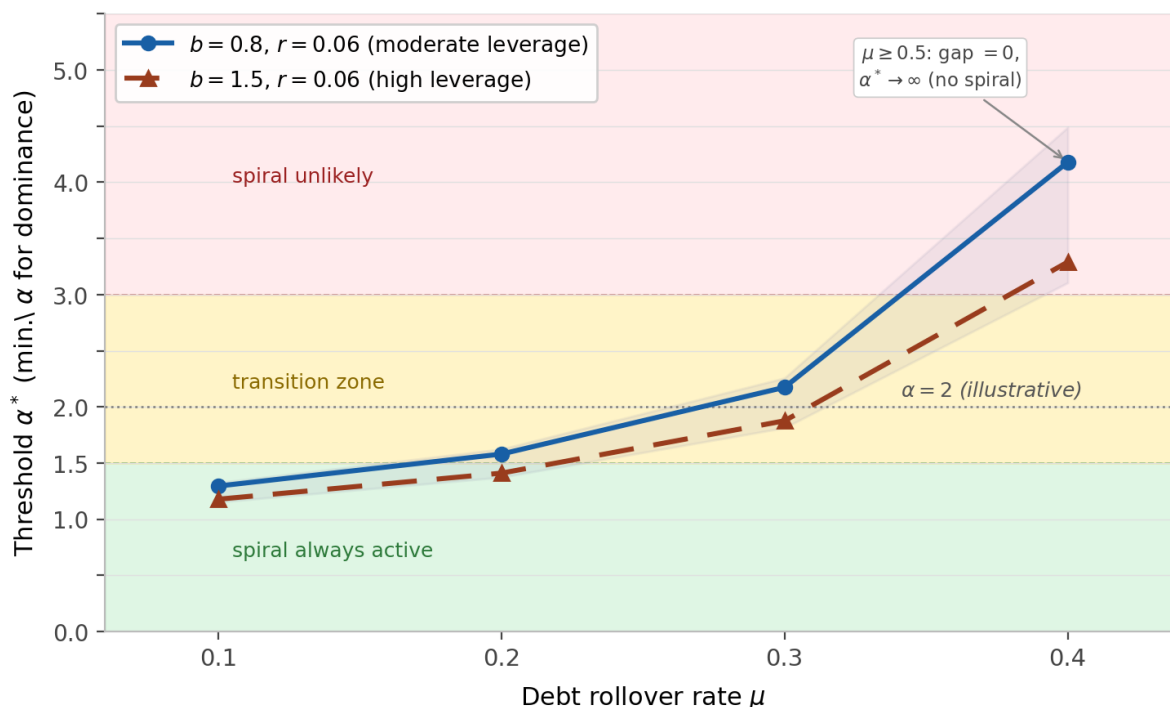
$$\alpha \cdot n^* > (1 - \mu) \cdot b + \beta \quad (19)$$

where $n^* = N^*/Y$ is the settlement gap as a share of income; $b = B/Y$ is the leverage ratio, $h = \frac{H}{Y}$ the hoarding ratio, and $\beta = \partial h / \partial \lambda$ the marginal hoarding rate. The dominance ratio is $\delta = \alpha \cdot n^* / [(1 - \mu) \cdot b + \beta]$; α^* is the minimum α required for $\delta = 1$.

Figure 1 shows the threshold α^* (y-axis) as a function of μ (x-axis) for moderate (solid blue) and high leverage (dashed red), setting the baseline parameters: $r = 0.06$, $h = 0.05$, $z = 0.10$, $\beta = 0.10$. Moderate leverage is simulated by $b = 0.8$ (roughly euro area private-sector debt before the global financial crisis); high leverage by $b = 1.5$ (post-crisis deleveraging or Japan circa 2000). The interest-rate effect on α^* is small (at most 0.15 across the r range shown). Shaded band shows sensitivity to $r \in \{0.04, 0.08\}$ and $b \in \{0.8, 1.5\}$. Dotted line marks $\alpha = 2$.

Three findings stand out. First, the dominance condition is satisfied for $\alpha \geq 2$ across all rollover rates up to $\mu = 0.3$. Second, the condition fails at $\mu \geq 0.5$ regardless of leverage: when most debt is rolled over, the settlement gap closes through rollover alone. Third, Figure

1 confirms that μ is the decisive parameter; leverage b and interest rate r shift the threshold only modestly.



Note: shaded band between outer lines shows sensitivity to $r \in \{0.04, 0.08\}$ and $b \in \{0.8, 1.5\}$. Baseline: $h/Y = 0.05$, $z = 0.10$, $\beta = 0.10$.

Figure 1. Threshold α^* for the dominance condition across rollover rates and leverage.

5. The Keynes-Minsky-Clower Spiral

When condition (18) holds, the economy enters a self-reinforcing contraction. A rise in uncertainty σ_t raises λ_t , which raises N_t^* , but because credit effectiveness falls faster, nominal income Y_t declines. Lower income raises b_t , which feeds back into higher expected settlement obligations. Formally, the system $(\lambda_{t+1}, N_{t+1}) = \mathcal{F}(\lambda_t, N_t)$ has an unstable fixed point at (λ^*, N^*) ; trajectories diverge under the parameter restrictions in Proposition 2,

Proposition 3 (Spiral). *A rise in macro-financial uncertainty generates a self-reinforcing contraction in nominal demand through the settlement channel. The spiral is self-terminating only if outside money expands sufficiently ($\partial z_t / \partial \lambda_t > 0$) or debt is restructured to reduce Ω_t . If uncertainty subsides and the liquidity premium falls, the spiral works in the opposite direction.*

For proof see Annex A2. The spiral captures the Keynesian paradox of thrift in a credit-money setting (Keynes, 1936, ch. 17), the financial fragility dynamics of Minsky (1986), and the cash-in-advance constraint of Clower (1967) — but derives their interaction from a single

settlement condition rather than three separate mechanisms. The formal parallel to Brunnermeier and Sannikov's (2014) liquidity spiral is precise: both feature an endogenous state variable that amplifies an initial shock through balance-sheet feedback.

6. Outside Money as a Structural Offset

According to equation (16), the comparative static with respect to outside money is $\partial n_t^* / \partial z_t = -1$: an additional unit of outside money as a ratio to inherited income reduces required new private lending one-for-one.

Proposition 4 (Outside money offset). Assuming perfect substitutability and fixed ψ , *outside money reduces required private funding one-for-one. When $\partial z_t / \partial \lambda_t > 0$ — that is, when the public sector expands liquidity provision in response to rising liquidity preference — the spiral is broken. But when $\partial z_t / \partial \lambda_t < 0$, stress becomes self-reinforcing.*

This reframes the fiscal multiplier debate. The question is not whether government spending stimulates aggregate demand through conventional Keynesian channels, but whether sovereign liquidity injection closes the settlement gap that private credit cannot close when liquidity preference is elevated. In Figure 1 outside money shifts the effective μ rightward, moving the economy toward the no-spiral zone. This provides a settlement-theoretic rationale for quantitative easing and central bank maturity-extension operations.

7. Conclusion

The key result of the settlement-gap framework — that higher liquidity preference raises required credit creation while reducing credit effectiveness, with ambiguous net effect — corrects the standard presumption that tighter financial conditions unambiguously contract demand. The dominance condition under which demand falls is testable and depends on the credit-sensitivity parameter α and the rollover rate μ . Quantitative easing and the debt rollover rate are instruments to break the Keynes-Minsky-Clower spiral.

Annex

A1. Proof of Proposition 1.

When the settlement constraint (2) binds, $m^* = \Omega(s') - f(s')$ and $x^* = y - m^*$. Differentiating the binding first-order condition

$$\lambda = U'(x^*) - E[\beta V_m(m^*, s')] \quad (\text{A. 1.1})$$

with respect to $E[\Omega(s')]$, and using $\partial m^* / \partial E[\Omega] = 1$ and $\partial x^* / \partial E[\Omega] = -1$, gives:

$$\frac{\partial \lambda}{\partial E[\Omega]} = -U''(x^*) - E[\beta V_{mm}] > 0 \quad (\text{A. 1.2})$$

since $U'' < 0$ and $V_{mm} < 0$ by concavity of U and V . The variance and shortfall-probability claims follow from a standard mean-preserving-spread argument: holding $E[\Omega]$ fixed, a mean-preserving spread in net inflows $\Omega(s') - f(s')$ increases the probability of the constraint binding, raising the expected shadow cost

Annex A2.

Define two state variables: liquidity preference λ_t and new lending N_t . Assume two adjustment equations close the dynamics:

$$\lambda_{t+1} = \lambda_t + \alpha(\bar{N} - N_t) \quad (\text{A 2.1})$$

$$N_{t+1} = \chi(\lambda_t) \cdot N_t \quad (\text{A 2.2})$$

Equation (A 2.1) says liquidity preference rises when lending falls below its threshold $\bar{N}$ — the precautionary response to credit tightening. Equation (A 2.2) says: net expenditure-generating lending next period equals the current conversion rate applied to current lending.

Fixed point.

At (λ^*, N^*) : $N^* = \bar{N}$ and $\chi(\lambda^*) = 1$, i.e. the conversion rate is unity at the steady-state liquidity level.

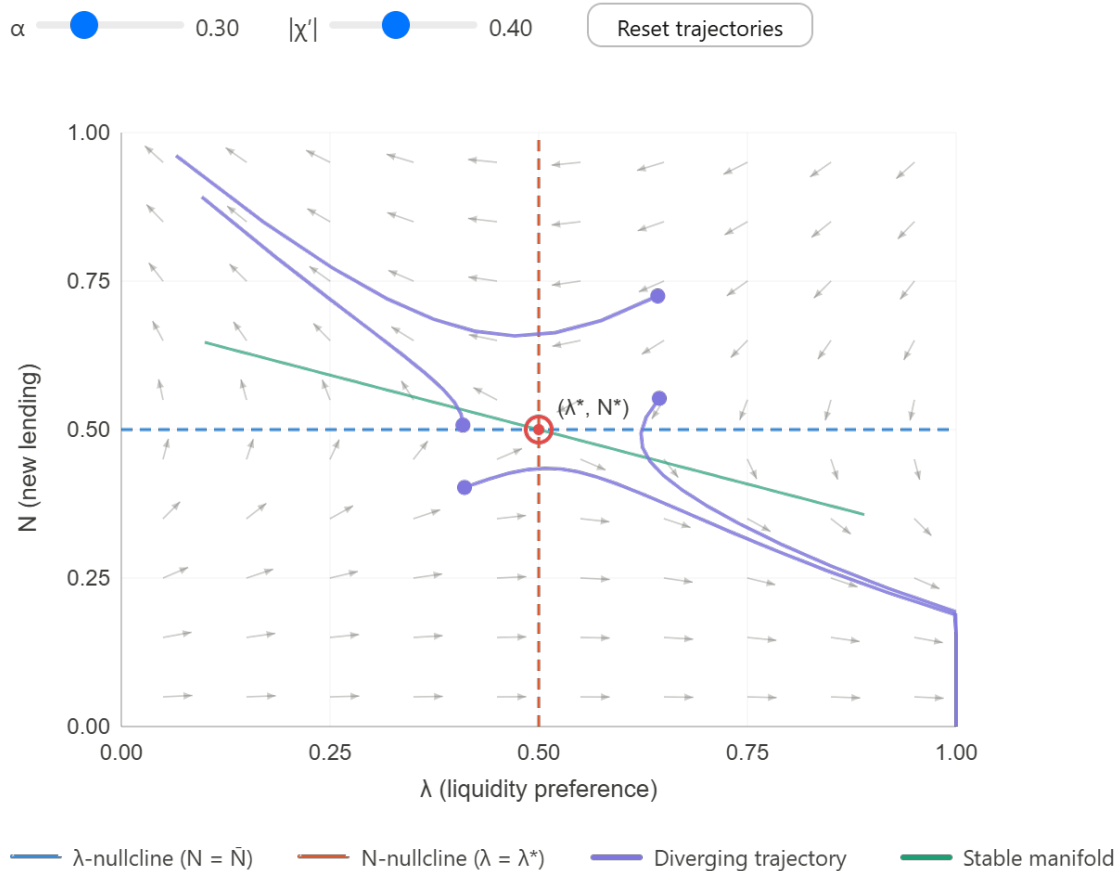
Jacobian and instability.

Linearising around (λ^*, N^*) :

$$J = \begin{pmatrix} 1 & -\alpha \\ \chi'(\lambda^*)N^* & 1 \end{pmatrix} \quad (\text{A 2.3})$$

Eigenvalues:

$\mu = 1 \pm \sqrt{-\alpha\chi'N^*}$. Since $\chi' < 0$, both terms under the root are positive, giving one eigenvalue $\mu_1 > 1$. The fixed point is an unstable saddle — trajectories diverge unless initialised exactly on the stable manifold.



The λ -nullcline is $N = \bar{N}$: above it λ falls, below it λ rises. The N -nullcline is $\lambda = \lambda^*$: left of it N rises, right of it N falls. The stable manifold is the unique trajectory converging to (λ^*, N^*) ; all others diverge. A small shock pushing λ above λ^* reduces N , which raises λ further, which depresses N further — the self-reinforcing collapse.

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