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Institutional Constraints on Endogenous Growth

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Abstract

This paper argues that endogenous growth requires not merely savings and investment, but institutions that ensure investment is productivity-enhancing. We develop a model in which agents choose between productive entrepreneurship and rent-seeking, with institutional quality governing the relative returns to each activity. The fraction of productive investment, λ , is determined endogenously by this occupational choice, and interacts with precautionary liquidity demand to generate multiple equilibria. Below a critical institutional threshold, the economy is trapped in stagnation even when markets clear and savings are high. We derive closed-form conditions for the existence of the stagnation trap and show that the trap is more likely when savings rates are low, speculative returns are high, and uncertainty is elevated. These results distinguish two empirically relevant failure modes: savings-abundant economies such as Japan, where the primary constraint is institutional quality, and savings-scarce economies such as the United Kingdom, where low savings and poor institutional quality constitute a dual failure requiring distinct policy responses.

JEL Codes: O41, E22, E44, O43

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1 Introduction

In many advanced economies, sustained investment coexists with persistent stagnation. Japan's lost decades and the United Kingdom's prolonged productivity malaise illustrate that the mere presence of savings and capital accumulation is not sufficient for growth. Standard endogenous growth theory, building on Romer (26) and Aghion and Howitt (3), emphasises internal mechanisms innovation, human capital, and knowledge spillovers as the engines of long-run growth. These models implicitly assume, however, that savings are automatically channelled into productivity-enhancing investment. This paper argues that assumption is institutionally contingent, and that relaxing it generates a richer and more empirically relevant account of why advanced economies stagnate.

The central contribution is a negative feedback loop between two channels that the existing literature has treated in isolation. Murphy et al. (1991) show that when rent-seeking offers sufficiently high returns, talented agents choose it over productive entrepreneurship, depressing aggregate growth. Aiyagari (4) shows that idiosyncratic income risk generates precautionary liquidity demand that competes with productive investment for household savings. This paper shows that these two mechanisms interact: low institutional quality depresses entrepreneurial appropriability, which reduces the return to productive investment, which raises precautionary liquidity demand, which tightens the threshold for positive productivity growth, which further depresses entrepreneurial activity. That loop is absent from both parent literatures and it is what drives the paper's central results. The interaction is formalised through an endogenous productive investment share λ , the fraction of investment directed toward frontier innovation rather than rent-seeking, which responds to institutional quality, aggregate capital intensity, and equilibrium liquidity demand simultaneously. When λ falls below a critical threshold λ^* , productivity growth turns negative even though markets clear and savings remain positive. The failure is not one of aggregate demand but of the endogenous growth mechanism itself.

This mechanism differs qualitatively from the strategic complementarity models of Cooper and John (9), with which it shares the multiple equilibria structure, in a way that matters for policy. In Cooper and John (9) complementarity operates through a single strategic margin and positive interventions generate smooth recovery from any starting point within the multiple equilibria region. Here complementarity operates through three interacting margins: liquidity demand, speculative returns, and

entrepreneurial appropriability, and the resulting fixed-point map is S-shaped rather than simply kinked. The unstable intermediate equilibrium is a saddle point whose stable manifold separates the basins of attraction of the growth and stagnation equilibria. A negative shock can shift the economy across the separatrix with relatively little force, but recovery requires either a permanent improvement in institutional quality sufficient to eliminate the stagnation equilibrium entirely, or a coordinated shift in expectations large enough to move the economy across the separatrix from below. Incremental reforms that leave institutional quality within the multiple equilibria region have no guaranteed effect. This asymmetry between collapse and recovery is a structural consequence of the three-way interaction rather than an assumption.

The mechanism also differs from the secular stagnation literature of Summers (28) and Eggertsson and Mehrotra (12) in a way that has direct policy implications. Those frameworks identify the savings-investment channel and the real interest rate as the binding constraints on growth. Our model predicts that in a low institutional quality environment these instruments are insufficient and potentially counterproductive: raising savings channels additional resources into rent-seeking rather than frontier innovation, leaving TFP growth unchanged, while cutting interest rates reduces the opportunity cost of liquidity without addressing the occupational choice distortion that suppresses λ . The empirical anchor is Hayashi and Prescott (16), who show that Japan's lost decade reflected a collapse in TFP rather than insufficient capital accumulation, precisely what our model predicts and what the savings-investment channel cannot explain. The binding constraint in our framework is institutional quality at the innovation margin, not the savings rate.

Our framework builds on Murphy et al.(1991) and extends it in three directions. First, we endogenise the rent-seeking return through a no-arbitrage condition on existing capital assets, so that ρ responds to capital intensity rather than being fixed exogenously, generating a dynamic feedback between accumulation and misallocation that the static Murphy et al.(1991) framework cannot produce. Second, we introduce institutional quality q as the appropriability of entrepreneurial returns, providing a structural microfoundation for the reform channel. Third, embedding the occupational choice in a dynamic model with precautionary liquidity demand generates multiple equilibria and a stagnation trap that Murphy et al.(1991) does not produce. In contrast to Hsieh and Klenow (17), whose quantitative framework attributes TFP losses to exogenous wedges whose source is left unexplained, misallocation here is an

equilibrium outcome of occupational choice: agents rationally select rent-seeking when q is low and ρ is high. The importance of institutions for long-run growth is emphasised by Acemoglu, Johnson, and Robinson (1); our model provides a dynamic complement by deriving the critical thresholds $\underline{q}$ and $\bar{q}$ below and above which stagnation or growth is the unique outcome.

The paper derives two main results. First, there exist critical thresholds for institutional quality below which only stagnation is possible, above which only sustained growth is possible, and between which both equilibria exist and initial conditions determine outcomes. Second, the stagnation trap is more likely when the savings rate is low, speculative returns are high, knowledge depreciation is fast, and idiosyncratic uncertainty is elevated. These comparative statics distinguish two empirically important failure modes. Savings-abundant economies such as Japan can sustain growth despite moderate institutional dysfunction but are vulnerable to sudden transitions when speculative returns surge. Savings-scarce economies such as the United Kingdom face a dual failure in which low s and low q reinforce each other and neither instrument alone is sufficient to restore growth.

The paper proceeds as follows. Section 2 develops the model, establishing the production structure, the occupational choice microfoundation for λ , and the portfolio choice determining liquidity demand. Section 3 characterises the equilibria and derives the main propositions. Section 4 analyses stability and transitional dynamics. Section 5 interprets the results in the context of Japan and the United Kingdom. Section 6 concludes.

2 The Model

2.1 Production and Growth

The economy has a Cobb-Douglas production function:

$$Y_t = K_t^\alpha (A_t L)^{1-\alpha}, \quad 0 < \alpha < 1 \quad (1)$$

with L normalised to unity. Productivity evolves according to:

$$\frac{\dot{A}}{A} = \phi \cdot \lambda \cdot (s - m) - \xi \quad (2)$$

where s is the gross savings rate, $m = M/Y$ is the fraction of output held as liquid assets, so that $(s - m)$ is the fraction available for investment; $\xi > 0$ is the rate of knowledge depreciation; $\phi > 0$ is the efficiency with which productive investment generates innovation; and $\lambda \in [0, 1]$ is the fraction of investment that is productivity-enhancing, determined endogenously in Section 2.2.¹ Capital accumulates as:

$$\dot{K} = (s - m)Y - \delta K \quad (3)$$

On a balanced growth path (BGP), $g_A = g_K \equiv g^*$. Using equations (2) and (3), this requires:

$$\phi \cdot \lambda \cdot (s - m) - \xi = \frac{(s - m)Y}{K} - \delta \quad (4)$$

The condition for positive BGP growth reduces to:

$$\lambda > \lambda^* \equiv \frac{\xi}{\phi(s - m)} \quad (5)$$

When $\lambda < \lambda^*$, productivity growth is negative. Capital accumulates faster than A_t , so $MPK = \alpha(A_t/K_t)^{1-\alpha}$ declines monotonically. Investment eventually ceases when MPK falls below the minimum required return, and the economy stagnates. Crucially, markets clear throughout: the savings-investment identity holds, and there is no demand shortfall in the Keynesian sense. The failure is instead one of the endogenous growth mechanism itself — savings do not generate sufficient innovation to sustain returns on capital. The threshold λ^* depends on m , the fraction of output held as liquid assets: higher liquidity demand tightens the growth condition by reducing the resources available for investment. The determination of m in equilibrium is therefore central to the analysis, and we return to it in Section 2.3.

2.2 Occupational Choice and the Microfoundation of λ

A unit mass of agents each period chooses between two activities: productive entrepreneurship, which advances the technological frontier, and rent-seeking or speculation, which generates private returns without raising aggregate productivity. The

¹Throughout the analysis s is treated as an exogenous parameter. Carroll and Weil (1994) show empirically that causality between savings and growth runs largely from growth to savings rather than the reverse. If s responds endogenously to g , the stagnation trap acquires an additional self-reinforcing channel: falling growth reduces s , raising λ^* through equation (5), and deepening the trap. This strengthens the multiplicity result without altering the formal analysis.

profitability of entrepreneurship depends on the ability of agents to appropriate the returns to innovation, while the profitability of rent-seeking depends on the scale of existing capital and speculative opportunities. Institutional quality therefore determines the relative attractiveness of these activities and the endogenous share of investment allocated to frontier innovation, denoted by λ .

Entrepreneurial investment raises productivity and yields the return:

$$r^E = \phi A_t \cdot q \quad (6)$$

where ϕ is the efficiency with which productive investment generates innovation, A_t is the current level of productivity, and $q \in (0, 1]$ is institutional quality. The term q reflects the probability that an entrepreneur can appropriate the returns to her innovation, capturing property-rights protection, contract enforcement, and regulatory effectiveness. Higher q increases the expected payoff to entrepreneurship. This formulation has a natural grounding in the Schumpeterian tradition. In a standard quality-ladder model, a successful innovator captures a flow profit proportional to the current productivity level A_t , but faces two sources of return erosion: knowledge depreciation at rate ξ and expropriation risk $(1 - q)$ per unit time. The expected instantaneous return then takes the form $r^E = \phi A_t q$, where ϕ combines innovation efficiency and the profit markup, and q operates as a hazard rate on property rights. Improvements in institutional quality raise the expected duration over which an innovator appropriates returns, increasing the relative attractiveness of entrepreneurship. Higher q thus increases the expected payoff to entrepreneurship through a precise microeconomic mechanism rather than as a reduced-form scaling assumption.²

Rent-seeking investment involves acquiring existing capital assets, such as land, real estate, or claims on incumbent firms, rather than funding new productive capacity. Let P_t denote the price of a unit of the speculative asset. In equilibrium, the total return to holding this asset must equal the rental yield on existing capital plus the capital

²This hazard-rate interpretation of q does not privilege formal intellectual property protection as the primary instrument through which appropriability operates. First-mover advantage, tacit knowledge embedded in the innovator, and competitive position all contribute to the expected duration over which an innovator captures returns, and q is best read as a composite measure across all such channels. Boldrin and Levine (2008) argue that formal patent protection is unnecessary for innovation incentives because first-mover rents alone are sufficient to motivate invention. That claim is consistent with the present framework: it bears on which instruments raise q , not on whether q governs occupational choice. The comparative statics of Propositions 3 and 4 are therefore robust to a range of views on the relative importance of formal IP versus competitive appropriability as the operative channel.

gain, implying the no-arbitrage condition

$$r^R = \frac{\text{MPK}_t}{P_t} + \frac{\dot{P}_t}{P_t}. \quad (7)$$

When the supply of the asset is fixed, capital accumulation raises its scarcity value, increasing both its rental rate and price.

Solving for the equilibrium price-rental ratio and substituting into (7) using $\text{MPK}_t = \alpha(A_t/K_t)^{1-\alpha}$ yields the reduced form speculative return

$$r^R = \rho \left(\frac{K_t}{Y_t} \right)^\beta, \quad \rho > 0, \beta > 0 \quad (8)$$

where ρ and β are functions of the underlying technological and asset-supply parameters. The positive relationship between K/Y and r^R arises from asset scarcity: as the capital stock grows relative to output, the marginal product and price of the fixed asset rise. This formulation captures real estate booms, land price appreciation, and financial speculation in existing assets: activities that generate private gains through asset price appreciation without expanding the productive frontier.³

Agents differ in entrepreneurial ability. Each agent i draws $\varepsilon_i \sim U[0, 1]$, independently across agents and over time. An agent chooses entrepreneurship if and only if:

$$\varepsilon_i \cdot r^E \geq r^R \iff \varepsilon_i \geq \varepsilon^* \equiv \frac{\rho(K/Y)^\beta}{\phi A_t \cdot q} \quad (9)$$

Agents with $\varepsilon_i \geq \varepsilon^*$ become entrepreneurs; the rest become rent-seekers. Since ability is uniformly distributed, the fraction of agents choosing entrepreneurship is:

$$\lambda = 1 - \varepsilon^* = 1 - \frac{\rho(K/Y)^\beta}{\phi A_t \cdot q} \quad (10)$$

with boundary conditions $\lambda = 1$ if $\varepsilon^* < 0$ and $\lambda = 0$ if $\varepsilon^* > 1$.

³Let land in fixed supply $\bar{L}$ enter a sub-production function with capital yielding rental income $R_t = \gamma(K_t/\bar{L})^\gamma$ per unit of land. In equilibrium the asset price P_t equals the present value of rental income, so on a balanced path $P_t = R_t/r$ where r is the discount rate. The capital gain term is then $\dot{P}_t/P_t = \gamma(\dot{K}_t/K_t)$, which on the BGP equals g . Substituting into equation (7) and using $\text{MPK}_t = \alpha(A_t/K_t)^{1-\alpha}$ to eliminate the rental yield, the total return reduces to $r^R = \rho(K_t/Y_t)^\beta$ where ρ is a positive function of γ , α , and the discount rate, and $\beta = \gamma(1 - \alpha) > 0$ follows directly from the production parameters. The same reduced form obtains for any fixed-supply asset whose rental value is a power function of capital intensity; the specific case of land is illustrative. Away from the BGP, $\dot{P}_t/P_t$ will differ from g , so the reduced form should be understood as an approximation valid in a neighbourhood of the balanced growth path.

This expression highlights the central comparative statics. Higher institutional quality q raises λ by increasing entrepreneurial appropriability; reductions in q capture observable failures such as weak intellectual property protection, lengthy permitting, or poor contract enforcement, each of which compresses the expected duration over which an innovator captures returns. The speculative return ρ reflects the attractiveness of acquiring fixed-supply assets, urban land under zoning constraints, spectrum licences, legacy corporate infrastructure, whose rental value rises with capital accumulation. The elasticity β governs how sensitive these returns are to capital deepening and maps directly onto the inverse of the housing supply elasticity estimated by Saiz (27): supply-constrained markets have low elasticity and high β , amplifying the feedback from accumulation to rent-seeking. Higher capital intensity K_t/Y_t or higher ρ reduce λ by making rent-seeking more attractive, while higher productivity A_t raises λ by increasing the entrepreneurial payoff. These forces generate the feedback loop that underlies the multiple equilibria in Section 3: low λ depresses A_t , which further lowers λ , and conversely.

2.3 Portfolio Choice and Liquidity Demand

Agents face idiosyncratic income risk each period, generating a precautionary motive to hold liquid assets. This section derives the liquidity demand function and the two monotonicity properties that feed into the growth threshold.

2.3.1 Household Problem

We adopt log utility for tractability, following Aiyagari (4). The key property required is that the substitution effect of a rise in r^{net} dominates the income effect, so that liquidity demand falls when investment becomes more attractive; this holds under log utility and extends to CRRA preferences with $\gamma \neq 1$, as shown in Appendix B. The economic logic is direct: the marginal cost of holding liquid assets is the foregone excess return r^{net} , so when entrepreneurial returns are high the opportunity cost of liquidity rises and agents optimally reduce m^* .

Each agent has savings s to allocate between a liquid asset with gross return normalised to one and an illiquid asset yielding gross return $1 + r^{\text{net}}$. In period 2 the agent faces an idiosyncratic income shock: value $-\sigma < 0$ (bad state) with probability $\pi \in (0, 1)$, and 0 (good state) with probability $1 - \pi$. The liquid asset can be drawn down to cover the shortfall; the illiquid asset cannot.

The agent chooses $m \in [0, \bar{m}]$ to maximise expected log utility:

$$\max_m (1 - \pi) \log c_2^G + \pi \log c_2^B \quad (11)$$

where $c_2^G = (s - m)(1 + r^{net}) + m$ and $c_2^B = (s - m)(1 + r^{net}) + m - \sigma$. The upper bound $\bar{m}$ is the saturation point beyond which further liquidity provides no additional insurance.

For an interior solution, the first-order condition equates the marginal cost of liquidity, the foregone excess return on illiquid investment, with its marginal benefit, consumption smoothing in the bad state:

$$\frac{(1 - \pi) r^{net}}{c_2^G} = \frac{\pi(1 - r^{net})}{c_2^B} \quad (12)$$

Proposition 1 (Monotonicity of liquidity demand). *Under log utility: (i) $\partial m^* / \partial \sigma > 0$; (ii) $\partial m^* / \partial r^{net} < 0$ provided $r^{net} > 0$.*

Proof. Differentiating equation (12) implicitly. For (i): a rise in σ reduces c_2^B for any given m , raising the right-hand side relative to the left. To restore equality m^* must rise. For (ii): a rise in r^{net} raises the left-hand side directly and raises c_2^G , while the effect on the right-hand side is dominated by the increase in the numerator. Under log utility the substitution effect dominates the income effect, so m^* must fall. $\square$

Remark 1. *Both properties extend under DARA preferences and continuous shock distributions, since the income effect is smaller under DARA than under log utility. Details are available on request.*

2.3.2 General Equilibrium Content of r^{net}

The expected return on illiquid savings depends on the occupational distribution:

$$r^{net} = \lambda r^E + (1 - \lambda) r^R \quad (13)$$

where r^E is the entrepreneurial return and r^R the speculative return. Agents take r^{net} as given when solving the household problem. The equilibrium r^{net} is therefore a function of (A_t, K_t) and institutional quality q .

2.3.3 Liquidity Demand and the Growth Threshold

Combining Proposition 1 with the balanced-growth condition (5) yields the effective growth threshold. In equilibrium m is replaced by its equilibrium value m^* , so condition (5) becomes:

$$\lambda > \lambda^*(m^*) \equiv \frac{\xi}{\varphi(s - m^*)} \quad (5')$$

This is not a new condition but condition (5) evaluated at equilibrium liquidity demand. The two margins nonetheless reinforce each other in a way that is not visible in (5) alone. By Proposition 1, m^* is decreasing in r^{net} , which is itself increasing in λ . High λ therefore raises r^{net} , suppresses m^* , and relaxes the threshold — making sustained growth easier to maintain. Low λ has the opposite effect: it depresses r^{net} , raises m^* , tightens the threshold, and further discourages entrepreneurship. Condition (5') thus captures a self-reinforcing feedback that condition (5), taken in isolation before liquidity demand is determined, cannot.

3 Equilibrium

Definition 1 (Equilibrium). *Given (A_t, K_t) and institutional quality q , a static equilibrium is a pair (λ^*, m^*) satisfying:*

$$\lambda^* = 1 - \frac{\rho(K_t/Y_t)^\beta}{\phi A_t \cdot q} \quad (14)$$

$$m^* = \Psi(r^{\text{net}}(\lambda^*), \sigma^2) \quad (15)$$

where $r^{\text{net}}(\lambda^*) = \lambda^* r^E + (1 - \lambda^*) r^R$ and $\Psi(\cdot)$ is the liquidity demand function characterised in Proposition 1. A dynamic equilibrium is a path $\{A_t, K_t\}_{t \geq 0}$ such that at each t the static equilibrium (λ^*, m^*) is selected and (A_t, K_t) evolves according to equations (2) and (3).

Fixed-point structure. Setting $g^* = 0$ in equation (2) gives $\lambda(m) = \xi/[\phi(s - m)]$, strictly increasing in m . Writing $r^R(m) = \rho(K(m)/Y(m))^\beta$, the static equilibrium reduces to the fixed point:

$$m = F(m) \equiv \Psi\left(\frac{\xi}{\phi(s - m)} r^E + \left(1 - \frac{\xi}{\phi(s - m)}\right) r^R(m), \sigma^2\right) \quad (16)$$

The map $F : [0, \bar{m}] \rightarrow [0, \bar{m}]$ is continuous by Proposition 1; its fixed points correspond to static equilibria.

Lemma 1 (S-shape of F). *Define the feedback parameter:*

$$\Gamma \equiv \frac{\rho\beta}{\phi q} \cdot \frac{(K/Y)^\beta}{s} \quad (17)$$

When $\Gamma > (1 - \pi)/(\pi\sigma)$, the map F is S-shaped and has up to three fixed points. When this condition fails, F is everywhere concave and has a unique fixed point.

Proof. Write $\Lambda(m) \equiv \xi/[\phi(s - m)]$, so $\lambda(m) = \Lambda(m)$ with $\Lambda'(m) > 0$, and $R(m) \equiv \rho[K(m)/Y(m)]^\beta$ with $R'(m) < 0$. Since K/Y falls linearly in $(s - m)$, we have $R(m) = \rho[\kappa(s - m)]^\beta$ for a positive constant κ , giving $R''(m) = \rho\beta(\beta - 1)\kappa^\beta(s - m)^{\beta-2} > 0$ for $\beta < 1$. The net return is $r^{net}(m) = \Lambda(m)r^E + (1 - \Lambda(m))R(m)$, so:

$$\frac{dr^{net}}{dm} = \Lambda'(m)[r^E - R(m)] + [1 - \Lambda(m)]R'(m) \quad (18)$$

In the stagnation region $r^E < R(m)$, so both terms are negative and $dr^{net}/dm < 0$. Since $d\Psi/dr^{net} < 0$ by Proposition 1, $F'(m) > 0$.

For F'' , write $F''(m) = (d^2\Psi/dr^{net^2})(dr^{net}/dm)^2 + (d\Psi/dr^{net})(d^2r^{net}/dm^2)$. Under log utility $d^2\Psi/dr^{net^2} > 0$ (verified by differentiating equation (12) twice), so the first term is strictly positive throughout. The second term has sign opposite to d^2r^{net}/dm^2 :

$$\frac{d^2r^{net}}{dm^2} = 2\Lambda'R' - \Lambda''[r^E - R] + [1 - \Lambda]R'' \quad (19)$$

At $m = 0$: $(s - m) = s$ is large, $R(0)$ is large, and the first (negative) term dominates, making $d^2r^{net}/dm^2 < 0$ and the second term of F'' positive. $F''(0) > 0$ if and only if the first term of F'' exceeds the second in magnitude, which reduces to the condition $\Gamma > (1 - \pi)/(\pi\sigma)$. For intermediate m , $R'(m)$ diminishes and the positive terms in d^2r^{net}/dm^2 grow, eventually making it positive and $F''(m) < 0$. Near $\bar{m}$ the insurance motive saturates so $d\Psi/dr^{net} \rightarrow 0$, the second term vanishes, and $F''(\bar{m}) > 0$ is restored. By continuity F'' changes sign exactly twice on $(0, \bar{m})$ when the condition holds, confirming the S-shape. When the condition fails the first term of F'' never dominates and F is everywhere concave. $\square$

Remark 2. Γ is large when speculative returns are sensitive to capital intensity (high

ρ, β) and appropriability is weak (low q)—precisely the configuration that Proposition 4 associates with stagnation.

Note that, when $\Gamma < (1 - \pi)/(\pi\sigma)$, F is concave and crosses the 45° line once, yielding a unique equilibrium. As Γ rises through the threshold, F becomes S-shaped and three fixed points emerge. The basin of attraction of the growth equilibrium shrinks as Γ rises, so economies with high speculative sensitivity or weak institutions are increasingly likely to converge to stagnation from a given initial condition.

Proposition 2 (Fixed-point multiplicity). *When ρ , σ^2 , or $1/q$ are sufficiently large, F crosses the 45-degree line three times, yielding two stable fixed points (m^L, m^H) separated by an unstable fixed point m^* . Otherwise F crosses once. The two stable fixed points correspond to the stagnation trap and the growth equilibrium respectively.*

Proof. F is continuous and increasing by Proposition 1. The boundary conditions $F(0) > 0$ and $F(\bar{m}) \leq \bar{m}$ guarantee at least one fixed point. When the feedback of m on r^{net} is strong—which occurs precisely when the S-shape condition holds— F lies above the 45-degree line for small and large m and crosses it from above twice in the interior, yielding three fixed points. The outer two are stable ($F'(m) < 1$) and the middle one unstable ($F'(m) > 1$). When feedback is weak F is everywhere concave and crosses once.⁴ $\square$

⁴Multiple equilibria sustained by pure expectations coordination are fragile to global games refinements of the kind developed by Morris and Shin (2003): when agents have heterogeneous private signals about fundamentals, equilibrium selection is typically unique. The multiplicity here is of a different character, being sustained by a real feedback between productivity, occupational choice, and liquidity demand rather than by self-fulfilling expectations alone. Whether the S-shaped structure of $F(m)$ survives the introduction of heterogeneous private information is an open question that we leave for future work.

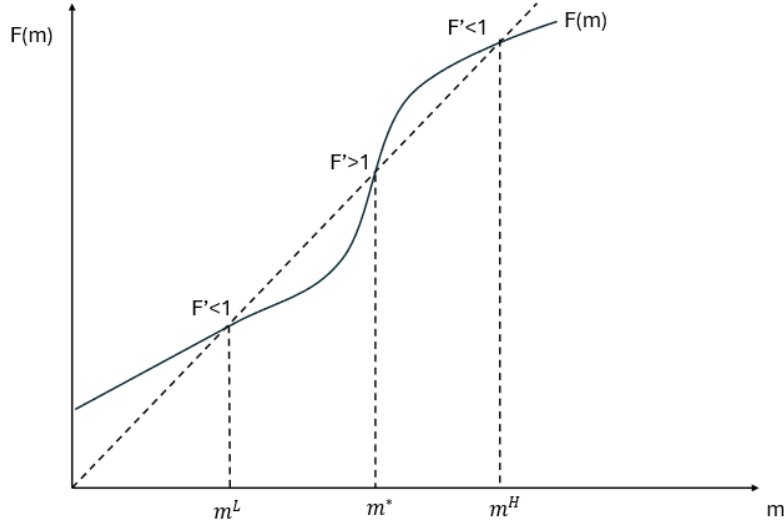


Figure 1: The S-shaped fixed-point map $F(m)$. The outer intersections m^L and m^H with the 45° line are the two stable equilibria, characterised by $F'(m) < 1$ at the crossing points. The middle intersection m^* is unstable, with $F'(m) > 1$. When three fixed points exist the economy converges to m^H (the growth equilibrium) or m^L (the stagnation trap) depending on initial conditions; when parameters are such that F crosses the 45° line only once, the unique equilibrium is determined by the parameter configuration as described in Proposition 2.

Substituting equation (10) into (2), the growth rate at any equilibrium is:

$$g = \phi \left(1 - \frac{\rho(K/Y)^\beta}{\phi A \cdot q} \right) (s - m^*) - \xi \quad (20)$$

In a high-productivity equilibrium, A is large, ε^* is small, λ is high, r^{net} is high, m^* is low, and $g > 0$. In a low-productivity equilibrium the reverse holds and $g \leq 0$. Growth and stagnation are each self-sustaining.

Proposition 3 (Multiple equilibria). *There exist thresholds $\underline{q}$ and $\bar{q}$ with $0 < \underline{q} < \bar{q} \leq 1$ such that: (i) if $q < \underline{q}$, only the stagnation equilibrium exists; (ii) if $q > \bar{q}$, only the growth equilibrium exists; and (iii) if $\underline{q} \leq q \leq \bar{q}$, both equilibria exist and convergence depends on initial conditions (A_0, K_0) .*

Proof. As $q \rightarrow 0$, $\lambda \rightarrow 0 < \lambda^*$ and $g < 0$. As $q \rightarrow 1$, $\lambda \rightarrow 1$ and $g > 0$ provided $s > \xi/\phi + m^*$, which we assume. By continuity of λ in q the thresholds exist as

described. In region (iii) the feedback between A , λ , m^* , and g admits two stable fixed points separated by an unstable threshold. $\square$

Proposition 4 (Comparative statics on the stagnation trap). *The stagnation trap is more likely, in the sense that both $\underline{q}$ and $\bar{q}$ are higher, when: (i) knowledge depreciation ξ is higher; (ii) the savings rate s is lower; (iii) speculative returns ρ are higher; (iv) idiosyncratic uncertainty σ^2 is higher; or (v) capital intensity K/Y is higher.*

Proof. Conditions (i), (ii), (iv) raise λ^* directly through equation (5), tightening the growth threshold. Conditions (iii), (v) lower λ through equation (10), reducing the productive investment share. In both cases the gap $\lambda^* - \lambda$ widens, requiring higher q to close it, shifting both thresholds upward. $\square$

A further implication concerns the asymmetry between falling into and escaping the trap. A negative shock, a rise in σ^2 or ρ , or a fall in A —can trigger a transition to the low equilibrium by pushing λ below λ^* . Recovery requires either q to exceed $\bar{q}$, eliminating the stagnation equilibrium entirely, or a large coordinated shift in expectations. Incremental improvements that leave $q \in [\underline{q}, \bar{q}]$ have no guaranteed effect.

4 Stability and Transitional Dynamics

Section 3 established the existence of multiple equilibria and their comparative statics properties. We now ask whether these equilibria are stable, how the economy moves between them, and what determines which one is reached from a given starting point. The analysis proceeds in three steps. We first write down the dynamic system in (k, A) space and linearise around each equilibrium. We then establish local asymptotic stability of the stagnation trap and the growth equilibrium respectively, showing that the stability conditions map directly onto the institutional thresholds $\underline{q}$ and $\bar{q}$ of Proposition 3. Finally we characterise the separatrix separating the basins of attraction of the two stable equilibria, which determines whether a given economy converges to growth or stagnation and how large a policy intervention is needed to shift it from one basin to the other. The fixed-point structure underlying this analysis—the S-shaped map $F(m)$ with stable equilibria m^L and m^H and unstable threshold m^* —is illustrated in Figure 1 above.

4.1 Dynamic System

The dynamic system is:

$$\frac{\dot{A}}{A} = \phi \left(1 - \frac{\rho k^\beta}{\phi A q} \right) (s - m^*) - \xi \quad (21)$$

$$\dot{k} = (s - m^*) k^\alpha - (\delta + g_A) k \quad (22)$$

where $\lambda = 1 - \rho k^\beta / (\phi A q)$ from equation (10) and m^* is evaluated at its equilibrium value.

4.2 Stability of the Two Equilibria

Linearising the system around each equilibrium yields a 2×2 Jacobian J . Local asymptotic stability requires $\text{tr}(J) < 0$ and $\det(J) > 0$. Full Jacobian calculations are in Appendix A.

Low equilibrium. The dominant stabilising force is the standard diminishing-returns effect on capital accumulation. The liquidity-productivity feedback enters through J_{21}^L , which is of order $1/(A^L)^2$ and second order at low productivity. For $\beta < 1$ and $\alpha < 1$, both $\text{tr}(J^L) < 0$ and $\det(J^L) > 0$ hold, so both eigenvalues are real and negative (see Appendix A.1).

Proposition 5 (Stability of the stagnation trap). *For $\beta < 1$, the low equilibrium (k^L, A^L) is locally asymptotically stable when $q < \underline{q}$.*

The stagnation trap is stable because the liquidity-productivity feedback is second order at low A : so diminishing returns to capital dominate, and no self-correcting force returns the economy to the growth equilibrium.

High equilibrium. The key tension is between the stabilising diagonal element $J_{11}^H < 0$, reflecting diminishing returns to capital, and the destabilising element $J_{22}^H > 0$, reflecting the self-reinforcing productivity-entrepreneurship feedback. The off-diagonal elements are of order $1/(A^H)^2$ and negligible at high productivity. Stability therefore reduces to $\text{tr}(J^H) = J_{11}^H + J_{22}^H < 0$, which holds if and only if $q > \bar{q}$, the upper threshold of Proposition 3 (see Appendix A.2).

Proposition 6 (Stability of the growth equilibrium). *When $q > \bar{q}$, the BGP is locally asymptotically stable and the economy converges to $g^H = \phi\lambda^H(s - m^*) - \xi > 0$ from any initial condition in its basin of attraction. When $q \in [\underline{q}, \bar{q}]$, at least one eigenvalue has non-negative real part and convergence depends on initial conditions.*

The condition $\text{tr}(J^H) < 0$ has a direct interpretation. $J_{22}^H > 0$ captures the self-reinforcing feedback between productivity and entrepreneurship: higher A raises r^E , drawing more agents into entrepreneurship and accelerating growth further. $J_{11}^H < 0$ captures the stabilising force of diminishing returns to capital. Stability requires the latter to dominate, and since J_{22}^H is decreasing in q , stronger institutions dampen the amplification loop and make the BGP easier to stabilise. The threshold $\bar{q}$ is therefore the level of institutional quality at which the diminishing-returns brake exactly offsets the productivity-entrepreneurship feedback.

4.3 The Separatrix and Basins of Attraction

When $q \in [\underline{q}, \bar{q}]$, an unstable intermediate equilibrium (k^*, A^*) exists at which $\lambda(k^*, A^*) = \lambda^*(m^*)$ exactly. At this point the fixed-point map F crosses the 45-degree line from below, so $dF/dm > 1$. Translating into the dynamic system, the feedback of m on r^{net} is stronger than the stabilising forces, implying $\det(J^*) < 0$: J^* has one positive and one negative eigenvalue, $\mu_2 > 0 > \mu_1$, confirming (k^*, A^*) is a saddle point.

Proposition 7 (Separatrix). *The stable manifold S of (k^*, A^*) is a one-dimensional curve with slope:*

$$\left. \frac{dA}{dk} \right|_S = \frac{\mu_1 - J_{11}^*}{J_{12}^*} > 0 \quad (23)$$

where $\mu_1 < 0$ is the negative eigenvalue of J^* . Initial conditions above S converge to the growth equilibrium; those below converge to the stagnation trap.

Proof. The slope follows from $J^*v_1 = \mu_1v_1$. Since $J_{12}^* < 0$ (higher k raises speculative returns, reducing λ) and $\mu_1 < J_{11}^*$ (the negative eigenvalue lies below the $(1, 1)$ diagonal entry, as $J_{11}^* > 0$ at the intermediate equilibrium), the numerator $\mu_1 - J_{11}^*$ is negative. The ratio of two negative quantities is positive. The basin characterisation follows from standard saddle-point theory. $\square$

Corollary 1 (Asymmetry of collapse and recovery). *A negative shock reducing A_0 or raising k_0/A_0 can shift the economy from above S to below it. Restoring growth requires*

either (i) a permanent increase in q above $\bar{q}$, eliminating the stagnation equilibrium, or (ii) a sufficiently large coordinated shock to (k_0, A_0) that shifts the economy back above S . Incremental reforms leaving $q \in [\underline{q}, \bar{q}]$ have no guaranteed effect.

Corollary 2 (Effectiveness of productivity interventions). *Since S has positive slope, a policy raising A_0 —through technology transfer, human capital investment, or deregulation—shifts the economy vertically in (k, A) space. The required productivity increase is larger when k_0 is high, explaining why moderate supply-side interventions have proved insufficient in capital-intensive stagnating economies.*

4.4 Transitional Dynamics

Consider a shock raising σ^2 , which increases m^* and reduces $(s - m^*)$. This immediately lowers g_A , reducing $r^E = \phi A q$, raising ε^* , and pushing λ down. If the shock is large enough to push λ below λ^* , productivity growth turns negative. As A_t falls, ε^* rises further and the economy spirals toward the low equilibrium. This mechanism explains why the Japanese bubble collapse—by simultaneously raising uncertainty and speculative returns—triggered a permanent transition to low growth despite initially strong fundamentals.

Recovery requires either a permanent improvement in q above $\bar{q}$ or a coordinated expectations shift across the separatrix. The latter is inherently fragile, which is why institutional reform is the more reliable instrument. For savings-scarce economies, raising q alone is insufficient if s remains too low to satisfy $s > \xi/\phi + m^*$: the separatrix shifts but the low equilibrium persists.

5 Japan and the United Kingdom

The model’s comparative statics distinguish two empirically important failure modes that the secular stagnation literature tends to conflate.

Japan

Japan’s lost decades are a transition from the high to the low equilibrium driven by conditions (iii), (iv), and (v) of Proposition 4 acting in conjunction. A savings rate of approximately 0.25–0.30 kept λ^* low, allowing the economy to sustain growth despite emerging institutional dysfunction, but this advantage was undone when the asset price

collapse of the early 1990s simultaneously raised uncertainty σ^2 and capital intensity K/Y , pushing λ below threshold. Krugman (19) documents how Japan entered precisely this kind of self-reinforcing low-return trap, while Caballero, Hoshi, and Kashyap (7) show that zombie lending kept ρ artificially elevated long after the bubble burst by sustaining credit to insolvent firms, holding λ below its critical value and suppressing the reallocation of capital toward productive uses that recovery would have required. The implication is that macroeconomic stimulus, which leaves the occupational choice distortion intact, cannot restore growth; the required instrument is institutional reform sufficient to raise q above $\bar{q}$, eliminating the stagnation equilibrium entirely. Hayashi and Prescott (2002) attribute the productivity collapse primarily to a fall in technology adoption rather than to capital misallocation through zombie lending; in the language of the present model a fall in ϕ raises λ^* through equation (5) by the same mechanism as a rise in ρ , making the two accounts observationally complementary rather than mutually exclusive.

The United Kingdom

The United Kingdom presents a structurally distinct dual failure. With a savings rate of approximately 0.06–0.08, condition (ii) of Proposition 4 raises λ^* substantially — the institutional bar for growth is high precisely because there is little investment to work with. Simultaneously, financialisation has elevated ρ , drawing talent and capital toward non-productive activity. Philippon and Reshef (24) document that the financial sector in the UK and US drew disproportionate shares of high-ability graduates from the 1980s onward, compressing the talent available for frontier innovation precisely as financialisation was raising ρ . Gutiérrez and Philippon (15) show that declining competition and rising financial returns have depressed productive investment relative to earnings across the OECD, while Gopinath et al. (14) find that sustained capital misallocation of this kind reduced TFP growth by up to one percentage point annually in Southern Europe, a magnitude that in our framework corresponds to λ falling persistently below threshold. Unlike Japan, where high savings provide the raw material for recovery given sufficient institutional reform, the UK faces a configuration in which low s and low q reinforce each other and neither instrument alone is sufficient. Raising s in a low- q environment channels additional resources into rent-seeking; raising q without addressing the savings shortage shifts the separatrix without eliminating the low equilibrium. A simultaneous two-pronged reform is required, and the sequencing

matters.

The mechanisms through which low q and high ρ operate in practice connect the model’s parameters to observable policy features. Preferential tax treatment of capital gains, carried interest, and property income relative to entrepreneurial earned income directly raises ρ relative to r^E , tilting occupational choice toward rent-seeking at the margin. An educational system oriented toward finance, law, and accountancy rather than engineering and applied science shifts the effective ability distribution toward rent-seeking before the occupational choice is even made, and is observationally equivalent to a fall in q . These channels are mutually reinforcing: a tax system that favours asset ownership, an educational system oriented toward wealth extraction, and a culture that valorises financial careers over productive entrepreneurship are jointly determined features of the institutional environment, and coordinated reform across all three is implied.

The contrast between the United States and Europe provides further validation. Venture capital investment in the EU averaged approximately 0.3 percent of GDP over the past decade, less than one third of the US figure, with institutional investors supplying 72 percent of US venture capital but only 30 percent of the European equivalent (IMF, 2024; EIB, 2024). European regulatory fragmentation depresses q by weakening the appropriability of entrepreneurial returns across segmented national markets while leaving returns to existing asset ownership unaffected, elevating ρ — precisely the trap-inducing configuration of Proposition 4. A deeper US venture ecosystem additionally suppresses m^* by providing liquid exit routes that reduce the illiquidity premium on entrepreneurial investment, reinforcing the high- λ equilibrium through the r^{net} channel of Proposition 1. The Draghi (11) report reaches a structurally identical conclusion: capital market fragmentation is the primary obstacle to scaling frontier innovation, and market consolidation is the instrument required to push q above $\bar{q}$. The United Kingdom, combining European institutional fragmentation with a savings rate of 6–8 percent, faces the dual failure in a more acute form than either continental Europe or the United States.

Relationship to alternative explanations. The mechanism here complements rather than competes with demographic, monetary, and global savings accounts of stagnation. Each of those operates through s or σ^2 in the present model, shifting λ^* but leaving λ unchanged if institutional quality remains low. The institutional mechanism

is distinct in that it depresses λ directly: raising savings or cutting interest rates leaves the occupational choice distortion intact and cannot restore TFP growth, a prediction consistent with Hayashi and Prescott (16), who show that Japan's stagnation reflected a collapse in TFP rather than insufficient capital accumulation.

6 Conclusion

This paper has argued that endogenous growth is institutionally contingent. Savings and capital accumulation are necessary but not sufficient for sustained productivity growth: what matters is whether investment is directed toward activities that advance the productive frontier rather than toward rent-seeking and speculation. We have formalised this through an occupational choice model in which institutional quality governs the appropriability of entrepreneurial returns, determining endogenously the fraction of investment λ that is productivity-enhancing. Combined with a precautionary liquidity demand motive, this generates multiple equilibria. The central results are two. First, there exist critical thresholds for institutional quality below which only stagnation is possible, above which only sustained growth is possible, and between which both equilibria exist and history determines outcomes. Second, the stagnation trap is more likely when savings rates are low, speculative returns are high, knowledge depreciates rapidly, and idiosyncratic uncertainty is elevated. These comparative statics are structural consequences of the model rather than calibrated assumptions, and they generate distinct predictions for economies with different savings and institutional profiles.

The framework distinguishes two empirically important failure modes that are easily conflated in the secular stagnation literature. In savings-abundant economies such as Japan, the primary constraint on growth is institutional quality: high savings keep λ^* low, allowing the economy to sustain growth despite moderate institutional dysfunction, but a sufficiently large shock to uncertainty or speculative returns can trigger a permanent transition to stagnation from which moderate policy responses cannot recover. The policy prescription is institutional reform sufficient to raise q above the upper threshold $\bar{q}$, ensuring the stagnation equilibrium ceases to exist. Macroeconomic stimulus that leaves the occupational choice distortion intact, low appropriability of entrepreneurial returns, high speculative returns, cannot achieve this. In savings-scarce economies such as the United Kingdom, the failure is dual: low s raises the institutional

bar λ^* while low q and high ρ depress λ , and the gap between them is wide. Institutional reform alone is insufficient here because even perfect allocation of insufficient savings may fail to clear the growth threshold. A simultaneous increase in both s and q is required, and the sequencing matters: raising savings in a low- q environment merely channels additional resources into rent-seeking, while raising q without addressing the savings shortage shifts the separatrix without eliminating the low equilibrium.

A qualification deserves emphasis. The analysis treats q as a parameter subject to deliberate reform, but institutional quality is itself endogenous to the distribution of political power. An economy trapped in the stagnation equilibrium may remain there not merely because $q < \bar{q}$ but because incumbent rent-seekers—whose returns depend on ρ remaining high and q remaining low—have both the incentive and, in a low- q environment, the capacity to block reforms that would raise q above $\bar{q}$. Olson (1982) shows that entrenched distributional coalitions organise precisely to resist such reforms, and Acemoglu and Robinson (2012) argue more broadly that extractive institutions persist because they serve the interests of those with the power to change them. The policy prescriptions derived above are therefore best understood as characterising the reforms that are *sufficient* for escape from the stagnation trap, conditional on the political will to implement them, rather than as a complete account of why such reforms are or are not undertaken. The political economy of institutional persistence is a natural direction for future work.

These results have implications beyond the two cases examined. The model predicts that economies operating within the multiple equilibria region are vulnerable to sudden growth collapses following relatively small adverse shocks, while recovery requires large and credible policy commitments. This asymmetry between collapse and recovery is a direct consequence of the saddle point structure of the unstable intermediate equilibrium, and it rationalises the observed pattern in which advanced economies fall into prolonged stagnation despite policy interventions that would, in a single-equilibrium model, appear sufficient to restore growth.

Several directions for future work suggest themselves. On the empirical side, the model’s central parameter λ , the share of investment that is productivity-enhancing, can in principle be estimated from the capital misallocation literature following Hsieh and Klenow (17), and the predicted relationship between λ , institutional quality, and TFP growth can be tested in panel data, building on the cross-country savings-investment evidence of Attanasio, Picci, and Scorcu (5). The threshold $\lambda^* = \xi/\phi(s -$

m^*) generates a testable prediction: economies crossing this threshold from above should exhibit a discrete deterioration in TFP growth that is not accounted for by standard factor accumulation, consistent with the Portuguese experience documented by Reis (25) and the Southern European evidence of Gopinath et al. (14). On the theoretical side, the model abstracts from financial intermediation, treating the allocation of savings between entrepreneurship and rent-seeking as a direct occupational choice. Introducing a banking sector that screens projects would enrich the analysis and connect more directly to the financial development literature of Levine (20), as well as to the zombie lending mechanism of Caballero, Hoshi, and Kashyap (7), in which banks themselves become a conduit for misallocation. The role of corporate taxation in distorting occupational choice toward rent-seeking, documented by Djankov et al. (10), suggests a further extension in which fiscal policy enters the determination of λ directly through its effect on the relative returns r^E and r^R . Finally, the interaction between the savings rate and institutional quality in determining the growth threshold suggests that distributional policies affecting household savings, pension reform, income redistribution, taxation of speculative gains, may have first-order effects on long-run growth through their influence on λ^* , a channel that has received limited attention in the endogenous growth literature.

A Stability Analysis

A.1 Stability Analysis: Low Equilibrium

At the low equilibrium, $\dot{A} = \dot{k} = 0$ and the steady state satisfies:

$$\phi \left(1 - \frac{\rho (k^L)^\beta}{\phi A^L q} \right) (s - m^*) = \xi \quad (\text{A.1})$$

$$(s - m^*) (k^L)^\alpha = \delta k^L \quad (\text{A.2})$$

Linearising around (k^L, A^L) , the Jacobian J^L has elements:

$$\begin{aligned} J_{11}^L &= \frac{\rho (k^L)^\beta (s - m^*)}{A^L q} > 0, & J_{12}^L &= -\frac{\rho \beta (k^L)^{\beta-1} (s - m^*)}{q} < 0 \\ J_{21}^L &= -k^L \cdot J_{11}^L / A^L < 0, & J_{22}^L &= \alpha (s - m^*) (k^L)^{\alpha-1} - \delta - k^L \cdot J_{12}^L / A^L \end{aligned}$$

Note J_{21}^L is scaled by $1/(A^L)^2$, confirming the second-order nature of the liquidity-productivity feedback.

The trace and determinant of J^L are:

$$\text{tr}(J^L) = \frac{\rho (k^L)^\beta (s - m^*)}{A^L q} (1 - \beta) + (\alpha - 1) \delta < 0, \quad (\text{A.3})$$

$$\det(J^L) = J_{11}^L J_{22}^L - J_{12}^L J_{21}^L > 0. \quad (\text{A.4})$$

The trace is negative because $\beta < 1$ and $\alpha < 1$: the first term is positive but bounded, while the second term $(\alpha - 1) \delta < 0$ dominates given that J_{21}^L is scaled by $1/(A^L)^2$ and is therefore second order at low productivity. The determinant is positive because $J_{22}^L < 0$ from the steady-state condition (A.2) and the cross-product $J_{12}^L J_{21}^L > 0$ (both off-diagonal elements are negative) is dominated by $J_{11}^L J_{22}^L$ at low A^L .

Since $\text{tr}(J^L) < 0$ and $\det(J^L) > 0$, both eigenvalues

$$\mu_{1,2}^L = \frac{\text{tr}(J^L) \pm \sqrt{\text{tr}(J^L)^2 - 4 \det(J^L)}}{2} \quad (\text{A.5})$$

are real and negative when $\text{tr}(J^L)^2 > 4 \det(J^L)$, and complex with negative real part otherwise. In either case the real parts of both eigenvalues are negative, so (k^L, A^L) is locally asymptotically stable: trajectories initiating in a neighbourhood of the stagnation steady state converge to it monotonically (node) or with damped oscillations

(spiral). This confirms Proposition 5: when $q < \bar{q}$, the economy is trapped in stagnation regardless of initial conditions within the basin of attraction, and no self-correcting force returns it to the growth equilibrium. $\square$

A.2 Stability Analysis: High Equilibrium

On the BGP define $z_t \equiv \dot{A}/A - g^H \rightarrow 0$. Linearising around $(k^H, 0)$, the Jacobian J^H has elements:

$$J_{11}^H = \alpha(s - m^*)(k^H)^{\alpha-1} - (\delta + g^H) < 0, \quad (\text{A.6})$$

$$J_{12}^H = -(k^H) \cdot \frac{\rho(k^H)^\beta (s - m^*)}{(A^H)^2 q} < 0, \quad (\text{A.7})$$

$$J_{21}^H = -\frac{\rho\beta(k^H)^{\beta-1}(s - m^*)}{A^H q} < 0, \quad (\text{A.8})$$

$$J_{22}^H = \frac{\rho(k^H)^\beta (s - m^*)}{A^H q} > 0. \quad (\text{A.9})$$

Since J_{12}^H is of order $1/(A^H)^2$, the cross-product $J_{12}^H J_{21}^H$ is negligible at high productivity and $\det(J^H) \approx J_{11}^H J_{22}^H - J_{12}^H J_{21}^H > 0$. The stability condition reduces to:

$$\text{tr}(J^H) = J_{11}^H + J_{22}^H < 0. \quad (\text{A.10})$$

Substituting and using the BGP condition $g^H = \phi\lambda^H(s - m^*) - \xi > 0$, the trace is negative if and only if $|J_{11}^H|$ exceeds J_{22}^H . Since J_{22}^H is decreasing in q and $|J_{11}^H|$ is increasing in g^H , this holds if and only if q is sufficiently large. The upper threshold $\bar{q}$ in Proposition 3 is defined as the value at which $\text{tr}(J^H) = 0$; for $q > \bar{q}$ the trace is strictly negative. Both eigenvalues therefore have strictly negative real parts, confirming local asymptotic stability of the BGP. When $q \in [\underline{q}, \bar{q}]$ the trace is non-negative, at least one eigenvalue has non-negative real part, and convergence depends on initial conditions, as stated in Proposition 6. $\square$

B Robustness to CRRA Preferences

Under CRRA utility $u(c) = c^{1-\gamma}/(1-\gamma)$ with $\gamma > 0$, the first-order condition replacing equation (12) is:

$$(1 - \pi) \frac{r^{\text{net}}}{(c_2^G)^\gamma} = \pi \frac{1 - r^{\text{net}}}{(c_2^B)^\gamma} \quad (\text{B.1})$$

Monotonicity in σ (Proposition 1(i)) holds for all $\gamma > 0$ by the same argument as the log case: a rise in σ reduces c_2^B , raising the right-hand side and requiring m^* to rise to restore equality.

Monotonicity in r^{net} (Proposition 1(ii)) holds provided $\gamma < c_2^G/[r^{\text{net}}(s - m)]$. Since $c_2^G > r^{\text{net}}(s - m)$ for all $m > 0$, this is satisfied for $\gamma \leq 1$ and holds in the empirically relevant range for $\gamma > 1$. The S-shape of F and fixed-point multiplicity of Proposition 2 depend only on these two monotonicity properties, so the qualitative results are robust to the choice of γ .

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