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Working Paper N. 19/2026

DISEI, Università degli Studi di Firenze
Via delle Pandette 9, 50127 Firenze (Italia)
www.disei.unifi.it

Tourism-Led Growth or Tourism Poverty Traps? A Coordination Model of Institutions, Informality, and Local Linkages

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Abstract

Tourism is often promoted as a route to local development, yet many destinations combine persistent visitor flows with poverty, informality, insecurity, and weak local spillovers. This paper develops a coordination model to explain that paradox. Governments choose between public investment and extraction, residents between formal and informal participation, and tourists between local engagement and enclave consumption. Tourism-led growth emerges only when these choices are mutually reinforcing. Otherwise, individually rational responses can stabilize a low-development regime in which institutions remain weak, residents stay informal, and visitor spending bypasses local supply chains. The static game admits both a low-development equilibrium and a high-development equilibrium. Embedding the model in replicator dynamics shows how thresholds, initial conditions, and coordinated reforms shape transitions between traps and more inclusive regimes. The paper contributes a mechanism-based framework for understanding why tourism can be economically central and yet fail to generate broad-based local development.

Keywords: Tourism-led growth; poverty traps; coordination failure; informality; enclave tourism; evolutionary game theory.

JEL classification: C72; C73; O17; O43; R11; Z32

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1. Introduction

Tourism is frequently promoted as a development strategy for regions with attractive natural, cultural or urban amenities. The underlying argument is straightforward: visitor demand can increase production in accommodation, restaurants, transport, retail trade, entertainment, construction and public services; it can create employment; and it can expand the local fiscal base. This intuition is supported by a large tourism-led growth literature, which finds that tourism can contribute to output, employment, foreign-exchange earnings and regional economic activity under favourable conditions (Brida et al., 2010; Brida and Risso, 2010; Sánchez Carrera et al., 2008; De Vita and Kyaw, 2016; Schubert et al., 2011). Recent evidence for Mexico is especially relevant because it shows that tourism can generate sizable average local gains and spillovers along the coastline (Faber and Gaubert, 2019).

However, the same literature increasingly stresses that the relationship between tourism and development is conditional rather than automatic. Empirical estimates vary across countries, periods, methods and destination structures, and recent reviews emphasise that the benefits of tourism depend on local linkages, institutional quality, ownership patterns, human capital and the distribution of gains (Liu et al., 2022; Sun et al., 2025). Tourism can therefore be associated with growth in aggregate indicators while still producing weak or unequal local development outcomes. This distinction is central for destinations where visitor flows remain strong but poverty, labour-market informality, insecurity, environmental pressure and weak local spillovers persist.

A second line of research studies tourism as a poverty-reduction and inclusive-development strategy. This literature argues that tourism can benefit low-income groups through direct employment, indirect supply-chain linkages, induced local demand and public investment, but that these channels depend on whether poor households and local firms can participate on favourable terms (Blake et al., 2008; Mitchell and Ashley, 2010). Inclusive-tourism scholarship similarly asks who is included in tourism development, on what terms, and with what significance for livelihoods, participation and power (Scheyvens and Biddulph, 2018). The implication is that tourist expenditure is not sufficient by itself: the developmental content of tourism depends on how spending is organised, captured and converted into local capabilities.

A third literature focuses on leakages, enclave structures and local production linkages. Dependency and political-economy accounts have long argued that externally controlled tourism can reproduce uneven development when profits, inputs and strategic decisions are concentrated outside the host economy (Britton, 1982). Empirical research on Mexico shows that even in large tourism economies such as Quintana Roo, backward linkages with local agriculture may remain weak because of standards, scale, reliability, infrastructure, intermediaries, market power and import dependence (Torres, 2003). More recent work on enclave tourism and local linkages reaches a similar conclusion: tourism generates broader development effects when it is connected to local suppliers and communities, but it generates fewer spillovers when consumption is spatially or organisationally isolated (Jeyacheya and Hampton, 2020; Saarinen and Wall-Reinius, 2019).

Institutions and informality provide a fourth strand of explanation. Development economics has shown that institutions shape the provision of public goods, contract enforcement, fiscal capacity, investment incentives and long-run development paths (Rodrik et al., 2004; Acemoglu et al., 2010). At the same time, informality is not merely a residual labour-market category; it affects productivity, tax capacity, worker protection, firm growth and the ability of governments to regulate and coordinate economic activity (La Porta and Shleifer, 2014; Ulyssea, 2020). In tourism destinations, weak institutions and informality can reinforce one another: weak enforcement and poor public goods lower the returns to formal participation, while widespread informality reduces the tax base and the political incentives needed to sustain public investment.[1]

This paper addresses that gap by interpreting tourism-led development as a coordination problem. We ask: under what conditions can a tourism-dependent destination become trapped in a low-development equilibrium rather than move toward inclusive tourism-led growth? The answer proposed here is that tourism-led growth requires mutually reinforcing behaviour by three groups. Governments must invest in public goods and destination management; residents must find it worthwhile to participate formally in local supply chains; and tourists must find it attractive to engage with local providers rather than remain within enclave circuits. If one of these channels is weak, the private returns to the others also decline.

The formal logic draws on the broader literature on strategic complementarities, coordination failure and poverty traps. In such models, individually rational behaviour can generate multiple equilibria: a low-level equilibrium in which agents do not invest because others do not invest, and a high-level equilibrium in which complementary actions make investment profitable (Cooper and John, 1988; Murphy et al., 1989; Azariadis and Stachurski, 2005; Bowles et al., 2006). Applied to tourism, the mechanism is intuitive. Governments are less likely to invest when informality and enclave tourism limit taxable returns. Residents are

[1]These literatures identify important pieces of the development puzzle, but they leave a mechanism gap. The tourism-led growth literature documents positive average effects and heterogeneous outcomes. The inclusive-tourism and poverty-reduction literatures show that benefits depend on local participation and distribution. The linkage and enclave literatures explain why tourist expenditure may leak away from host economies. The institutional and informality literatures explain why public goods and formalisation may be difficult to sustain. What is still less developed is a formal mechanism showing how governments, residents and tourists may jointly reproduce a low-development outcome even when tourism demand is present.

less likely to formalise when public goods are weak and tourists do not buy locally. Tourists are less likely to engage locally when insecurity, poor infrastructure or thin formal supply chains reduce the value of local experiences. These feedbacks can make the low-development outcome self-reinforcing.

The paper formalises this argument through a three-player coordination model. The government chooses between public investment and extraction. Investment represents security, infrastructure, destination management, environmental protection and regulatory capacity. Extraction represents rent-seeking, corruption, diversion of public resources, weak enforcement and short-term use of the tourism base. Residents choose between formal and informal participation. Formal participation includes registered employment, legal entrepreneurship, skill formation and integration into local supply chains. Informal participation captures low-productivity activities outside the formal institutional framework. Tourists choose between local engagement and enclave consumption. Local engagement generates stronger spillovers because visitors purchase from local providers and interact with the wider destination. Enclave consumption concentrates spending in spatially or organisationally isolated circuits with weaker local multipliers.

The model produces two main regimes. In the high-development regime, public investment, formal resident participation and local tourist engagement are mutually reinforcing. In the low-development regime, extraction, informality and enclave consumption reinforce each other. The low-development equilibrium is not a situation without tourism. It is a situation in which tourism exists but its local development effects remain limited because the complementary behaviours that convert visitor demand into broad local welfare are absent. This distinction is central: a destination may be tourism intensive and yet development poor.

We then embed the coordination game in a system of replicator dynamics. This evolutionary formulation is useful because institutions, residents and tourists do not adjust instantaneously to a single central plan. They adapt gradually to observed payoffs, expectations and destination conditions. The dynamic system shows that the low-development trap can be locally stable. It also shows that, under favourable parameters, the high-development regime can be stable as well. The long-run outcome then depends on initial conditions and on the basin of attraction in which the destination begins. Policy is therefore a problem of coordinated regime change, not merely of marginal improvements in one variable.

The paper makes four contributions. First, it connects tourism-led growth with a formal poverty-trap mechanism based on strategic complementarities. This helps explain why positive average effects of tourism can coexist with persistent local underdevelopment in particular destinations. Second, it integrates three mechanisms that are often studied separately: institutional incentives, resident informality and segmented tourist behaviour. Third, it gives a dynamic interpretation of tourism traps through replicator dynamics, showing how low-development and high-development regimes can both be locally stable. Fourth, it translates the model into policy implications: isolated reforms may fail when the system is below the relevant thresholds, whereas coordinated packages that reduce extraction, increase returns to formality, strengthen local supply chains and improve the attractiveness of local engagement can shift the destination toward a better equilibrium.[2]

The remainder of the paper is organised as follows. Section 2 reviews the development puzzle and presents the motivating application. Section 3 develops the coordination game. Section 3.1 characterises the static equilibria. Section 4 introduces replicator dynamics and studies stability. It discusses comparative statics, shocks and policy thresholds. Section 5 provides a compact numerical illustration. Section 6 concludes.

2. Tourism, local linkages and the development puzzle

Tourism can support development through several channels. It creates direct demand for labour and services; it induces investment in infrastructure; it can stimulate backward linkages with agriculture, construction, transport and local manufacturing; and it can increase public revenue. These channels are strongest when visitor spending circulates through local supply chains and when public institutions transform tourism revenue into durable public goods. A large literature therefore finds positive relationships between tourism activity and economic growth in many settings (Brida et al., 2010; Brida and Risso, 2010; De Vita and Kyaw, 2016; Schubert et al., 2011; Enilov and Wang, 2022).

At the same time, empirical studies and policy reviews emphasise that tourism's development effects are heterogeneous. Recent systematic work stresses that estimates of tourism impact depend on measurement, local linkages, institutional quality and the distribution of gains (Liu et al., 2022). Work on inclusive growth further emphasises that tourism benefits depend on supply-chain participation, local ownership and the ability of host communities to capture value (Jeyacheya and Hampton, 2020). Research on enclave tourism shows that spatially and organisationally isolated forms of consumption can limit local spillovers, even when visitor numbers are high (Saarinen and Wall-Reinius, 2019). The relationship between tourism and growth is therefore conditional rather than automatic.

Institutions are central to this conditionality. Tourism requires public goods that are not

[2] The empirical role of Acapulco and Guerrero, Mexico, is illustrative. Guerrero is highly dependent on tourism, but it also exhibits persistent poverty, informality and insecurity. Acapulco has a long history as a major destination and has been analysed as a case of territorial pressure, social segmentation and uneven distribution of benefits (Ramírez Mendoza, 1979; Carrascal and Pérez Villegas, 1998; Speakman and Díaz Garay, 2016).

supplied by individual firms alone: security, urban services, infrastructure, environmental management, zoning, disaster preparedness and credible regulation. These public goods affect the returns to formal participation for residents and the attractiveness of local engagement for tourists. If institutions are weak, informal economic activity may become more attractive than compliance, and visitors may prefer controlled circuits that reduce perceived risk but also reduce contact with the broader local economy. Conversely, stronger institutions can raise the returns to both formality and local engagement.

This mechanism is also consistent with the broader poverty-trap literature. Poverty traps are not necessarily caused by the absence of markets. They can emerge when returns are increasing over relevant ranges and when agents' decisions are complementary (Kraay and Raddatz, 2007; Arunachalam and Shenoy, 2017; Barnett et al., 2008). In tourism economies, the relevant complementarities connect public investment, formal participation and visitor behaviour. If these components are jointly weak, the economy can remain in a low-return state even with a substantial flow of tourists.

2.1. Acapulco and Guerrero as an illustrative application

Acapulco and the wider tourism economy of Guerrero in Mexico, provide a useful example of the general problem. Tourism is economically central in the state. Based on INEGI Economic Census tourism tabulations for 2018, tourism-related activities accounted for a substantial share of establishments, employment, remuneration and gross production in Guerrero (Table 1).

Table 1: Tourism centrality in Guerrero, 2018

Indicator	Share (%)	Local role	Interpretation
Tourism-related establishments	19.48	Business base	Tourism represents a large share of firms and establishments.
Tourism-related employment	27.42	Labour demand	Tourism is central to job creation and household income.
Tourism-related remuneration	28.90	Wage income	Tourism contributes materially to remunerated work.
Tourism-related gross production	33.51	Output	Tourism is a major source of measured production.

Notes: Shares are computed from INEGI Economic Census 2019 tourism tabulations for 2018 using INEGI's classification of tourism-related activities and Guerrero state totals as denominators. The table is descriptive and does not estimate a causal effect.

Tourism centrality coexists with major development challenges. Guerrero has persistent poverty, labour informality and insecurity, while Acapulco exhibits substantial social deprivation and inequality despite its long history as a major destination (CONEVAL, 2023; INEGI, 2024a,b; Data México, 2025). The contradiction is not that tourism is absent. The contradiction is that tourism is present but insufficiently translated into broad local development.

The historical literature on Acapulco is consistent with this interpretation. Earlier research documents how tourism expansion interacted with territorial pressure, social segmentation and uneven distribution of benefits (Ramírez Mendoza, 1979; Carrascal and Pérez Villegas, 1998). Other work emphasises planning difficulties and complex destination dynamics (Speakman and Díaz Garay, 2016). The case therefore illustrates the broader mechanism: a destination can remain tourism dependent while institutions, resident participation and tourist behaviour fail to coordinate around a high-linkage path.

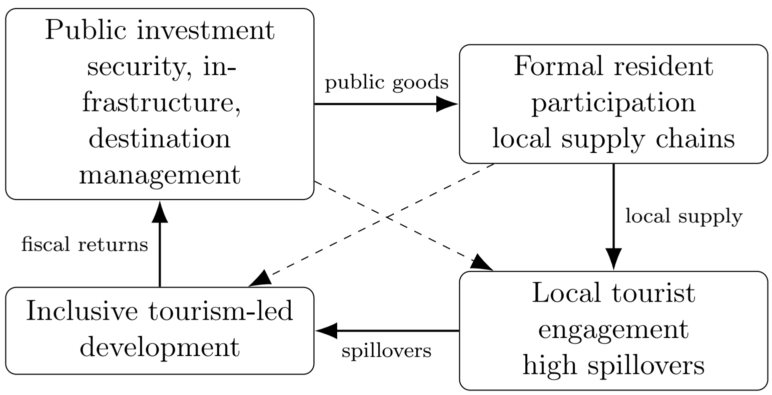

Figure 1: Strategic complementarities in inclusive tourism-led development

Notes: The figure summarises the mechanism. Public investment raises the returns to formal participation and local engagement; formal participation thickens the local supply base; local engagement increases spillovers and the fiscal-political returns to investment. Weakness in any component can reverse the cycle.

The purpose of using this case is not to claim that Acapulco is unique. Rather, it anchors a general theory in a concrete destination where tourism intensity, institutional fragility and limited local development coexist. The next section formalises this theory.

3. The coordination-game model

Consider a tourism-dependent destination with three populations of agents: a government, local residents and tourists. The government is interpreted broadly as the institutional authority responsible for public goods, regulation and destination management. Residents represent workers and local entrepreneurs whose participation may be formal or informal. Tourists represent visitors whose consumption may be integrated with the local economy or concentrated within enclave-type circuits.

Each population has two strategies. The government chooses between investment, denoted I, and extraction, denoted E. Residents choose between formal participation, denoted F, and informal participation, denoted N. Tourists choose between local engagement, denoted H, and enclave consumption, denoted L. Let p, q and r denote the shares of governments, residents and tourists using the productive strategies I, F and H, respectively. Thus $(p, q, r) \in [0, 1]^3$.

The government obtains a return from investment only when residents participate formally and tourists engage locally. This reflects the fact that tax revenues, political support and visible development gains are larger when tourism spending enters the local formal economy. The payoff from investment is

$$\pi_I = \tau qr - c, \tag{1}$$

where $\tau > 0$ is the fiscal and political return from a coordinated tourism economy and $c > 0$ is the cost of public investment. The payoff from extraction is

$$\pi_E = \rho, \tag{2}$$

where $\rho > 0$ measures short-run rents from corruption, rent seeking or resource diversion.

Residents obtain higher returns to formality when tourists engage locally and when the government invests in public goods. The payoff from formal participation is

$$\pi_F = wr + \beta p, \tag{3}$$

where $w > 0$ measures the market return created by local tourism demand and $\beta > 0$ measures the institutional benefit of public investment. The payoff from informal participation is

$$\pi_N = v_0, \tag{4}$$

where $v_0 > 0$ is the outside option from informality or survival activity.

Tourists obtain higher utility from local engagement when both institutions and local supply chains function well. Their payoff from local engagement is

$$\pi_H = u_H pq - d(1 - p), \tag{5}$$

where $u_H > 0$ is the value of an authentic and locally integrated experience, and $d > 0$ is the loss associated with weak governance, insecurity or poor destination quality. The payoff from enclave consumption is

$$\pi_L = u_L, \tag{6}$$

where $u_L > 0$ is the utility from a safer or more standardised enclave experience.

The payoff differences are

$$\Phi_G(q,r) = \pi_I - \pi_E = \tau q r - c - \rho, \tag{7}$$

$$\Phi_R(p,r) = \pi_F - \pi_N = w r + \beta p - v_0, \tag{8}$$

$$\Phi_T(p,q) = \pi_H - \pi_L = u_H p q - d(1-p) - u_L. \tag{9}$$

A productive strategy is attractive whenever its payoff difference is positive. These expressions show the strategic complementarities directly. The return to investment increases with resident formality and tourist engagement. The return to formality increases with public investment and local engagement. The return to local engagement increases with public investment and resident formality.

Environmental and resilience concerns enter through the same payoff structure. Public investment may include coastal protection, urban infrastructure, waste management, security and disaster preparedness. Formal firms are easier to regulate and integrate into sustainability standards. Local engagement creates incentives to preserve shared destination assets. Conversely, extraction, informality and enclave tourism weaken the public and private incentives needed for sustainable management.

The model deliberately remains parsimonious. It does not distinguish among types of tourists, levels of government or sectors of residents. It also treats shocks as changes in parameters rather than additional strategies. A hurricane, pandemic, security crisis or environmental shock can reduce u_H, w or τ, and can increase d, c or v_0. Institutional reform can reduce ρ or increase β. The purpose is to capture the minimal set of interactions needed to explain why tourism may fail to become inclusive.

3.1. Static equilibrium analysis

The static game has two economically important pure-strategy equilibria: a low-development equilibrium and a high-development equilibrium. The low-development equilibrium is (E, N, L): the government extracts, residents remain informal and tourists consume in enclave circuits. The high-development equilibrium is (I, F, H): the government invests, residents participate formally and tourists engage locally.

Proposition 1 (Pure-strategy equilibria)**.** *The strategy profile (E, N, L) is a strict Nash equilibrium if*

$$\rho > -c, \qquad v_0 > 0, \qquad u_L + d > 0. \tag{10}$$

The strategy profile (I, F, H) is a strict Nash equilibrium if

$$\tau - c > \rho, \qquad w + \beta > v_0, \qquad u_H > u_L. \tag{11}$$

Proof. At (E, N, L), investment yields $-c$ to the government while extraction yields ρ; formal participation yields zero to residents while informality yields v_0; and local engagement yields $-d$ to tourists while enclave consumption yields u_L. The stated inequalities make the defensive strategies strictly optimal. At (I, F, H), investment yields $\tau - c$ instead of ρ, formal participation yields $w + \beta$ instead of v_0, and local engagement yields u_H instead of u_L. The second set of inequalities makes the productive strategies strictly optimal. □

The first equilibrium exists under very weak conditions because the parameters are positive. This does not mean that the low-development outcome is socially desirable. It means that, when the other actors are defensive, each actor has a private incentive to remain defensive as well. If residents are informal and tourists are enclaved, public investment has little immediate fiscal return. If institutions are weak and tourists are enclaved, formality has low private return. If institutions are weak and local formal supply is thin, enclave consumption is attractive.

The high-development equilibrium requires stronger conditions. Public investment must generate returns greater than extraction rents; formal participation must generate returns greater than informality; and local engagement must be more attractive than enclave consumption. These are not purely technological conditions. They are shaped by policy, security, ownership structures, supply-chain organisation, fiscal rules and destination management.

The threshold conditions are useful for interpretation. Residents choose formality when

$$wr + \beta p > v_0. \tag{12}$$

Government invests when

$$\tau qr - c > \rho. \tag{13}$$

Tourists engage locally when

$$u_H pq - d(1 - p) > u_L. \tag{14}$$

Each inequality depends on the behaviour of the other actors. Thus isolated action may be privately unprofitable even when coordinated action would be collectively beneficial.

This result clarifies the meaning of a tourism poverty trap. The trap is not simply poverty in a tourist destination. It is a self-reinforcing configuration in which the incentives of governments, residents and tourists jointly reproduce weak local development. In this configuration, tourism may still generate aggregate spending and employment, but the spending is poorly linked to formal local production and to public-good provision. The destination grows around tourism without achieving broad-based tourism-led development.

The static model also explains why average tourism effects can be positive while some destinations remain trapped. If a large sample contains both high-linkage and low-linkage destinations, the average effect of tourism may be positive. Yet destinations with weak institutions, limited formal participation and enclave consumption may remain in the low-development basin. The mechanism therefore complements, rather than contradicts, evidence that tourism can raise average local activity (Faber and Gaubert, 2019).

4. Evolutionary model and replicator dynamics

The static game identifies the possible coordination equilibria but does not describe how tourism-dependent economies move between them. In practice, governments, residents and tourists adjust gradually to observed economic returns, institutional performance, perceived risk and destination quality. An evolutionary formulation is therefore appropriate: productive strategies expand when their payoffs exceed those of the corresponding defensive alternatives.

Let $p(t)$, $q(t)$ and $r(t)$ denote the shares of investment-oriented institutions, formally participating residents and locally engaged tourists, respectively. Equivalently, these variables can be read as mixed-strategy probabilities in a representative destination or as the prevalence of the three behaviours across comparable destinations. In all interpretations, $(p, q, r) \in [0, 1]^3$, where $(0, 0, 0)$ corresponds to the low-development regime and $(1, 1, 1)$ to the high-development regime.

The payoff differences between productive and defensive strategies are

$$\Phi_G(q, r) = \tau qr - c - \rho, \tag{15}$$

$$\Phi_R(p, r) = wr + \beta p - v_0, \tag{16}$$

$$\Phi_T(p, q) = u_H pq - d(1 - p) - u_L. \tag{17}$$

The corresponding replicator dynamics are

$$\dot{p} = p(1 - p)\, \Phi_G(q, r), \tag{18}$$

$$\dot{q} = q(1 - q)\, \Phi_R(p, r), \tag{19}$$

$$\dot{r} = r(1 - r)\, \Phi_T(p, q). \tag{20}$$

Thus the share of a productive strategy increases whenever its payoff exceeds the payoff of the corresponding defensive strategy. Because each payoff difference depends on the behaviour of the other populations, the system creates endogenous feedbacks between public investment, formal economic participation and local tourist engagement. Adverse shocks such as insecurity, natural disasters, environmental degradation or pandemics can be represented by parameter changes that reduce u_H, w or τ or increase d, c or v_0. Institutional reform can be represented by lower ρ or higher β.

Throughout the analysis, unless otherwise stated, we assume

$$\tau, w, \beta, u_H, d, c, \rho, v_0, u_L > 0.$$

We now establish the basic dynamical properties of (18)–(20).

Proposition 2 (Forward invariance of the state space)**.** *The cube $[0,1]^3$ is forward invariant under the flow generated by (18)–(20). In particular, if $x(0) \in [0,1]^3$, then $x(t) \in [0,1]^3$ for all $t \geq 0$.*

Proof. Consider the equation for p: $\dot{p} = p(1-p)\Phi_G(q,r)$.

If $p = 0$, then $\dot{p} = 0$, and if $p = 1$, then $\dot{p} = 0$. Therefore, the boundary hyperplanes $\{p = 0\}$ and $\{p = 1\}$ are invariant. The same argument applies to q and r, since each equation contains the corresponding replicator factor $z(1-z)$, with $z \in \{p, q, r\}$.

Hence every boundary hyperplane is invariant. Since the boundary of the cube $[0,1]^3$ is the union of these hyperplanes, trajectories starting inside the cube cannot leave it. Therefore, $[0,1]^3$ is forward invariant. □

Proposition 3 (Well-posedness)**.** *The vector field defined by (18)–(20) admits a unique global solution for every initial condition $x(0) \in [0,1]^3$.*

Proof. The right-hand sides of the system are polynomial functions of (p,q,r) and therefore smooth on $\mathbb{R}^3$. Standard results for ordinary differential equations guarantee local existence and uniqueness.

By Proposition 2, every trajectory starting in $[0,1]^3$ remains inside this compact invariant set. Since solutions confined to a compact set cannot diverge in finite time, the local solution extends globally for all $t \geq 0$. □

Remark 1 (Invariant faces, edges, and vertices)**.** *Because every boundary hyperplane is invariant, every face, edge, and vertex of the cube $[0,1]^3$ is invariant under the dynamics. In evolutionary terms, once a population reaches a monomorphic boundary state, it cannot leave that state under the replicator dynamics.*

The interior dynamics are governed entirely by the payoff differentials. For any $(p,q,r) \in (0,1)^3$, the replicator terms $p(1-p)$, $q(1-q)$, and $r(1-r)$ are strictly positive. Therefore, the direction of motion of each state variable is determined exclusively by the corresponding payoff difference. This yields the following threshold characterization.

Proposition 4 (Threshold characterization in the interior)**.** *For any $(p,q,r) \in (0,1)^3$:*

1. *Government investment increases if and only if $\tau qr > c + \rho$, and decreases if and only if $\tau qr < c + \rho$.*
2. *Formal participation increases if and only if $wr + \beta p > v_0$, and decreases if and only if $wr + \beta p < v_0$.*
3. *Local tourist engagement increases if and only if $u_H pq - d(1-p) > u_L$, and decreases if and only if $u_H pq - d(1-p) < u_L$..*

Proof. Since $(p, q, r) \in (0, 1)^3$, the terms $p(1-p)$, $q(1-q)$, and $r(1-r)$ are strictly positive. Hence, the sign of each derivative is determined by the sign of the corresponding payoff difference:

$$\Phi_G(q, r), \qquad \Phi_R(p, r), \qquad \Phi_T(p, q).$$

Substituting the expressions of these payoff differences gives the stated threshold conditions. □

Corollary 1 (Threshold surfaces)**.** *The interior null-surfaces of the replicator system are given by*

$$\begin{aligned} &\mathcal{N}_p : \tau qr = c + \rho, \\ &\mathcal{N}_q : wr + \beta p = v_0, \\ &\mathcal{N}_r : u_H pq - d(1-p) = u_L. \end{aligned}$$

These surfaces partition the interior of the state space into regions where the corresponding strategy share increases or decreases.

Remark 2. *The null-surfaces represent the dynamic counterpart of the indifference conditions of the static game. Their intersections determine candidate interior stationary points and separate regions with different directions of evolution.*

We now characterize the stationary points of the replicator system. A point $x^* = (p^*, q^*, r^*)$ is stationary if and only if

$$\dot{p} = \dot{q} = \dot{r} = 0.$$

Because the system is factorized, equilibrium conditions can be obtained directly from the replicator structure.

Proposition 5 (Equilibrium characterization)**.** *A point $(p^*, q^*, r^*) \in [0, 1]^3$ is an equilibrium if and only if each coordinate satisfies*

$$\begin{aligned} &p^* \in \{0, 1\} \quad \text{or} \quad \tau q^* r^* = c + \rho, \\ &q^* \in \{0, 1\} \quad \text{or} \quad wr^* + \beta p^* = v_0, \\ &r^* \in \{0, 1\} \quad \text{or} \quad u_H p^* q^* - d(1-p^*) = u_L. \end{aligned}$$

Proof. The result follows immediately from the factorized form of the replicator equations. Each derivative is a product of a boundary term, $z(1-z)$, and the corresponding payoff differential. Hence, each equation equals zero if and only if either the population share is at a boundary value or the associated payoff difference is zero. □

Remark 3 (Boundary equilibria)**.** *All eight vertices of the cube are equilibria:*

$$(0, 0, 0), (1, 0, 0), (0, 1, 0), (0, 0, 1), (1, 1, 0), (1, 0, 1), (0, 1, 1), (1, 1, 1).$$

More generally, any point located on a face or edge is an equilibrium whenever the remaining interior coordinates satisfy the corresponding indifference conditions in Proposition 5.

Proposition 6 (Interior equilibrium)**.** *An interior equilibrium* $(p^*, q^*, r^*) \in (0,1)^3$ *exists if and only if the following system admits a solution in* $(0,1)^3$*:*

$$\tau q r = c + \rho, \tag{21}$$
$$w r + \beta p = v_0, \tag{22}$$
$$u_H p q - d(1-p) = u_L. \tag{23}$$

Whenever such an equilibrium exists, it satisfies

$$r^* = \frac{v_0 - \beta p^*}{w}, \tag{24}$$
$$q^* = \frac{c+\rho}{\tau r^*}, \tag{25}$$
$$q^* = \frac{u_L + d - d p^*}{u_H p^*} = \frac{u_L + d}{u_H p^*} - \frac{d}{u_H}. \tag{26}$$

Therefore, p^* *must satisfy the consistency condition obtained by equating the two expressions for* q^* *after substituting equation* (24)*.*

Proof. At an interior equilibrium, none of the replicator terms $p(1-p)$, $q(1-q)$, and $r(1-r)$ vanish. Therefore, the equilibrium conditions require

$$\Phi_G = \Phi_R = \Phi_T = 0,$$

which yields equations (21)–(23). Solving equation (22) for r^* gives equation (24). Substituting this expression into equation (21) gives equation (25), while solving equation (23) for q^* gives equation (26). The two expressions for q^* must coincide, providing the required consistency condition. □

Remark 4. *Generically, the system admits only finitely many interior equilibria because the equilibrium conditions reduce to an algebraic equation in a single variable. In the coordination-game region of parameters, the model typically generates either no interior equilibrium or a unique interior threshold equilibrium separating the basins of attraction of the low- and high-development regimes.*

4.1. Stability analysis

We now analyse the local stability properties of the stationary points of the replicator system. Stability is determined by the eigenvalues of the Jacobian matrix evaluated at each equilibrium. The economically relevant stationary points are the low-development trap, the high-development regime, and the interior threshold equilibrium.

Proposition 7 (Stability of the low-development trap)**.** *The equilibrium* $(0,0,0)$ *is locally asymptotically stable. Its Jacobian matrix is*

$$J(0,0,0) = \begin{bmatrix} -(c+\rho) & 0 & 0 \\ 0 & -v_0 & 0 \\ 0 & 0 & -(u_L+d) \end{bmatrix}.$$

Proof. At $(p,q,r) = (0,0,0)$, the off-diagonal elements of the Jacobian vanish due to the replicator structure. The diagonal entries are

$$-(c+\rho), \qquad -v_0, \qquad -(u_L+d).$$

Since all parameters are positive, all eigenvalues are strictly negative. Therefore, the equilibrium is locally asymptotically stable.

□

Remark 5. *The stability of* $(0,0,0)$ *captures the tourism poverty-trap mechanism. When all populations are sufficiently close to the defensive strategies, the payoff differentials remain negative, reinforcing extraction, informality, and low-spillover tourist behaviour.*

Proposition 8 (Stability of the high-development equilibrium)**.** *The equilibrium* $(1,1,1)$ *is locally asymptotically stable if and only if*

$$\tau > c+\rho, \qquad w+\beta > v_0, \qquad u_H > u_L. \tag{27}$$

The Jacobian matrix is

$$J(1,1,1) = \begin{bmatrix} -(\tau-c-\rho) & 0 & 0 \\ 0 & -(w+\beta-v_0) & 0 \\ 0 & 0 & -(u_H-u_L) \end{bmatrix}.$$

Proof. At $(1,1,1)$, all off-diagonal elements vanish. The diagonal elements are

$$-(\tau-c-\rho), \quad -(w+\beta-v_0), \quad \text{and} \quad -(u_H-u_L).$$

Hence, all eigenvalues are negative if and only if condition (27) holds.

□

Remark 6 (Bistability and path dependence)**.** *When condition* (27) *holds, both* $(0,0,0)$ *and* $(1,1,1)$ *are locally asymptotically stable. Therefore, the system exhibits local bistability. The long-run development trajectory depends on initial conditions and on the basin of attraction in which the economy starts.*

We next consider the interior stationary point. As established in the equilibrium characterization, any interior equilibrium satisfies the three indifference conditions of the populations. Such an equilibrium acts as a threshold separating the two stable regimes.

Theorem 1 (Instability of interior equilibria)**.** *Every interior equilibrium of the replicator system is unstable.*

Proof. At an interior equilibrium the three payoff differences vanish. The Jacobian therefore has zero diagonal and positive off-diagonal entries:

$$J^* = \begin{bmatrix} 0 & a & b \\ c & 0 & e \\ f & g & 0 \end{bmatrix}, \qquad a, b, c, e, f, g > 0.$$

Its characteristic polynomial is

$$\chi(\lambda) = \lambda^3 - S\lambda - P, \qquad S = ac + bf + eg > 0, \quad P = aef + bcg > 0.$$

Since $\chi(0) = -P < 0$ and $\chi(\lambda) \to +\infty$ as $\lambda \to +\infty$, continuity implies the existence of a positive real eigenvalue. Hence the interior equilibrium has an unstable direction and cannot be locally asymptotically stable. □

Remark 7 (Interior equilibrium as a threshold state)**.** *Whenever it exists, the interior equilibrium should be interpreted as an unstable threshold state rather than as a stable development regime. Small perturbations move the system toward either the low-development trap or the high-development equilibrium.*

4.2. Comparative statics of local stability

We now analyse how primitive parameters affect the local stability conditions of the productive equilibrium. Since local stability is determined by the signs of the eigenvalues, comparative statics follow directly from the Jacobian evaluated at $(1, 1, 1)$.

Proposition 9 (Comparative statics at $(1, 1, 1)$)**.** *Assume that* $(1, 1, 1)$ *is locally asymptotically stable. Then:*

1. *Increasing ρ or c makes the first eigenvalue less negative and therefore weakens the stability margin of the government investment strategy.*
2. *Increasing τ makes the first eigenvalue more negative and therefore strengthens the stability of the investment strategy.*
3. *Increasing w or β strengthens the stability of the formal participation strategy by making the second eigenvalue more negative.*
4. *Increasing u_H strengthens the stability of high-spending local engagement, whereas increasing u_L weakens it.*

Proof. The eigenvalues at $(1, 1, 1)$ are

$$\lambda_1 = -(\tau - c - \rho), \quad \lambda_2 = -(w + \beta - v_0), \quad \text{and} \quad \lambda_3 = -(u_H - u_L).$$

The comparative statics follow directly by differentiating these expressions with respect to the corresponding parameters.

□

Corollary 2 (Critical stability thresholds)**.** *The equilibrium* $(1,1,1)$ *loses local hyperbolic stability when one of the following conditions is reached:*

$$\rho = \tau - c, \quad v_0 = w + \beta, \quad u_H = u_L.$$

These conditions define critical parameter thresholds at which the productive equilibrium becomes locally unstable.

Remark 8. *These threshold conditions represent codimension-one boundaries in parameter space separating regions with different local stability properties.*

4.3. Reduced dynamics on invariant faces

The invariance of the cube allows the analysis of lower-dimensional subsystems. These reduced dynamics clarify the role of strategic complementarities in sustaining the productive equilibrium.

Proposition 10 (Dynamics on the face $r = 0$)**.** *On the invariant face* $\{r = 0\}$*, the system reduces to*

$$\dot{p} = p(1-p)(-c-\rho),$$

$$\dot{q} = q(1-q)(\beta p - v_0),$$

$$\dot{r} = 0.$$

For every interior initial condition on this face,

$$p(t) \to 0,$$

and consequently

$$q(t) \to 0.$$

Proof. Since

$$\dot{p} = p(1-p)(-c-\rho) < 0$$

for every $p \in (0,1)$, the government investment share decreases monotonically toward zero. As $p(t) \to 0$,

$$\dot{q} \to q(1-q)(-v_0) < 0,$$

which implies that formal participation also converges to zero.

□

Remark 9. *If tourist engagement remains permanently limited to enclave behaviour, the investment strategy cannot be sustained evolutionarily because the complementarity between public investment and local tourism demand disappears.*

Proposition 11 (Dynamics on the face $p = 0$). *On the invariant face $\{p = 0\}$,*

$$\dot{q} = q(1 - q)(wr - v_0),$$

$$\dot{r} = r(1 - r)(-d - u_L),$$

$$\dot{p} = 0.$$

Hence,

$$r(t) \to 0$$

and subsequently

$$q(t) \to 0$$

for every interior initial condition on this face.

Proof. Because

$$\dot{r} = r(1 - r)(-d - u_L) < 0,$$

tourist engagement declines monotonically toward zero. The resident equation then converges to

$$\dot{q} = q(1 - q)(-v_0) < 0,$$

so formal participation also disappears.

□

Remark 10. *Without an investment-oriented institutional environment, high-spending local tourism is not evolutionarily sustainable.*

Proposition 12 (Dynamics on the face $q = 0$). *On the invariant face $\{q = 0\}$,*

$$\dot{p} = p(1 - p)(-c - \rho),$$

$$\dot{r} = r(1 - r)(-d(1 - p) - u_L),$$

$$\dot{q} = 0.$$

Therefore,

$$p(t) \to 0, \qquad r(t) \to 0$$

for every interior initial condition on this face.

Proof. The government equation implies

$$\dot{p} < 0$$

for all $p \in (0,1)$, hence $p(t) \to 0$. Substituting this result into the tourist equation gives

$$\dot{r} = r(1-r)(-d - u_L) < 0,$$

which implies convergence of tourist engagement toward zero.

□

Remark 11. *If residents remain entirely informal, the productive tourism regime cannot be maintained because the local participation channel required for strategic complementarity disappears.*

4.4. Global implications and coordination interpretation

The previous results yield the main mathematical logic of the model.

Theorem 2 (Main dynamical structure)**.** *Assume the parameter conditions*

$$\tau > c + \rho, \qquad w + \beta > v_0, \qquad u_H > u_L$$

hold, and suppose an interior equilibrium exists. Then:

1. $(0,0,0)$ *is locally asymptotically stable.*
2. $(1,1,1)$ *is locally asymptotically stable.*
3. *Every interior equilibrium is unstable.*
4. *The coexistence of two locally asymptotically stable corner equilibria implies disjoint attraction regions associated with the low-development trap and the high-development equilibrium.*

Proof. Items (1) and (2) follow from Propositions 7 and 8. Item (3) follows from Theorem 1. Since the two corner equilibria are distinct locally asymptotically stable equilibria of a continuous dynamical system on a connected invariant set, their basins are disjoint open subsets of the cube. Because an interior unstable equilibrium exists, the basin boundary is nonempty. Hence the state space is partitioned into at least two attraction regions. □

Corollary 3 (Path dependence)**.** *When the high-development stability conditions hold, long-run outcomes depend on initial conditions. Small differences in the initial shares of investment, formality, or broad tourist engagement may produce qualitatively different development paths.*

Corollary 4 (Need for coordinated reform)**.** *A policy intervention that changes only one payoff differential may be insufficient to move the system from the basin of the low-development trap to the basin of the high-development regime. Coordinated changes in the parameters* $(\rho, c, \tau, w, \beta, u_H, u_L, d)$ *are generally more effective.*

Proof. The basin boundary is determined jointly by the three null-surfaces and the unstable threshold equilibrium. Changing only one parameter shifts only part of that geometry, whereas coordinated reform shifts several threshold conditions simultaneously. □

A useful reformulation of the replicator dynamics is obtained by expressing the system in log-odds coordinates. The variables p, q, and r represent population shares and are therefore bounded between zero and one. However, the replicator term $z(1-z)$ implies that the speed of adjustment mechanically declines when a strategy becomes either very rare or nearly dominant. The log-odds transformation removes this mechanical scaling and expresses the dynamics in terms of changes in the relative prevalence of productive versus defensive strategies.

This transformation is particularly useful for the economic interpretation of the model. In the original variables, a small change in p, q, or r may reflect either a genuine change in the relative attractiveness of strategies or simply the fact that the population is approaching a boundary. In contrast, the evolution of the log-odds directly captures the change in the ratio between the productive and defensive strategies. Therefore, the payoff differentials can be interpreted as the instantaneous growth rates of the relative advantage of productive behaviour over time.

Define the log-odds variables

$$\ell_p = \log \frac{p}{1-p}, \qquad \ell_q = \log \frac{q}{1-q}, \qquad \ell_r = \log \frac{r}{1-r}.$$

These variables measure the relative prevalence of productive strategies in each population. A positive change in ℓ_p, for example, means that the relative weight of investment-oriented governments increases with respect to extractive governments. The following proposition follows directly from the replicator structure.

Proposition 13 (Log-odds representation)**.** *For any interior trajectory $(p,q,r) \in (0,1)^3$, the dynamics can be written as*

$$\frac{d}{dt} \log \frac{p}{1-p} = \tau q r - c - \rho,$$

$$\frac{d}{dt} \log \frac{q}{1-q} = w r + \beta p - v_0,$$

$$\frac{d}{dt} \log \frac{r}{1-r} = u_H p q - d(1-p) - u_L.$$

Proof. For a generic replicator equation

$$\dot{z} = z(1-z)\Psi(z),$$

the derivative of the log-odds ratio is

$$\frac{d}{dt} \log \frac{z}{1-z} = \frac{d}{dt}(\log z - \log(1-z)).$$

Therefore,

$$\frac{d}{dt}\log\frac{z}{1-z} = \frac{\dot{z}}{z} + \frac{\dot{z}}{1-z} = \frac{\dot{z}}{z(1-z)} = \Psi(z).$$

Applying this identity to the three equations of the replicator system yields the result. □

Remark 12. *The log-odds representation provides a direct interpretation of the payoff differentials. Each payoff difference is exactly the instantaneous growth rate of the relative frequency of the productive strategy. Therefore, the evolution of institutions, residents' participation, and tourist engagement is governed by whether productive strategies generate higher expected returns than their defensive alternatives.*

4.5. Bifurcation analysis and basin geometry

The preceding results establish local bistability. We now describe how structural parameters alter the qualitative dynamics. The relevant thresholds are not cyclical bifurcations but stability losses of the productive corner and changes in the geometry of the basin boundary.

Define the payoff advantages of the productive strategies at the high-development equilibrium:

$$A := \tau - c - \rho, \tag{28}$$

$$B := w + \beta - v_0, \tag{29}$$

$$C := u_H - u_L. \tag{30}$$

The high-development equilibrium is locally asymptotically stable exactly when

$$A > 0, \qquad B > 0, \qquad C > 0.$$

The associated critical surfaces are

$$\Sigma_G = \{A = 0\}, \qquad \Sigma_R = \{B = 0\}, \qquad \Sigma_T = \{C = 0\}.$$

They represent the loss of institutional-investment, resident-formality and tourist-engagement incentives, respectively.

Proposition 14 (Local stability thresholds)**.** *The equilibrium* $(1,1,1)$ *is hyperbolic if and only if* $ABC \neq 0$*. It is locally asymptotically stable if and only if* $A > 0$*,* $B > 0$ *and* $C > 0$*. It loses hyperbolicity on* $\Sigma_G \cup \Sigma_R \cup \Sigma_T$*.*

Proof. At $(1,1,1)$ the Jacobian is diagonal:

$$J(1,1,1) = \begin{bmatrix} -A & 0 & 0 \\ 0 & -B & 0 \\ 0 & 0 & -C \end{bmatrix}.$$

The result follows immediately from the eigenvalues $-A$, $-B$ and $-C$. $\square$

The same thresholds can be read from the invariant edges adjacent to $(1,1,1)$. On $E_G = \{(p,1,1) : p \in [0,1]\}$, $\dot{p} = Ap(1-p)$; on $E_R = \{(1,q,1) : q \in [0,1]\}$, $\dot{q} = Bq(1-q)$; and on $E_T = \{(1,1,r) : r \in [0,1]\}$, $\dot{r} = Cr(1-r)$. Thus a change in the sign of A, B or C reverses the local motion along the corresponding institutional, resident or tourist dimension.

Figures 2–4 provide schematic illustrations of these local thresholds and of the basin geometry generated by the unstable threshold state.

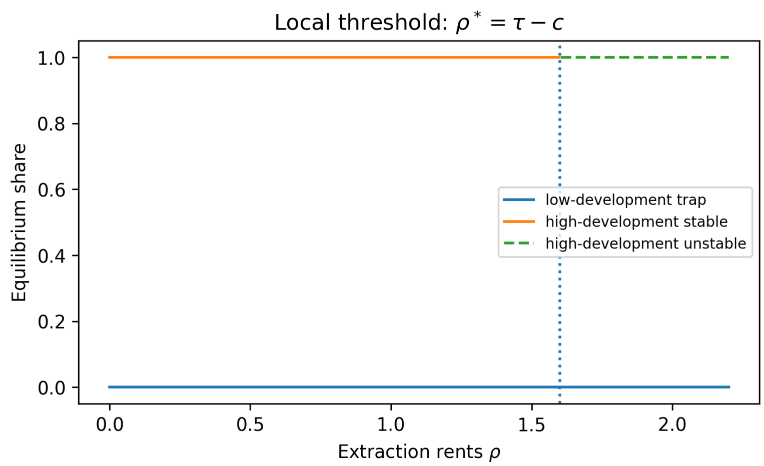

Figure 2: Local stability threshold with respect to extraction rents ρ

Notes: The low-development trap remains locally stable for positive parameters. The high-development equilibrium is locally stable only when $\rho < \tau - c$.

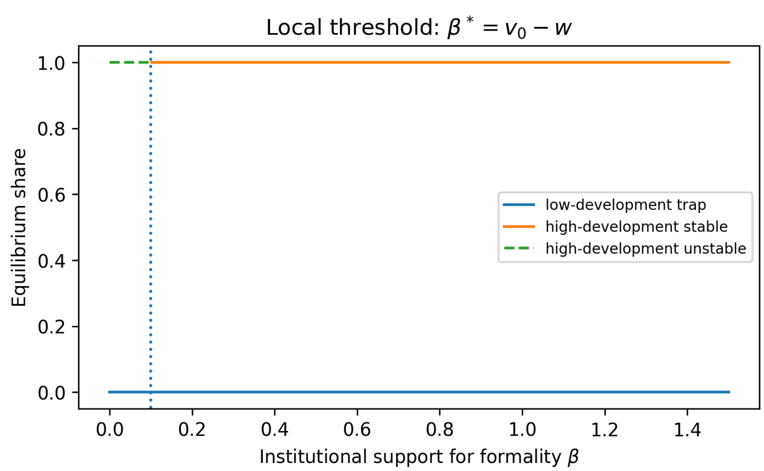

Figure 3: Local stability threshold with respect to institutional support for formality β

Notes: The high-development equilibrium is locally stable in the resident dimension only when $\beta > v_0 - w$.

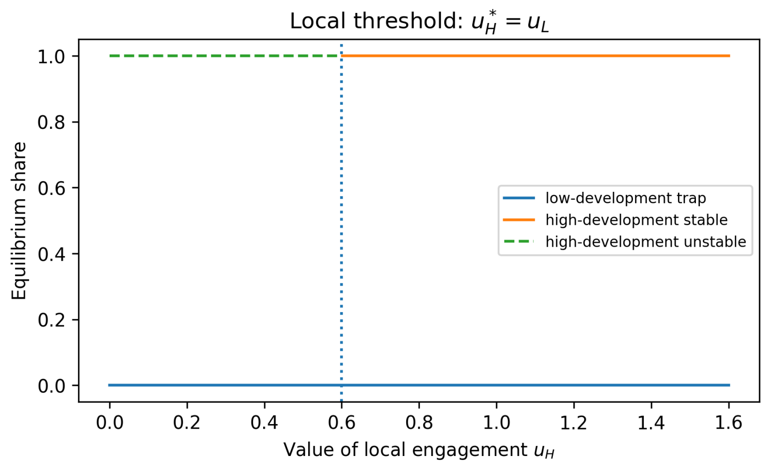

Figure 4: Local stability threshold with respect to the value of local engagement u_H

Notes: The high-development equilibrium is locally stable in the tourist dimension only when $u_H > u_L$.

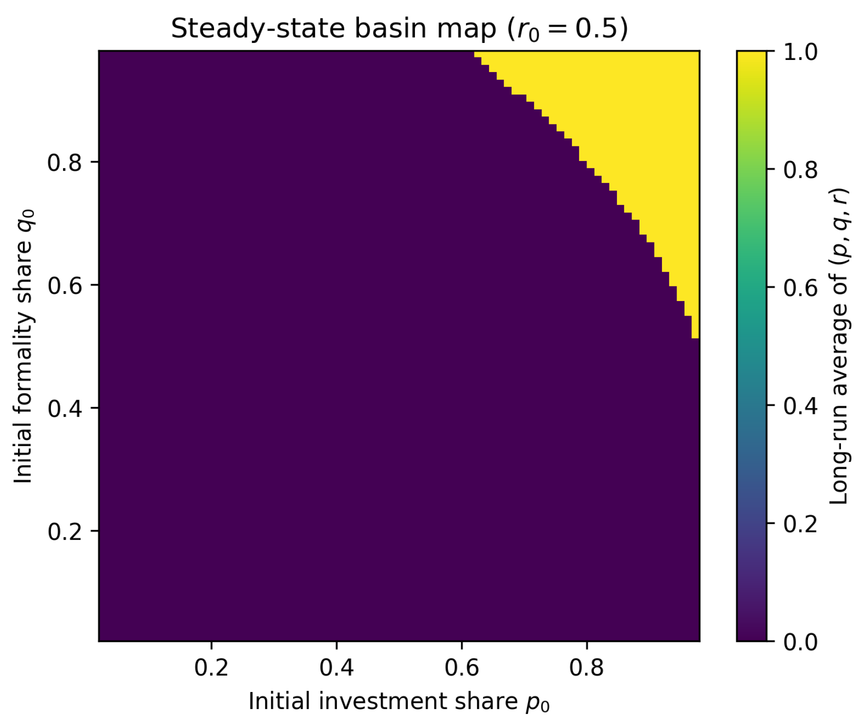

Figure 5: Illustrative basin map for fixed initial tourist engagement

Notes: Each point is an initial condition (p_0, q_0) for a fixed r_0. The shading reports convergence to the low-development or high-development regime. The separating curve is the numerical counterpart of the unstable threshold state.

Interior threshold equilibria satisfy

$$\tau q r = c + \rho, \tag{31}$$

$$w r + \beta p = v_0, \tag{32}$$

$$u_H p q - d(1-p) = u_L. \tag{33}$$

They are economically important because they locate the threshold between basins, but Theorem 1 shows that they are not stable long-run regimes.

Theorem 3 (No local zero-eigenvalue bifurcation in the interior)**.** *An interior equilibrium cannot undergo a saddle-node, transcritical or pitchfork bifurcation inside* $(0,1)^3$.

Proof. At an interior equilibrium, the characteristic polynomial is $\chi(\lambda) = \lambda^3 - S\lambda - P$, with $S > 0$ and $P > 0$. Hence $\det(J^*) = P \neq 0$, so zero is not an eigenvalue. Local bifurcations requiring a zero eigenvalue cannot occur in the interior. □

It follows that changes in the existence of an interior threshold state occur through boundary collisions. Under positive parameters, collisions with $p = 0$, $q = 0$ or $r = 0$ are infeasible because they would require either $c+\rho = 0$ or $u_L = -d$. The relevant productive-face collision surfaces are therefore:

$$\mathcal{C}_p : \quad \tau \left(\frac{u_L}{u_H}\right)\left(\frac{v_0 - \beta}{w}\right) = c + \rho, \tag{34}$$

$$\mathcal{C}_q : \quad w \left(\frac{c+\rho}{\tau}\right) + \beta \left(\frac{u_L + d}{u_H + d}\right) = v_0, \tag{35}$$

$$\mathcal{C}_r : \quad u_H \left(\frac{v_0 - w}{\beta}\right)\left(\frac{c+\rho}{\tau}\right) - d\left(1 - \frac{v_0 - w}{\beta}\right) = u_L. \tag{36}$$

These expressions are meaningful only when the implied boundary coordinates lie in $[0,1]$.

The economic interpretation is direct. Σ_G is the institutional-investment threshold: extraction rents ρ must not exceed the net return $\tau - c$ from coordinated public investment. Σ_R is the formalisation threshold: the combined market and institutional return $w + \beta$ must exceed the informal outside option v_0. Σ_T is the tourist-engagement threshold: locally engaged consumption must be more valuable than enclave consumption. The boundary-collision surfaces $\mathcal{C}_p$, $\mathcal{C}_q$ and $\mathcal{C}_r$ do not create new stable regimes; instead, they move the separatrix that determines which initial conditions converge to each regime.

The broader implication is that tourism-dependent destinations may remain locked in low-development equilibria not because agents fail to recognise the benefits of productive strategies, but because individually rational behaviour can reproduce a self-reinforcing inefficient configuration. Escaping such a trap requires coordinated interventions that alter institutional incentives, local participation and tourist engagement at the same time.

5. Numerical illustration of the evolutionary model

This section provides a numerical illustration of the replicator system. The simulations are not structural estimates; they are disciplined examples designed to visualise four analytical results: (i) when the three high-development inequalities fail, the economy converges to the low-development trap; (ii) when the inequalities hold, the system becomes locally bistable; (iii) an interior threshold separates the basins of attraction of the low- and high-development regimes; and (iv) policy parameters such as extraction rents, formal-sector support, and tourist-risk reductions can change the size of those basins and, under sufficiently strong joint reforms, shift the long-run outcome.

All simulations solve the continuous-time replicator system

$$\begin{aligned}\dot{p} &= p(1-p)(\tau q r - c - \rho),\\ \dot{q} &= q(1-q)(w r + \beta p - v_0),\\ \dot{r} &= r(1-r)\big(u_H p q - d(1-p) - u_L\big),\end{aligned}$$

using a standard fourth-order Runge–Kutta routine on the interval $t \in [0, 140]$ or $[0, 150]$, depending on the experiment. The numerical integration is clipped only to remove machine-precision drift at the boundary; analytically, the unit cube is forward invariant by Proposition 2.

5.1. Simulation design

Table 2 reports the parameterisations used in the numerical experiments. Case A is chosen so that all three high-development conditions fail. Case B is chosen so that all three conditions hold, implying that both corner equilibria are locally stable and that an interior threshold state separates their basins of attraction. The final row reports a coordinated-reform package applied to the trap-dominant environment of Case A.

Table 2: Parameterisations used in the numerical illustration

Case	τ	c	ρ	w	β	v_0	u_H	u_L	d
A: Trap-dominant regime	1.20	0.50	0.90	0.50	0.20	0.90	0.70	0.80	0.30
B: Bistable regime	2.00	0.40	0.60	0.80	0.60	0.90	1.30	0.60	0.40
C: Coordinated reform package	1.80	0.50	0.20	0.70	0.90	0.90	1.20	0.80	0.05

Notes: In Case A, the high-development conditions fail because $\tau-c-\rho = -0.20$, $w+\beta-v_0 = -0.20$, and $u_H - u_L = -0.10$. In Case B, they all hold: $\tau-c-\rho = 1.00$, $w+\beta-v_0 = 0.50$, and $u_H-u_L = 0.70$. The coordinated package is used only in the policy experiment of Figure 10.

5.2. *Case A: Trap-dominant dynamics*

Figure 6 shows the simplest case. Starting from a relatively optimistic initial condition $(p_0, q_0, r_0) = (0.7, 0.7, 0.7)$, the economy still converges to the low-development trap when all three high-development conditions fail. The intuition is immediate: even if all three populations begin with a substantial share of productive strategies, the returns to investment, formality, and broad tourist engagement are too weak relative to extraction, informality, and enclave behaviour. The origin is therefore the only relevant attractor.

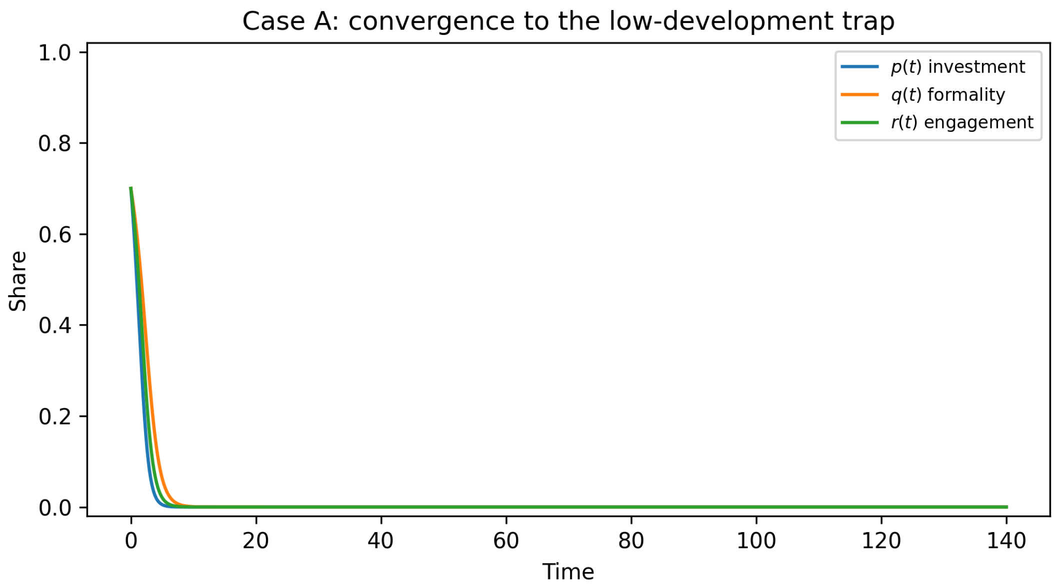

Figure 6: Case A: convergence to the low-development trap when all high-development conditions fail

Notes: Simulation of the replicator dynamics under Case A, with initial condition $(p_0, q_0, r_0) = (0.7, 0.7, 0.7)$. Even from relatively favourable initial conditions, all three productive shares decline toward zero because the high-development inequalities are violated. This illustrates the trap-dominant case of the model.

5.3. *Case B: Bistability and history dependence*

Figure 7 illustrates the central dynamic implication of the model. Under the same parameter values, two different initial conditions generate two different long-run outcomes. When the economy begins with low trust, weak institutional commitment, and little tourist engagement, it converges to the low-development trap. When it begins sufficiently close to the productive corner, it converges to the high-development equilibrium. This is the numerical counterpart of the analytical result that both $(0, 0, 0)$ and $(1, 1, 1)$ are locally stable when the three inequalities for the high-development regime are satisfied.

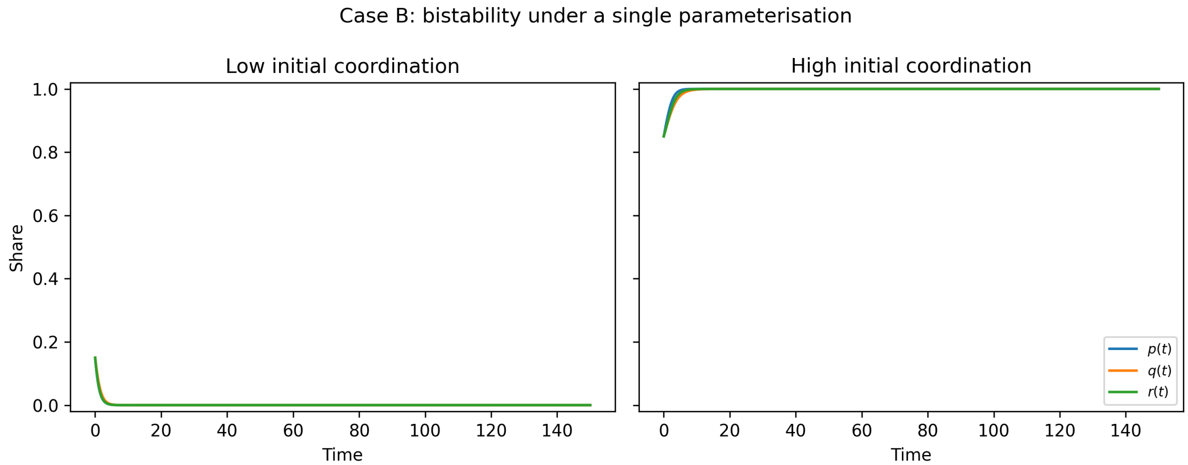

Figure 7: Case B: bistability under a single parameterisation

Notes: Both panels use Case B parameters. The left panel starts from $(p_0, q_0, r_0) = (0.15, 0.15, 0.15)$ and converges to the low-development trap. The right panel starts from $(p_0, q_0, r_0) = (0.85, 0.85, 0.85)$ and converges to the high-development equilibrium. The figure shows that the long-run regime depends on initial conditions even when the structural parameters are fixed.

The unstable interior state implied by the system acts as the threshold between those two regimes. For the baseline bistable case, the interior point solving the three zero-growth conditions is approximately $(p^*, q^*, r^*) = (0.684, 0.817, 0.612)$. This point is not a likely long-run outcome; rather, it marks the boundary between attraction to the trap and attraction to the high-development regime.

Figure 8 visualises that threshold more directly. Holding tourist initial conditions fixed at $r_0 = 0.75$, the figure varies the initial government and resident shares (p_0, q_0) over the unit square and records the long-run average of (p, q, r). The sharp transition between dark and light regions shows that a modest change in initial coordination can push the economy from one basin into the other.

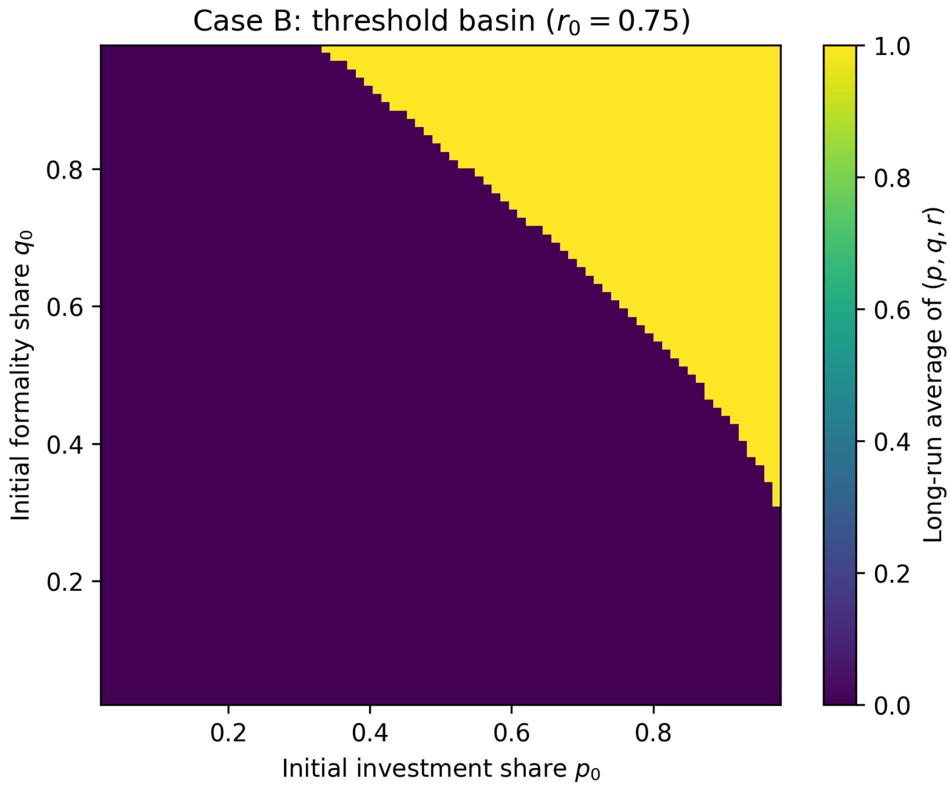

Figure 8: Threshold basin under the bistable regime

Notes: Heatmap for Case B with $r_0 = 0.75$ fixed. The horizontal axis varies the initial government investment share p_0 and the vertical axis varies the initial resident-formality share q_0. The colour scale reports the long-run average of (p, q, r), where values near zero correspond to convergence to the trap and values near one correspond to convergence to the high-development regime. The boundary between the two regions is the numerical counterpart of the interior threshold state.

5.4. Comparative statics and policy thresholds

The analytical discussion above identified $\rho^* = \tau - c$ as the local stability threshold for the high-development equilibrium. Figure 9 shows a related numerical experiment. Starting from a favourable initial condition $(0.85, 0.85, 0.85)$, the figure varies the extraction return ρ while keeping all other Case B parameters fixed. For low and moderate values of ρ, the economy converges to the high-development equilibrium. As extraction rents rise, however, the basin of attraction of the high-development regime shrinks; eventually, even a favourable initial condition is no longer sufficient to sustain convergence to the productive corner.

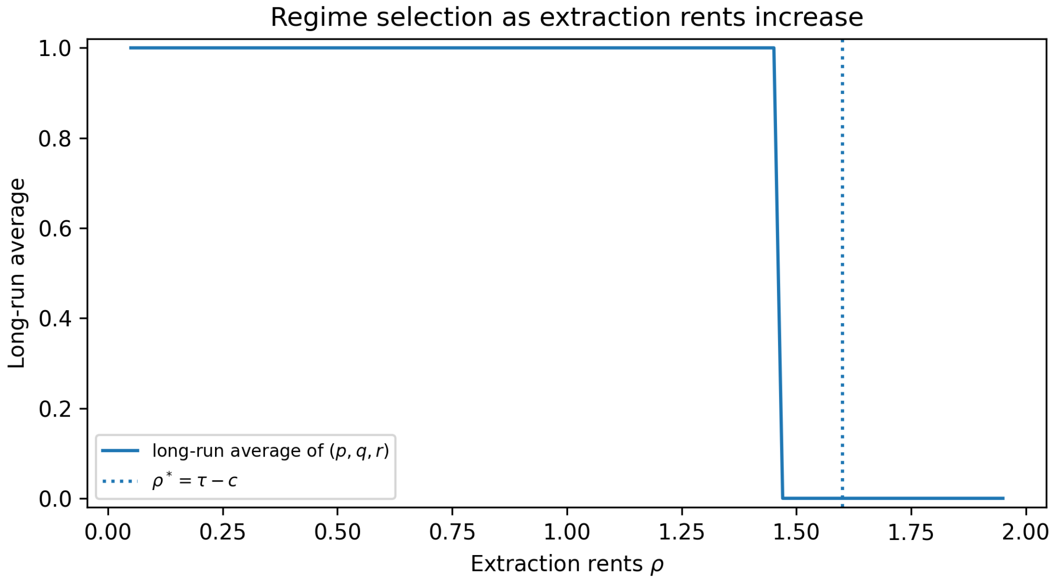

Figure 9: Long-run regime selection as extraction rents increase

Notes: The figure varies ρ while holding the other Case B parameters fixed and starting from $(p_0, q_0, r_0) = (0.85, 0.85, 0.85)$. The vertical dashed line marks the local stability threshold $\rho^* = \tau - c = 1.6$. In the simulation, regime collapse occurs slightly before that local boundary because the basin of attraction of the high-development equilibrium shrinks as ρ rises. This is a numerical illustration of how high extraction rents can erode institutional investment even before the productive corner loses local stability in the strict Jacobian sense.

Finally, Figure 10 compares isolated and coordinated reforms starting from the trap-dominant environment of Case A and the intermediate initial condition $(0.7, 0.7, 0.7)$. Lowering extraction rents alone, increasing support for the formal sector alone, or lowering tourist risk alone is not enough to move the system out of the trap. By contrast, a coordinated package that simultaneously lowers ρ, raises β and w, improves the attractiveness of broad local engagement (u_H), and lowers tourist risk (d) shifts the long-run outcome to the productive corner. This result is fully consistent with the strategic-complementarity logic of the model: when complementarities are strong, isolated reforms are typically dominated by bundled interventions.

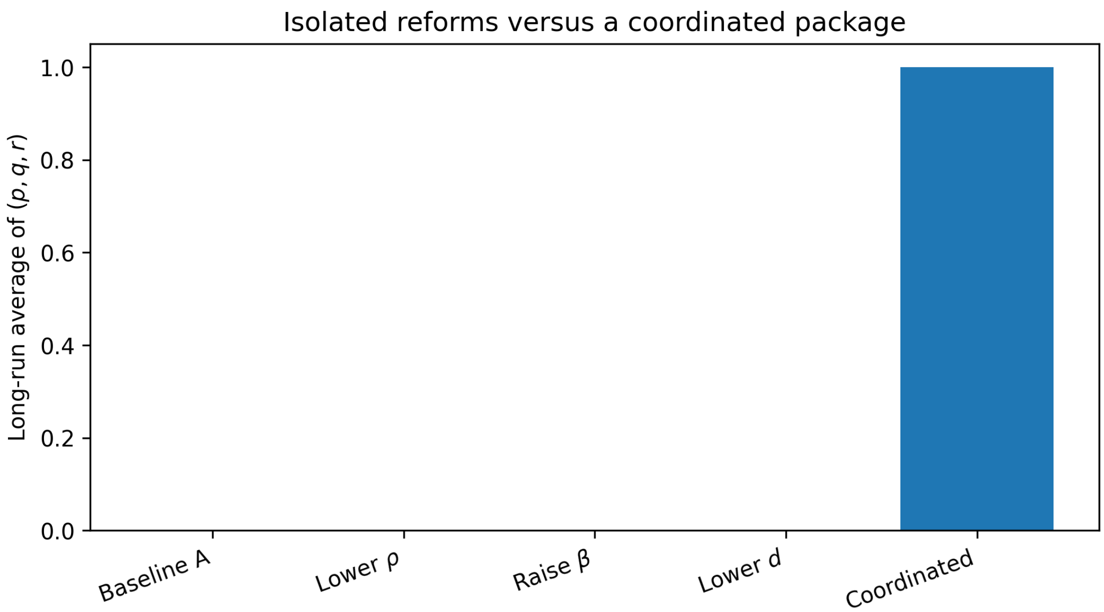

Figure 10: Isolated reforms versus coordinated policy packages

Notes: Bars report the long-run average of (p, q, r) from the common initial condition $(0.7, 0.7, 0.7)$. The first four bars use the trap-dominant baseline of Case A and then introduce one isolated reform at a time. The final bar applies the coordinated package reported in Table 2. The figure shows that single-margin improvements do not move the system out of the trap, whereas coordinated reforms can do so.

Taken together, the numerical analysis confirms the model's main logic. The low-development trap is robust when productive strategies do not deliver sufficiently high returns. Once the high-development inequalities hold, the economy becomes history-dependent and threshold-sensitive. In that region, policy is best understood not as marginal optimisation around a single equilibrium, but as coordinated regime change.

6. Concluding Remarks

This paper has examined a central paradox of tourism-led development: why some destinations remain trapped in low-development outcomes despite being deeply integrated into tourism markets. Using Acapulco within the wider tourism economy of Guerrero as a motivating case, we propose a coordination framework linking government incentives, resident participation, and tourist behaviour.[3]

[3] The empirical motivation shows that tourism is economically central in Guerrero, but this importance coexists with poverty, informality, insecurity, and limited local spillovers. The development challenge is therefore not the absence of tourism activity, but the weakness of the mechanisms that transform tourism demand into formal employment, public investment, and broader local benefits.

The theoretical model formalises this mechanism as a coordination problem. When governments favour extraction, residents remain informal and tourists concentrate consumption in enclave-type circuits, the economy may converge to a self-reinforcing low-development equilibrium. Conversely, investment, formalisation and broader local engagement can sustain a high-development equilibrium with stronger linkages and greater capacity for long-run tourism management. The evolutionary extension shows that these regimes may coexist, implying path dependence, threshold effects, and the possibility of persistent tourism traps.

The policy implication is that isolated interventions are unlikely to be sufficient. Reducing extraction incentives, increasing the returns to formal participation, and improving the conditions that encourage broader tourist engagement must operate jointly. In fragile destinations, resilience is also central: shocks affecting security, infrastructure, or environmental quality can weaken these complementarities and push the system toward a lower development basin, while effective recovery strategies can restore the conditions for a more inclusive trajectory.

The paper is a mechanism-based contribution rather than a causal reduced-form evaluation. The empirical evidence motivates the framework and establishes the relevance of the Acapulco/Guerrero case, but it does not identify municipality-level causal effects of tourism on poverty or estimate unique structural parameters. Future research could extend this approach by combining panel data on tourism activity, labour markets, insecurity, environmental conditions, and recovery processes with causal or semi-structural methods.

The broader conclusion is that tourism-led growth is not automatic. Tourism can generate substantial economic activity while failing to produce inclusive development when the institutional and behavioural complementarities required for local integration are weak. Understanding these complementarities is therefore essential for explaining why some tourism destinations diversify and prosper, while others remain trapped despite persistent visitor demand.

7. Appendix: Local Stability and Bifurcation Properties

The replicator system is defined as

$$\begin{aligned} f_1 &= p(1-p)(\tau q r - c - \rho), \\ f_2 &= q(1-q)(w r + \beta p - v_0), \\ f_3 &= r(1-r)(u_H p q - d(1-p) - u_L). \end{aligned}$$

The Jacobian is

$$J = \begin{bmatrix} (1-2p)A & p(1-p)\tau r & p(1-p)\tau q \\ q(1-q)\beta & (1-2q)B & q(1-q)w \\ r(1-r)(u_H q + d) & r(1-r)u_H p & (1-2r)C \end{bmatrix},$$

where

$$A = \tau q r - c - \rho, \qquad B = w r + \beta p - v_0, \qquad C = u_H p q - d(1-p) - u_L.$$

At all vertices of the unit cube, the Jacobian is diagonal. The eigenvalues are therefore real and given directly by the diagonal entries. Under the parameter restrictions supporting bistability, the mixed vertices are either unstable or saddle points and cannot represent attracting development regimes.

For an interior equilibrium $(p^*, q^*, r^*) \in (0,1)^3$, the payoff differences vanish:

$$\tau q^* r^* = c + \rho, \qquad w r^* + \beta p^* = v_0, \qquad u_H p^* q^* = d(1-p^*) + u_L.$$

Hence the Jacobian reduces to

$$J^* = \begin{bmatrix} 0 & a & b \\ c & 0 & e \\ f & g & 0 \end{bmatrix},$$

with all off-diagonal elements positive:

$$\begin{aligned} a &= p^*(1-p^*)\tau r^*, & b &= p^*(1-p^*)\tau q^*, \\ c &= q^*(1-q^*)\beta, & e &= q^*(1-q^*)w, \\ f &= r^*(1-r^*)(u_H q^* + d), & g &= r^*(1-r^*)u_H p^*. \end{aligned}$$

The characteristic polynomial is

$$\chi(\lambda) = \lambda^3 - S\lambda - P,$$

where

$$S = ac + bf + eg > 0, \qquad P = aef + bcg > 0.$$

No Hopf bifurcation can occur. Indeed, if $\lambda = i\omega$ with $\omega \neq 0$, then

$$\chi(i\omega) = -i\omega^3 - iS\omega - P,$$

whose real part equals $-P < 0$ and therefore cannot vanish. Since vertices also have only real eigenvalues, the system cannot generate oscillatory instability.

Consequently, qualitative changes in the dynamics arise through stability transitions of equilibria and threshold effects rather than through cyclical behaviour.

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