

A Model of Enclosures: Coordination, Conflict, and Efficiency in the Transformation of Land Property Rights

Matthew J. Baker^{*} Jonathan Conning^{*}

Abstract

Economists and historians have long debated how open-access areas, frontier regions, and customary landholding regimes transformed into private property. This paper analyzes decentralized enclosure processes using the theory of aggregative games, examining how population density, enclosure costs, potential productivity gains, and local governance capacity, including the power to demand compensation, jointly determine the mix of property regimes. Depending on these fundamentals, private decisions to enclose may be strategic complements or substitutes. Strategic complements generate tipping points and socially destructive property races, whereas strategic substitutes produce smoother transitions and may leave enclosure below the social optimum. While policies to strengthen customary governance or compensate displaced stakeholders can realign incentives, addressing one distortion while neglecting others can worsen welfare.

Keywords: property rights, institutional change, land tenure, enclosure, strategic complementarities, aggregative games

JEL Codes: D23, C73, K11, O13, Q15

^{*}Hunter College and the Graduate Center, CUNY. We thank Bård Harstad and five anonymous referees for comments and suggestions that substantially improved the paper. We would also like to thank participants from conferences at ThReD (MIT) and SIOE (Chicago), and seminar participants at Fordham, Cornell, the IAEE, The World Bank, Hunter College, and the Graduate Center at CUNY.

1 Introduction

The emergence of secure and exclusive private property rights to land from systems of possession and customary tenure is widely regarded as one of history’s most consequential institutional shifts. Leading thinkers, from Smith and Marx to North, have identified this transformation as central to the emergence of capitalism and modern economic growth. Yet, despite its importance, substantial debate persists around the underlying causes, social efficiency, and distributional consequences of the enclosure processes through which more clearly defined and exclusive ownership was established.¹

Historically, these transitions have rarely been smooth. While property rights often evolve endogenously in response to changing scarcity and relative prices (Demsetz 1967; Boserup 1965), evidence from the English enclosures, the American frontier, and rural Africa suggests that displacing customary tenure was and remains resource-intensive and contentious, involving fencing, demarcation, courts, and at times violent eviction. Following Coase (1960), societies must weigh the benefits of more exclusive arrangements against the costs of defining, enforcing and displacing existing users.

These debates remain critical given that an estimated 2.5 billion people face land insecurity (Pearce 2016) and fewer than ten percent of developing country plots are titled (Augustinus 2003). While secure ownership offers acknowledged benefits, the transition often entails uncompensated displacement, making formalization as much a matter of redistribution and power as of technical efficiency (Deininger 2003; Alden Wily 2018).

We develop a unified framework to analyze decentralized enclosure as an aggregative game of contested property claims. Building on Weitzman (1974)’s canonical productivity benchmark, we depart from the assumption of costless enforcement. Instead, following de Meza and Gould (1992), we endogenize the enclosure decision and transition costs, allowing the boundary between property regimes to emerge as an equilibrium outcome of individual decisions.

We also depart from the open-access benchmark by recognizing that customary communities often regulate resource use through internal governance (Ostrom 1990). We introduce two institutional parameters: μ , capturing the community’s capacity to regulate access to the commons, and τ , representing the ability of customary users to resist displacement or demand compensation. Following Anderson and McChesney (1994),

1. The term “enclosure” has contested meanings in economic history, at times encompassing not just changes in property but also production organization or technology use. Our framework distinguishes technology adoption and production reorganization from property transformation while modeling how they interact.

this framing distinguishes a “trade,” where enclosers compensate existing users, from a “raid,” where enclosure is imposed unilaterally with limited or no compensation. Our framework shows that while economic fundamentals drive the direction of institutional change, the timing and efficiency of transitions also depend on enforcement costs and the balance of power.

The strategic nature of the enclosure decision determines whether property rights evolve gradually through a mixed regime or undergo sudden, discontinuous shifts. In our benchmark, enclosure decisions are *strategic complements* when productivity gains to enclosure are modest or nonexistent. This may trigger a destabilizing feedback loop: enclosing a parcel displaces labor which crowds onto remaining unenclosed areas, eroding the common wage and increasing the return to further enclosure. This dynamic ignites a property race. Since strategic complementarity can generate multiple equilibria, we use the theory of global games to identify a unique risk-dominant equilibrium (Morris and Shin 2003). This characterizes the tipping points where society rushes toward full enclosure, identifying when such cascades become socially wasteful dissipative contests (Tullock 1967; Anderson and Hill 1990).

In contrast, when potential productivity gains following enclosure are sufficiently high, enclosure decisions become *strategic substitutes*. Each encloser draws labor out of the commons into more intensive production. This reduces crowding in the commons, improving the outside option for remaining users and raising the market wage, which lowers the profitability of further enclosure. In land-abundant settings, this leads to too little socially beneficial transformation.

This connects to frontier economics. Building on Domar (1970) and Wakefield (1849), we identify scenarios where high returns in unenclosed lands make labor’s outside options so favorable that enclosure remains unprofitable, even where enclosers bring significant technological improvements and face limited resistance or compensation obligations. In these settings, private producers often demanded external intervention to alter the labor-land ratio, explaining why colonial states restricted access to land, artificially manufacturing the scarcity needed to make enclosed estates profitable.

Transition efficiency depends on the balance of two opposing forces that drive a wedge between private and social returns. First, enclosure can increase social surplus by raising the marginal product of labor; yet, because enclosers cannot fully appropriate these wage gains, private returns may fall short of social returns, leading to *under-enclosure*. Second, displacement of customary users without full compensation allows enclosers to capture rents without internalizing the costs imposed on the displaced. This subsidizes appropriation, causing private returns to exceed social returns and

leading to *over-enclosure*. Our model characterizes how the economic and institutional environment determines which forces dominate.

We analyze how customary governance of the commons and compensation rights interact with enclosure costs. We derive a second-best result showing that addressing one institutional failure while neglecting others can worsen equilibrium outcomes. For example, lowering titling costs under weak customary protections can trigger a destructive raid rather than a productive transition. We show when a well-regulated customary regime can be more efficient than a private property regime established through uncompensated displacement, providing a unified logic for the diversity of property rights observed across history and culture.

The remainder of the paper is organized as follows. Section 2 reviews the related literature; Section 3 develops the model; Section 4 analyzes efficiency; Section 5 examines the interaction between institutions and the economic environment; Section 6 applies the framework to historical and contemporary settings; and Section 7 concludes.²

2 Related literature

Interpretations of the emergence and transformation of property rights vary across four dimensions: the role of conflict versus evolution; the extent to which inefficiency can arise and persist; the impact on labor displacement and inequality; and the degree to which institutional change is decentralized and emergent or imposed from above.

Early New Institutionalists (Alchian and Demsetz 1973; Demsetz 1967; North and Thomas 1973) view property rights as an evolutionary response to economic value, acknowledging that shared access persists efficiently when the costs of defining exclusive rights outweigh the benefits. As scarcity and asset values rise, however, the incentive to internalize externalities drives a transition toward private control (Boserup 1965; Coase 1960). Yet transaction costs and distributional conflicts often block such shifts (Libecap 1993). Ostrom (1990) demonstrates that communities can resolve common-pool dilemmas without privatization, while authors like Thompson (2015) argue that resistance to enclosure often reflects a defense of the “moral economy” against the encroachment of market forces.

Later New Institutionalists like North (1990) and Acemoglu, Johnson, and Robinson (2005) emphasize how transaction costs often block efficient change, allowing elites to impose and maintain institutions that serve their narrow interests despite societal

2. Supplementary materials, including proofs and interactive simulations, are available at <https://open-enclose.github.io/>.

inefficiency. Historically, characterizing customary land as “waste” or inefficient in use has justified displacement, from colonial expansion to modern land formalization (Greer 2018; Barbier 2010). Whether such interventions deliver promised improvements or primarily serve as pretext for appropriation remains a central debate (Platteau 1996; Berry 1993; Borras Jr and Franco 2012; Deininger 2003).

Political Marxists emphasize class power, arguing that capitalism required expropriating the peasantry (Brenner 1976; Wood 2002), creating a landless workforce dependent on wage labor. Allen (1992) critiques this and “Tory” views (Chambers 1953) as “agrarian fundamentalism” or the belief that customary institutions are inherently backward and impede modernization. He and others argue that significant productivity growth occurred under customary systems in Britain prior to Parliamentary enclosures, suggesting those reforms were often motivated by redistributive rent capture (Allen 1982; Clark 1998).

Together, these literatures suggest that transitions in property rights reflect a complex interaction between productivity gains, the effectiveness of customary governance, and the distributional power of affected groups. Our framework formalizes these dimensions by introducing parameters that capture (i) the relative productivity (TFP) gain of enclosed versus unenclosed land (θ); (ii) the effectiveness of customary governance (μ), which allows communities to generate rents without formal titling; and (iii) the ability of incumbents to resist enclosure or extract compensation (τ). A key implication is that effective customary governance can itself create valuable rents, which may paradoxically intensify incentives for inefficient, rent-shifting enclosure.

From these perspectives, the transition to private property is often a costly contest for exclusive control in which resources are expended to capture existing rents, exchanging the tragedy of the commons for a “tragedy of enclosure” (Tullock 1967; Anderson and Hill 1990). Our model identifies when enclosure leads to productive reorganization versus a dissipative raid.

Methodologically, our framework builds on Weitzman (1974), which provides the benchmark for efficiency losses under open access, but follows de Meza and Gould (1992) in endogenizing the costly transition between regimes. This dimension is often treated as exogenous in recent macro-development studies on misallocation (Chen, Restuccia, and Santaaulàlia-Llopis 2023; Gottlieb and Grobovšek 2019). We use our parameterization to isolate the determinants of the wedge between private and social outcomes and employ global games (Morris and Shin 2003) to resolve multiple equilibria and identify precise tipping points.

These historical dynamics remain critical to modern development policy. While de

Soto (2000) argues that formalizing property rights unlocks capital, critics warn that top-down titling can disrupt functional customary arrangements and concentrate ownership (Platteau 1996; Sjaastad and Cousins 2009). The empirical record supports this nuance: Heldring, Robinson, and Vollmer (2024) find large but highly heterogeneous gains from English Parliamentary enclosures, a pattern we return to in Section 6.2.

While historical and anthropological research is essential for understanding institutional nuance, formal models can serve a complementary role by clarifying mechanisms and organizing predictions.³ Our framework formalizes several of these implicit models, giving each narrative a parameterization and identifying the conditions under which competing theoretical predictions hold.

3 Benchmark model

3.1 Technology and resources

We begin with a model of a purely agricultural economy producing a single output, say, blueberries. Production uses land and labor, with land potentially existing in one of two states: enclosed or unenclosed. Enclosed land has an owner (or owners) who can exclude others at a cost. For now, unenclosed land is in open access; anyone can gather blueberries from any land that they can occupy by possession. Section 5 will extend the model to allow for community-based regulation of access to unenclosed or “common” land.

Production in the unenclosed (or customary/common) and enclosed sectors follows Cobb-Douglas technologies:

$$\begin{aligned} \text{Unenclosed: } AF(T_c, L_c) &= AT_c^{1-\alpha} L_c^\alpha \\ \text{Enclosed: } \theta AF(T_e, L_e) &= \theta AT_e^{1-\alpha} L_e^\alpha \end{aligned}$$

where T_i and L_i denote land and labor in sector $i \in \{c, e\}$, A is total factor productivity, and θ captures potential productivity differences between sectors. While we adopt Cobb-Douglas functions for tractability, the model’s aggregative structure holds for any concave, monotonic technology (Acemoglu and Jensen 2013). The constant threshold characterization in Section 3.3 below exploits the Cobb-Douglas form, but the displacement mechanism it indexes does not.

3. As Hatcher and Bailey (2001, p. 1) observe, “what historians write is imbued with an awareness of theory and abstract concepts” that “resonate with the influence of grand but conflicting models.”

We capture relative efficiency as a Hicks-neutral TFP gap $\theta = A_e/A_c$ (where $A_c = A$), so post-enclosure production is a homothetic transformation of customary production. Any difference in labor intensity across sectors then reflects the property regime rather than biased technical change, and θ corresponds to the productivity gain the empirical literature seeks to estimate (e.g., Allen 1982, p. 943, Eq. 3).⁴ When $\theta > 1$, enclosure enables technological or organizational improvements, as when fenced plots protect blueberries from trampling or animal foraging, or more secure property rights encourage investment in higher-yield varieties (Boserup 1965). When $\theta \leq 1$, enclosure offers no productivity advantage or may even reduce output, as when fencing reduces cultivable area.

The economy has fixed endowments of land ($\bar{T}$) and labor ($\bar{L}$), with population density defined as $\bar{l} = \frac{\bar{L}}{\bar{T}}$. Of these totals, if T_e units of land and L_e units of labor are employed in the enclosed sector, there will be $T_c = \bar{T} - T_e$ and $L_c = \bar{L} - L_e$ in the unenclosed sector. We denote the shares of enclosed land and labor as $t_e = \frac{T_e}{\bar{T}}$ and $l_e = \frac{L_e}{\bar{L}}$ respectively.

In the enclosed sector, competitive firms employ factors under constant returns to scale, paying market wages and land rents (in units of output). Labor freely moves between sectors until returns equalize: labor can either earn market wages in the enclosed sector or directly produce output in the unenclosed sector.

3.2 First-best labor allocation and enclosure

A social planner chooses both the share of land to enclose (t_e) and the share of labor to allocate to the enclosed sector (l_e), taking into account an output cost of c per unit of land enclosed, to maximize total output net of enclosure costs. With total land $\bar{T}$ and labor $\bar{L}$, this implies solving:

$$\max_{t_e, l_e} A [\theta F(t_e \bar{T}, l_e \bar{L}) + F((1 - t_e) \bar{T}, (1 - l_e) \bar{L})] - ct_e \bar{T} \quad (1)$$

where $ct_e \bar{T}$ represents enclosure costs in units of output.⁵ Under Cobb-Douglas production, expressing output in units of land, we can write $\theta AF(T_e, L_e) = \theta AF(t_e, l_e) \cdot F(\bar{T}, \bar{L})$ and express the objective more compactly as:

4. Under the Cobb-Douglas functional form required for closed-form solutions, factor-biased and Hicks-neutral technical change are observationally equivalent.

5. Following de Meza and Gould (1992), we assume linear enclosure costs: establishing and enforcing exclusive property rights costs c units of output per unit of land. Costs could instead be denominated in labor without changing the main results, but enclosure would then also compete for workers, complicating the clean decomposition of enclosure costs and benefits in (21).

$$\max_{t_e, l_e} [\theta F(t_e, l_e) + F(1 - t_e, 1 - l_e)] \cdot A\bar{l}^\alpha - c \cdot t_e \quad (2)$$

where $A\bar{l}^\alpha = AF(\bar{T}, \bar{L})/\bar{T}$ is potential output per unit land using the non-augmented technology. Efficiency requires equating the marginal product of labor across sectors ($MP_L^e = MP_L^c$). Differentiating the objective in (2) with respect to l_e and applying our functional forms yields:

$$\theta \alpha A \left(\frac{t_e}{l_e} \right)^{1-\alpha} = \alpha A \left(\frac{1-t_e}{1-l_e} \right)^{1-\alpha} \quad (3)$$

Solving for l_e gives the planner's first-best labor allocation function:

$$l_e^1(t_e) = \frac{\theta^{\frac{1}{1-\alpha}} t_e}{1 + (\theta^{\frac{1}{1-\alpha}} - 1) t_e}. \quad (4)$$

This tells us, for any initial share of enclosed land t_e , efficient or not, the share of labor l_e the planner would allocate to the enclosed sector to maximize total output.

When $\theta > 1$, we have $l_e^1(t_e) \geq t_e$ for all $t_e \in [0, 1]$, with strict inequality at interior points. The planner thus employs higher labor intensity on enclosed land than on unenclosed land, so $L_e/T_e \geq \bar{L}/\bar{T} \geq L_c/T_c$. This will contrast with the labor allocation reaction functions under decentralized enclosure situations studied below, where private enclosure reduces labor use on newly enclosed plots unless the expected productivity gain θ exceeds a high threshold θ_H .

To facilitate comparison with decentralized outcomes, we reformulate the planner's maximization problem in two steps. The planner first determines the optimal labor intensity function $l_e^1(t_e)$ for any enclosure rate t_e . This optimal labor share function (given by (4)) is substituted into the objective and the planner chooses the enclosure rate t_e , which solves:

$$\max_{t_e} z_1(t_e) - c \cdot t_e \quad (5)$$

where

$$z_1(t_e) = [\theta F(t_e, l_e^1(t_e)) + F(1 - t_e, 1 - l_e^1(t_e))] \cdot A\bar{l}^\alpha$$

which, using the functional form in (4) can be simplified to:

$$z_1(t_e) = \left[1 + \left(\theta^{\frac{1}{1-\alpha}} - 1 \right) t_e \right]^{1-\alpha} \cdot A\bar{l}^\alpha$$

Enclosure is costly, so it will only be socially optimal when it enables higher pro-

ductivity technology (that is, where $\theta > 1$) and effective population pressure $A\bar{l}^\alpha$ is sufficiently high relative to enclosure costs ct_e . Because the planner allocates labor efficiently across sectors, the enclosure decision reduces to a straightforward technology adoption decision: enclose a unit of land if and only if the output gains from technological improvement θ and associated optimal labor reallocation exceed the marginal cost c . This leads to our first result:

Lemma 1 (First-Best Enclosure). *When $\theta > 1$, the planner chooses enclosure rate t_e^1 as follows:*

- **No enclosure:** $t_e^1 = 0$, when $z_1'(0) \leq c$.
- **Full enclosure:** $t_e^1 = 1$, when $z_1'(1) \geq c$.
- **Partial enclosure:** $t_e^1 \in (0, 1)$, when $z_1'(0) > c$, $z_1'(1) < c$, and $z_1'(t_e^1) = c$.

When $\theta \leq 1$, the planner always chooses no enclosure.

Proof: For $\alpha \in (0, 1)$ and $\theta > 1$, the planner's benefit function $z_1(t_e)$ in equation (5) is strictly concave ($z_1''(t_e) < 0$). Therefore, to determine whether land should remain unenclosed, partially enclosed, or fully enclosed, we only need to compare the marginal benefit of enclosure $z_1'(t_e)$ with its marginal cost c at the endpoints, which determines whether $z_1(t_e) - ct_e$ is maximized at a corner or interior solution. When $\theta \leq 1$, $z_1(t_e)$ is nonincreasing in t_e , so with $c > 0$ no enclosure is optimal. $\square$

Lemma 1 maps model parameters into optimal enclosure decisions. Rearranging its no-enclosure condition $z_1'(0) \leq c$ yields a critical threshold for population density $\bar{l}$:

$$z_1'(0) \leq c \quad \Leftrightarrow \quad \bar{l} \leq \left[\frac{1}{(1 - \alpha) \left(\theta^{\frac{1}{1-\alpha}} - 1 \right)} \cdot \frac{c}{A} \right]^{\frac{1}{\alpha}} = \bar{l}_0^1(\theta) \quad (6)$$

Similarly, the 'full enclosure' condition requires $z_1'(1) \geq c$, which yields:

$$z_1'(1) \geq c \quad \Leftrightarrow \quad \bar{l} \geq \theta^{\frac{1}{1-\alpha}} \cdot \bar{l}_0^1(\theta) = \bar{l}_1^1(\theta) \quad (7)$$

Partial enclosure is optimal for population densities between the no-enclosure threshold (6) and the full enclosure threshold (7).

Figure 1 is a graphical representation of the parametric description of Lemma 1, and shows the loci $\bar{l}_0^1$ and $\bar{l}_1^1$ plotted as solid lines in $(\theta, \ln \bar{l})$ space.⁶ The shaded parameter

6. We plot the natural logs of the loci, for better scaling. This and all subsequent diagrams are drawn for parameters $c/A = 1$ and $\alpha = 2/3$.

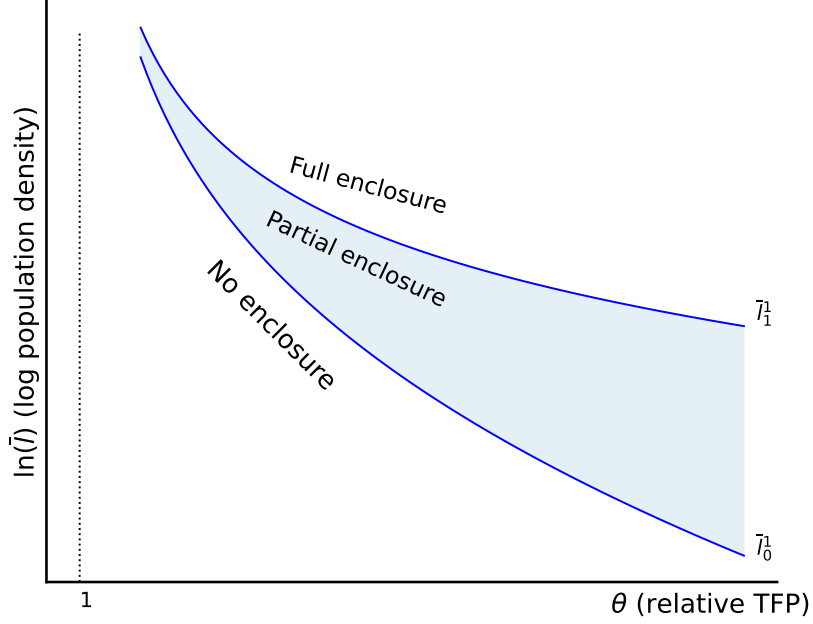


Figure 1: Socially efficient enclosure decisions as a function of log population density, $\ln \bar{l}$, and the expected TFP gain from enclosure, θ

region between the two loci corresponds to situations where partial land enclosure is optimal.

This analysis suggests a Boserupian interpretation of induced agricultural intensification: when land is abundant (low $\bar{l}$), enclosure benefits fall short of costs unless potential productivity gains θ are sufficiently high. Thus, while $\theta > 1$ is necessary for enclosure to be optimal when $c > 0$, it is not sufficient. Even with productivity-enhancing enclosure ($\theta > 1$), the opportunity cost of drawing labor from the unenclosed sector plus enclosure costs may outweigh potential gains when land is abundant (low $\bar{l}$) or enclosure costs are high relative to baseline productivity (high c/A).

Consider an economy initially below the $\bar{l}_0^1$ threshold where no enclosure is optimal. If population growth pushes density $\bar{l}$ above this threshold, the marginal social return to enclosure now exceeds its cost, leading the planner to enclose some land and operate it at higher labor intensity. However, since drawing labor from the unenclosed sector incurs increasing marginal costs, the planner at first encloses only enough land to efficiently accommodate the population increase.

3.3 Decentralized enclosure processes

Each unit of land has a potential encloser who can, at cost c units of output, establish exclusive rights. Following Weitzman (1974) and de Meza and Gould (1992), we initially assume enclosers do not compensate displaced users. In Section 5.2 we extend the model to settings where enclosers must pay compensation or overcome resistance.⁷

Upon enclosure, each unit of land enters a competitive formal sector employing technology $\theta AF(T, L)$. This sector pays competitive factor returns: land earns a rental rate r equal to its marginal product $MP_T^c = \theta AF_T$, while labor earns a wage $w_e = MP_L^c = \theta AF_L$.⁸

In equilibrium, labor mobility ensures that labor must be indifferent between sectors. The usual assumption is that labor earns average product on common land, so in equilibrium $AP_L^c = w_e = MP_L^c$. This implies $MP_L^c < MP_L^e$ and the classic result of higher-than-efficient labor intensity, or “overcrowding,” on open access land, also known as the “tragedy of the commons” (Dasgupta and Heal 1979; Cornes and Sandler 1996; Baland and Platteau 1996).

Some additional interpretation of the $AP_L^c = MP_L^c$ condition is helpful. When allocating across sectors, labor can be seen as choosing between a market wage, and simultaneously working and establishing possessory rights on open access land. With symmetric ability to contest possession, the L_c units of labor spread evenly across T_c units of unenclosed land. Each unit of labor thus operates T_c/L_c units of land. By Euler’s theorem and constant returns production, average product $AP_L^c = AF(T_c, L_c)/L_c$ decomposes into labor’s marginal product plus implied rents from possessed land:

$$AP_L^c = MP_L^c + MP_T^c \cdot \frac{T_c}{L_c} \quad (8)$$

Equation (8) suggests the labor allocated to the commons establishes possession over a share of land, earning an informal wage of MP_L^c . This expression becomes critical to understanding the interaction between institutions and enclosure incentives.

For our Cobb-Douglas specification, the equilibrium condition $AP_L^c = MP_L^e$ becomes:

$$\theta \alpha A \left(\frac{t_e}{l_e} \right)^{1-\alpha} = A \left(\frac{1-t_e}{1-l_e} \right)^{1-\alpha} \quad (9)$$

7. More elaborate contest functions and strategic aspects of enforcing claims can be readily incorporated. See Baker (2003, 2008) and Hafer (2006), and the discussion in Section 5.1.

8. This formulation is equivalent to enclosers either directly hiring labor and earning profits or charging competitive access tolls to laborers (see Weitzman 1974, p. 230).

This equilibrium condition yields the *labor reaction function* which determines the share of labor l_e allocated to the enclosed sector for any enclosure rate t_e :

$$l_e^0(t_e) = \frac{(\alpha\theta)^{\frac{1}{1-\alpha}} t_e}{1 + \left((\alpha\theta)^{\frac{1}{1-\alpha}} - 1 \right) t_e} \quad (10)$$

The coefficient $(\alpha\theta)^{\frac{1}{1-\alpha}}$ measures how many workers a plot keeps when it is enclosed. At every enclosure rate, enclosed land operates at this multiple of the commons' labor intensity. Below one, enclosure evicts workers, and the remaining commons grows more crowded as enclosure spreads. Above one, enclosure recruits workers, and the commons decongests. The planner's labor allocation function (4) has the same form with the larger coefficient $\theta^{\frac{1}{1-\alpha}}$, because private enclosers must pay labor its commons earnings, the average product inclusive of possession rents, while the planner values labor at its lower marginal product. Hence the decentralized equilibrium allocates strictly less labor to enclosed land, $l_e^0(t_e) < l_e^1(t_e)$, at any interior enclosure rate.

Unlike the planner's optimal labor allocation function (4), which is always concave whenever enclosure occurs, the labor reaction function (10) may be either convex or concave in the presence of enclosure. Specifically, by inspection of the denominator of (10), when $(\alpha\theta)^{\frac{1}{1-\alpha}} < 1$, $l_e^0(t_e)$ is convex to the origin; otherwise it is concave. This qualitative difference proves critical for the model's behavior and can be characterized by a threshold value θ_H :

Definition (High-TFP Threshold).

Let $\theta_H = \frac{1}{\alpha}$ denote the threshold where $(\alpha\theta)^{\frac{1}{1-\alpha}} = 1$. Then:

When $\theta \geq \theta_H$: enclosure introduces high-TFP gains and enclosed land employs more labor per unit land ($l_e \geq t_e$)

When $\theta < \theta_H$: enclosure introduces low-TFP gains and enclosed land employs less labor per unit land ($l_e < t_e$)

The threshold has an intuitive interpretation. Because the marginal product of labor under Cobb–Douglas is the fraction α of its average product, open access pays labor $1/\alpha$ times the marginal-product wage an employer would offer on the same land. Hence to leave a fenced plot's employment unchanged or enlarged, enclosure must raise productivity by a factor of at least $\theta_H = 1/\alpha$, exactly the premium that possession pays. Enclosure switches from evicting to recruiting labor as $\alpha\theta$ crosses one. The more labor-intensive the technology (higher α), the closer are marginal and average products, and the smaller the premium and the threshold. While the premium's constancy is special

to Cobb–Douglas, the mechanism only requires that possession pays labor more than its marginal product. The same comparison will return in Section 6.1 as the condition for labor to gain from enclosure.

This distinction proves critical for comparison of equilibria. Note that the low-TFP case includes situations where $\theta < 1$, implying productivity losses from enclosure.

The private return to enclosure equals the marginal product of land, which depends on the labor reaction function:

$$r(t_e) = \theta \cdot AF_T(t_e \bar{T}, l_e^0(t_e) \bar{L}) \quad (11)$$

Substituting the labor reaction function (10) into the parametric form of (11) yields:

$$r(t_e) = \theta \cdot (1 - \alpha) \cdot A \bar{L}^\alpha \cdot \left(\frac{(\alpha \theta)^{\frac{1}{1-\alpha}}}{1 + ((\alpha \theta)^{\frac{1}{1-\alpha}} - 1) t_e} \right)^\alpha \quad (12)$$

Atomistic potential enclosers compare this rental rate to the enclosure cost c , choosing to enclose when $r(t_e) > c$. In a Nash equilibrium, each would-be encloser makes a best-response enclosure decision taking others' enclosure actions (as well as labor reactions) as given. Since these actions affect payoffs only through the aggregate enclosure rate t_e , this process has the structure of an aggregative game (see Acemoglu and Jensen 2013). The nature of this game changes fundamentally depending on whether enclosure introduces high or low-TFP gains.

Enclosure decisions are strategic complements (substitutes) when the equilibrium return to enclosing, $r(t_e)$, is increasing (decreasing) in the aggregate enclosure rate t_e , so that one claimant's enclosure raises (lowers) every other player's incentive to enclose.

Proposition 1 (Strategic Interactions in Enclosure Decisions). *When $\theta \geq \theta_H$, enclosure decisions are strategic substitutes ($r'(t_e) \leq 0$); when $\theta < \theta_H$, they are strategic complements ($r'(t_e) > 0$).*

Proof: The rental rate function $r(t_e)$ in (12) inherits its properties from the labor reaction function (10). We have $r'(t_e) < 0$ when $(\alpha \theta)^{\frac{1}{1-\alpha}} > 1$, or equivalently, $\theta > \frac{1}{\alpha}$, coinciding with the definition of high-TFP gains to enclosure. Similarly, $r'(t_e) > 0$ when $\theta < \frac{1}{\alpha}$, in the low-TFP gains to enclosure region. $\square$

This result reveals a fundamental dichotomy in decentralized enclosure processes. In high-TFP economies ($\theta > \theta_H$), where each enclosure lowers the return to the next, equilibrium behavior is characterized as follows:

Proposition 2 (Decentralized Enclosure with High-TFP gains). *When $\theta > \theta_H$, pure strategy equilibria are characterized by:*

- **No enclosure:** $t_e^* = 0$, when $r(0) \leq c$.
- **Full enclosure:** $t_e^* = 1$, when $r(1) \geq c$.
- **Partial enclosure:** $t_e^* \in (0, 1)$, when $r(0) > c$, $r(1) < c$, and $r(t_e^*) = c$.

Proof: Whenever $\theta > \theta_H$ or $(\alpha\theta)^{\frac{1}{1-\alpha}} > 1$, differentiation of (12) shows $r'(t_e) < 0$, and $r''(t_e) > 0$. The results follow from comparing $r(t_e)$ with c at the boundaries and interior points. $\square$

While this high-TFP case yields equilibria qualitatively similar to the first-best outcomes in Lemma 1, the low-TFP case ($\theta < \theta_H$) produces starkly different results. Here, enclosure raises the return to further enclosure, and as Vives (2005) and Acemoglu and Jensen (2013) note, aggregative games with strategic complementarity can generate multiple equilibria and coordination failures, as we show in the next Proposition.

Proposition 3 (Decentralized Enclosure with Low-TFP gains). *In the low-TFP gains region, equilibria are characterized by:*

- **No enclosure** is the unique dominant strategy equilibrium when $r(1) < c$.
- **Full enclosure** is the unique dominant strategy equilibrium when $r(0) > c$.
- **Multiplicity** (either full or no enclosure) when $r(0) < c$ and $r(1) > c$.

Proof. When there are low-TFP gains, $(\alpha\theta)^{\frac{1}{1-\alpha}} < 1$ and $r(t_e)$ is strictly increasing in t_e . Thus, if $r(1) < c$, no encloser has an incentive to enclose even under the best circumstances, as $r(t_e) < r(1) < c$ for all t_e . Conversely, if $r(0) > c$, enclosure always pays off as $r(t_e) > r(0) > c$ for all t_e . When $r(0) < c < r(1)$, either equilibrium is possible. $\square$

The contrast between Propositions 2 and 3 reflects fundamentally different labor market responses to enclosure. In low-TFP economies, enclosed land employs less labor than the same plot when unenclosed. The displaced labor crowds onto the remaining common land, lowering equilibrium wages, raising labor utilization and rental rates across all land, as well as the return to further enclosures. Conversely, in high-TFP economies, each enclosure raises labor demand enough to increase plot-level employment, drawing in labor and reducing crowding on unenclosed land. While this raises wages, it reduces returns to further enclosure.

Substituting $t_e = 0$ into (11) we find an expression for the threshold level of population density $\bar{l}$ above which enclosure becomes attractive ($r(0) > c$):

$$r(0) \geq c \Leftrightarrow \bar{l} \geq \frac{1}{(\alpha\theta)^{\frac{1}{1-\alpha}}} \left[\frac{c}{\theta A} \cdot \frac{1}{(1-\alpha)} \right]^{\frac{1}{\alpha}} = \bar{l}_0^d \quad (13)$$

Similarly, the region where $r(1) \geq c$ holds defines a critical region where full enclosure will occur:

$$r(1) \geq c \Leftrightarrow \bar{l} \geq \left[\frac{c}{\theta A} \cdot \frac{1}{(1-\alpha)} \right]^{\frac{1}{\alpha}} = \bar{l}_1^d \quad (14)$$

The relative position of these thresholds depends on whether TFP gains are high or low. Under low-TFP gains, strategic complementarity implies the $r(0) > c$ threshold lies above the $r(1) > c$ threshold, creating the possibility of multiple equilibria. These thresholds are plotted in Figure 2. The two loci cross at $\theta_H = \frac{1}{\alpha}$ which separates the high and low-TFP regions.

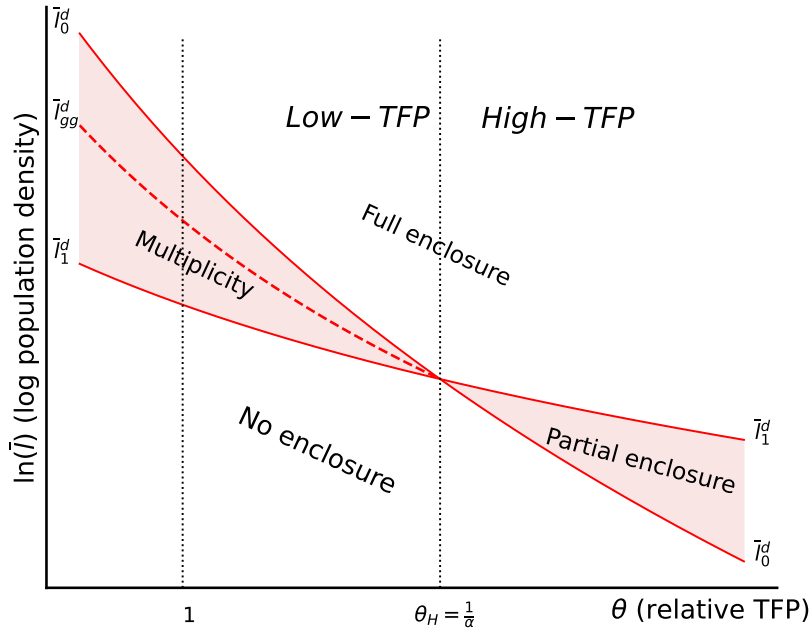


Figure 2: Decentralized enclosure equilibria as a function of log population density, $\ln \bar{l}$, and the expected TFP gain from enclosure, θ

In the high-TFP region between these thresholds, partial enclosure emerges as a stable equilibrium. However, in the low-TFP region, both no enclosure and complete

enclosure can be Nash equilibria,⁹ as detailed in Proposition 3. When no land is enclosed so $t_e = 0$, it is privately unprofitable for any one claimant to enclose land, yet each would find it profitable to enclose if all others did as well. In such environments, small changes in beliefs about others' enclosure decisions could trigger rapid transitions between property regimes, leading to sudden changes in output and distribution. This motivates the equilibrium selection criterion we introduce next.

3.4 Multiple equilibria and global games

The theory of global games (Carlsson and van Damme 1993; Morris and Shin 2003) provides a natural framework for selecting between the full- and no-enclosure equilibria in the low-TFP multiple-equilibria region. Consider introducing small uncertainty about the TFP parameter θ , drawn from a continuous distribution over the interval $(0, \theta_H)$. Potential enclosers observe a private signal $x_i = \theta + \sigma \varepsilon_i$, where ε_i has mean zero, finite variance, and finite support. As σ approaches zero, parametric uncertainty about θ vanishes, but strategic uncertainty remains. As Morris and Shin (2003) demonstrate, this leads to a unique equilibrium in cutoff strategies. Each player encloses if and only if the private signal x_i exceeds a threshold that converges to a cutoff θ^* as $\sigma \rightarrow 0$, so full enclosure emerges whenever $\theta \geq \theta^*$.¹⁰

The cutoff θ^* is determined by the θ at which a potential claimant is indifferent between enclosing or not, given a uniform expectation about the fraction of others enclosing (i.e., a Laplacian belief about the enclosure decisions of others). Specifically, θ^* solves:

$$\int_0^1 \left[(\alpha\theta)^{\frac{1}{1-\alpha}} \frac{(1-\alpha)}{\alpha} \cdot A\bar{l}^\alpha \cdot (1 + ((\alpha\theta)^{\frac{1}{1-\alpha}} - 1) t_e)^{-\alpha} - c \right] dt_e = 0$$

This condition can be simplified to show that full enclosure is the risk-dominant equilibrium when:

$$E[r(t_e) - c] \geq 0 \quad \Leftrightarrow \quad \bar{l} \geq \left[\frac{c}{\theta A} \cdot \frac{1 - (\alpha\theta)^{\frac{1}{1-\alpha}}}{(\alpha\theta)^{\frac{\alpha}{1-\alpha}} - (\alpha\theta)^{\frac{1}{1-\alpha}}} \right]^{\frac{1}{\alpha}} = \bar{l}_{gg}^d \quad (15)$$

The locus is plotted as a dashed red line ($\bar{l}_{gg}^d$) in Figure 2. In the low-TFP region, full

9. An unstable interior equilibrium with partial enclosure also exists.

10. The global games solution applies under standard conditions (Morris and Shin 2003, Sections 2.1–2.2). The payoff function r must be continuous, non-decreasing in t_e and θ , and admit a unique threshold θ at which $r - c = 0$ under uniform beliefs. The parameter space must also contain dominance regions in which enclosure or non-enclosure is optimal regardless of others' actions; in Figure 2, these lie horizontally to the left and right of the shaded region labeled “multiplicity.”

enclosure emerges above this threshold, while no enclosure prevails below it.

3.5 Comparative statics

The analysis and figures above help to describe how the equilibrium mix of property regimes, the amount of land allocated to open-access or enclosed plots, will change with key environmental parameters, including population density $\bar{l}$ and the potential for technological improvement after enclosure θ . These variables appear on the vertical and horizontal axes of Figures 1, 2, and all subsequent figures.

The base-level total factor productivity parameter A and the cost per unit land of enclosure c also matter for enclosure decisions. These parameters enter as c/A in all the boundary loci of enclosure decisions (expressions 6, 7, 13, 14, and 15). An increase in c generates an upward vertical displacement of all loci, making enclosure less likely, all else equal. Similarly, an increase in the base-level total factor productivity A generates a downward vertical displacement, making enclosure more likely. We analyze the effect of additional policy and institutional variables in Section 5.

4 The social efficiency of private enclosure decisions

Figure 3 superimposes the private enclosure decision regions of Figure 2 on the social planner's decision regions of Figure 1. This reveals where private and social enclosure decisions diverge and hence where decentralized equilibrium allocations $(t_e^*, l_e^0(t_e^*))$ fall short of potential output. For many parameter configurations, represented by most unshaded regions of the figure, decentralized enclosure produces efficient outcomes. For economies with low-TFP gains and low population density (the lower left region of Figure 3), the absence of private enclosure matches the social planner's choice. Similarly, for economies with high population density and high-TFP gains (upper right region), decentralized processes efficiently achieve full enclosure.

Figure 3 also shows that private equilibria may generate either too much or too little enclosure, and that enclosure may be complete even when none should occur. To the left of the TFP threshold θ_H on the diagram, enclosure decisions are strategic complements (Proposition 1), leading to corner outcomes of complete or no enclosure (Proposition 3). Any enclosure raises the return to further enclosure, which may trigger a cascade toward inefficient full enclosure, even when $\theta < 1$ and enclosure induces technical regress. Under global games equilibrium selection, complete enclosure occurs above the red-dashed $\bar{l}_{gg}^d$ locus even when the economy lies below the blue-shaded region in which

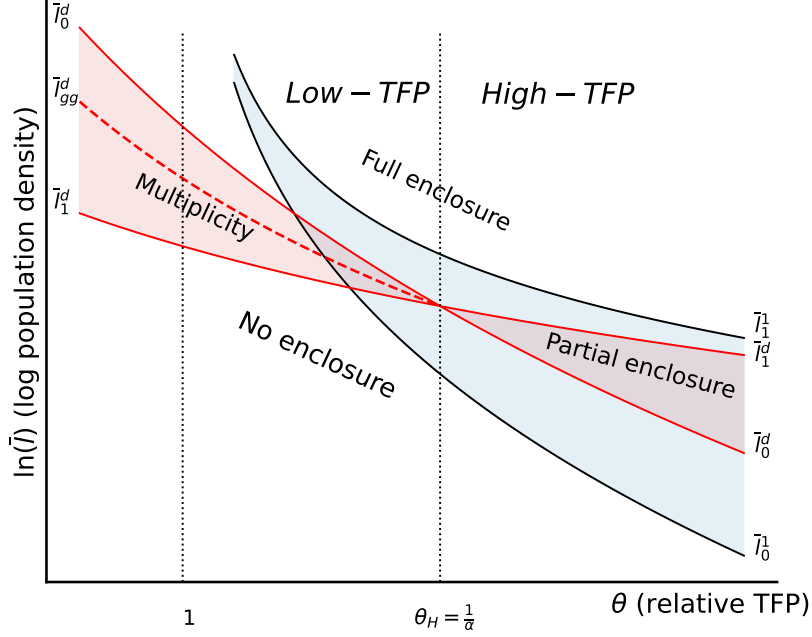


Figure 3: Optimal and decentralized enclosure outcomes compared. Red-shaded areas indicate regions with partial private enclosure or multiple equilibria, while blue-shaded areas indicate socially optimal partial enclosure. Outcomes are shown as functions of log population density, $\ln(\bar{l})$, and the expected TFP gain from enclosure, θ

enclosure is optimal. Complementarity may also prevent enclosure when some should occur. Near the θ_H line, blue-shaded areas appear below the dashed locus; here some enclosure is socially desirable, but complementarity prevents the process from starting.

To the right of the θ_H line on Figure 3, where enclosure decisions are strategic substitutes, equilibrium enclosures may again be excessive or deficient. In the blue-shaded region above $\bar{l}_0^l$ but below $\bar{l}_0^d$, some enclosure should occur but in equilibrium none does. Conversely, in the region below $\bar{l}_1^l$ yet above $\bar{l}_1^d$, enclosure is complete even though partial enclosure is optimal. Inefficiencies arise for these parameter configurations because enclosure decisions fail to internalize the social value forfeited by the displaced interests or to capture the labor reallocation gains, as we discuss in Section 5.

4.1 Are decentralized enclosures second-best?

While we can identify where private and social enclosure rates diverge, evaluating these divergences requires a more nuanced policy benchmark than the first-best optimum. The decentralized economy faces labor misallocation problems that the first-best plan-

ner simply assumes away. Governments often control which land areas can be enclosed through settlement or zoning laws that delineate where land claims will be recognized and registered. However, these same governments may be unable to prohibit squatting or regulate access to unenclosed frontier regions and informal settlement areas.¹¹ A more policy-relevant benchmark is therefore a constrained planner who chooses enclosure rates but cannot regulate labor entry.

To establish this second-best optimum, let $z_0(t_e)$ describe output per unit land achievable at different enclosure rates t_e , subject to the constraint that labor moves freely into any remaining unenclosed land until equilibrium condition (9) holds. We incorporate this constraint by substituting the labor reaction function $l^0(t_e)$ from (10) into the planner's objective (1):

$$z_0(t_e) = [\theta F(t_e, l_e^0(t_e)) + F(1 - t_e, 1 - l_e^0(t_e))] \cdot A\bar{l}^\alpha \quad (16)$$

After some simplification, the constrained planner's overall objective can be written using our parametric form as:

$$z_0(t_e) - c \cdot t_e = \frac{\theta(\alpha\theta)^{\frac{\alpha}{1-\alpha}}t_e + (1 - t_e)}{(1 + ((\alpha\theta)^{\frac{1}{1-\alpha}} - 1)t_e)^\alpha} \cdot A\bar{l}^\alpha - c \cdot t_e \quad (17)$$

This differs qualitatively from the unconstrained output function $z_1(t_e)$ in (5). While $z_0(t_e) = z_1(t_e)$ at the endpoints $t_e = 0$ and $t_e = 1$ where no labor misallocation occurs, $z_0(t_e)$ lies below $z_1(t_e)$ at all interior points since labor is misallocated relative to the first-best optimum.

The constrained-efficient enclosure policy regions follow from analyzing the properties of $z_0(t_e) - c \cdot t_e$. As before, the optimal solution depends on the shape of this objective function. Proposition 4 characterizes the key results.

Proposition 4 (Second-best Enclosure). *A constrained planner who chooses the optimal enclosure rate subject to the labor reaction rule $l_e^0(t_e)$ from (10) faces an objective function with no interior maximum in a low-TFP gain economy and a concave one in a high-TFP economy. In the low-TFP economy, the constrained planner chooses:*

- **No enclosure:** $t_e^c = 0$, when $z_0(1) - c \leq z_0(0)$.
- **Full enclosure:** $t_e^c = 1$, when $z_0(1) - c \geq z_0(0)$.

11. U.S. land policy from colonial times through the 19th century struggled to prevent squatters from settling beyond official frontier lines (see e.g. Murtazashvili 2013; Alston, Harris, and Mueller 2012). Similar challenges have characterized urban development from Lima to Dar es Salaam (de Soto 2000).

In the high-TFP economy, the constrained planner chooses:

- **No enclosure:** $t_e^c = 0$ when $z'_0(0) \leq c$.
- **Full enclosure:** $t_e^c = 1$ when $z'_0(1) \geq c$.
- **Partial enclosure:** $t_e^c \in (0, 1)$ when $z'_0(0) > c$ and $z'_0(1) < c$.

Proof: The shape of the planner's objective function $z_0(t_e) - ct_e$ in (17) depends on $(\alpha\theta)^{\frac{1}{1-\alpha}}$. When $(\alpha\theta)^{\frac{1}{1-\alpha}} > 1$ or $\theta > \theta_H$ (high-TFP), differentiating (17) shows the objective is concave, and the boundary and interior cases follow from the sign of $z'_0(t_e) - c$ at the endpoints. When $\theta < \theta_H$ (low-TFP), twice differentiating (17) shows the objective is convex whenever $(\alpha\theta)^{\frac{1}{1-\alpha}} \geq \alpha/(2 + \alpha)$, a condition that holds for every $\theta \geq 1$. For the remaining low-TFP values, all with $\theta < 1$, the first derivative $z'_0(t_e)$ is a positive factor times an increasing affine function that starts negative, so $z'_0(t_e) - c$ crosses zero at most once, from below. In both low-TFP cases the objective has no interior maximum, and the optimum follows from comparing its values at the two endpoints. $\square$

From Proposition 4, in the low-TFP economy, full enclosure yields higher net output when $z_0(1) - c \geq z_0(0)$. Since $z_0(1) - z_0(0) = A\bar{l}^\alpha(\theta - 1)$, this requires $\theta > 1$, in which case:

$$z_0(1) - c \geq z_0(0) \quad \Leftrightarrow \quad \bar{l} \geq \left[\frac{c}{A} \frac{1}{\theta - 1} \right]^{\frac{1}{\alpha}} = \bar{l}^s \quad (18)$$

where the superscript s denotes second-best decision thresholds. For $\theta \leq 1$ full enclosure never dominates, and the constrained planner leaves the commons unenclosed at any population density.

In the high-TFP economy, the constrained planner's concave objective yields different thresholds. Enclosure becomes optimal when $z'_0(0) > c$, requiring:

$$z'_0(0) \geq c \quad \Leftrightarrow \quad \bar{l} \geq \left[\frac{c}{A} \frac{\alpha}{\left((\alpha\theta)^{\frac{1}{1-\alpha}} (1 + \alpha) - \alpha \right)} \cdot \frac{1}{(1 - \alpha)} \right]^{\frac{1}{\alpha}} = \bar{l}_0^s \quad (19)$$

Full enclosure becomes optimal when $z'_0(1) > c$:

$$z'_0(1) \geq c \quad \Leftrightarrow \quad \bar{l} \geq \left[\frac{c}{\theta A} \cdot \frac{1}{(1 - \alpha)} \right]^{\frac{1}{\alpha}} = \bar{l}_1^s \quad (20)$$

Between these thresholds, partial enclosure is second-best optimal. The full enclosure threshold $\bar{l}_1^s$ in (20) coincides with the decentralized threshold $\bar{l}_1^d$ in (14).

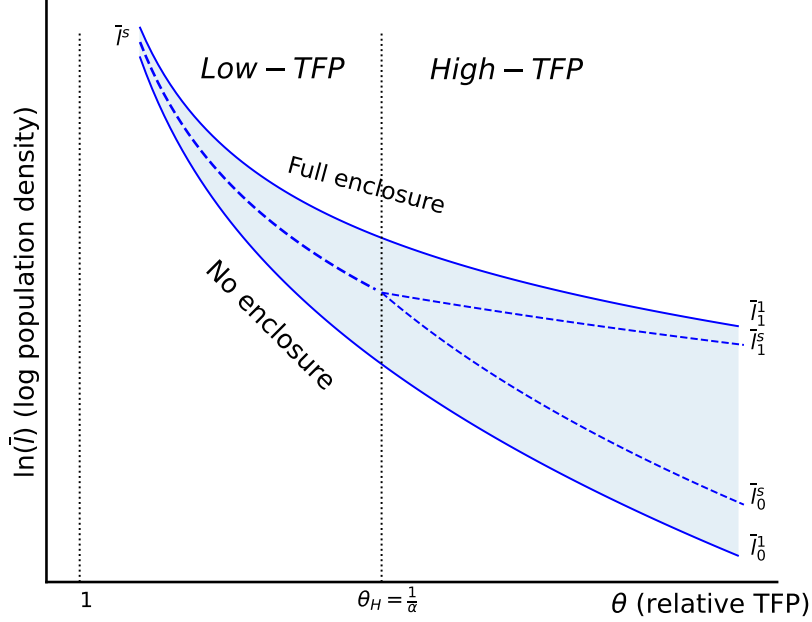


Figure 4: First- and second-best enclosure as functions of log population density, $\ln \bar{l}$, and the expected TFP gain from enclosure, θ . For $\theta > \theta_H$, partial enclosure is second-best optimal between the dashed boundaries. For $1 < \theta \leq \theta_H$, the second-best outcome is full enclosure above the dashed boundary and no enclosure below it

Figure 4 shows the boundaries of second-best enclosure regions (dashed blue lines $\bar{l}^s$, $\bar{l}_0^s$, and $\bar{l}_1^s$) superimposed on the first-best boundaries from Figure 1. The constrained planner differs from the unconstrained planner in two ways. First, for economies above $\bar{l}_0^l$ but below $\bar{l}^s$ and $\bar{l}_0^s$, the constrained planner avoids initiating enclosures because the resulting labor misallocation would exceed productivity gains. Second, for economies above $\bar{l}^s$ and $\bar{l}_1^s$ but below $\bar{l}_1^l$, the constrained planner chooses full enclosure to eliminate costly labor misallocation, while the first-best planner maintains some unenclosed land.

Figure 5 overlays the constrained planner's decision regions on the decentralized economy's enclosure regions from Figure 2, with the first-best regions of Figure 1 retained in lighter shading for comparison. The red- and blue-hatched regions identify excessive and insufficient private enclosure, respectively.

First, in low-TFP gain economies ($\theta < \theta_H$), marginal parameter shifts can trigger sudden enclosure cascades. An economy near the $\bar{l}_{gg}^d$ locus may be efficiently unenclosed, yet modest increases in population density $\bar{l}$ or the potential TFP gain from enclosure θ can trigger a race to enclose, even when the unenclosed state remains first- and

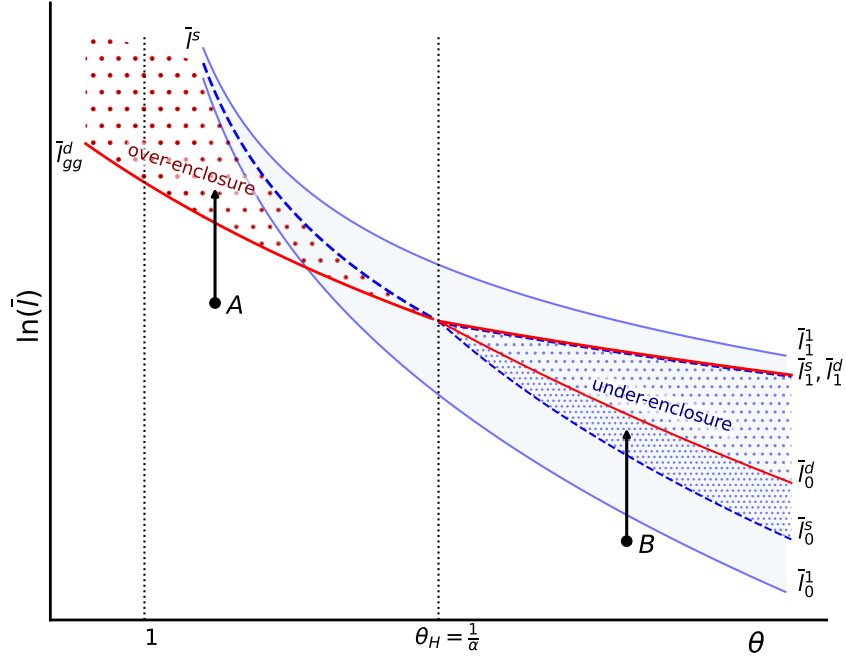


Figure 5: Comparing decentralized and second-best outcomes. Blue lines mark the planner’s thresholds (solid first-best, dashed second-best), red lines the decentralized thresholds; light blue shading is the first-best region of Figure 1. Red-hatched regions, where $\theta < \theta_H$, show excessive enclosure; blue-hatched regions, where $\theta > \theta_H$, insufficient enclosure. Arrows at A and B trace rising population density

second-best efficient. This is illustrated by an economy initially at point A on Figure 5. As population density increases and the economy crosses the $\bar{l}_{gg}^d$ locus, it undergoes a discontinuous transition to full and inefficient enclosure. Such races are particularly deleterious when $\theta < 1$ and enclosure reduces productivity. We thus distinguish the classic tragedy of the commons, defined by rent dissipation *in* the resource (Gordon 1954), from a tragedy of enclosure, defined by rent dissipation *for* the resource (Tullock 1967). In the latter, inefficiency stems from uncompensated capture: because the encloser’s incentive includes the transfer of customary rents, the private return exceeds the social gain, driving a dissipative race where enforcement costs c consume any surplus from efficiency gains. Our global games approach identifies these precise parametric boundaries, generalizing earlier analyses of dissipative races and “cusp catastrophes” (Anderson and Hill 1990; de Meza and Gould 1992).

A qualitatively different inefficiency emerges in high-TFP economies ($\theta > \theta_H$). In the hatched region above $\bar{l}_0^s$ but below $\bar{l}_1^d$, the labor reallocation gains that enclosers can-

not capture lead to suboptimal enclosure. Between $\bar{l}_0^s$ and $\bar{l}_0^d$, the decentralized economy fails to initiate enclosure despite clear gains in net output. This is illustrated by an economy initially at point B . As population density increases, the economy eventually begins to enclose only after crossing the $\bar{l}_0^d$ locus, even though partial enclosure would have been efficient through a sizeable part of the intervening region.

4.2 Sources of inefficiency

To pinpoint the sources of inefficiency, consider the net social marginal benefit of enclosure from a constrained planner's perspective. The derivative of the planner's second-best objective function, $z'_0(t_e) - c$, can be decomposed as:¹²

$$z'_0(t_e) - c = \underbrace{\theta F_T^e A \bar{f} - c}_{\text{private net return}} - \underbrace{F_T^c A \bar{f}}_{\text{displaced rents}} + \underbrace{(\theta F_L^e - F_L^c) A \bar{f} \cdot \frac{dl_e^0}{dt_e}}_{\text{labor reallocation gain}} \quad (21)$$

Private enclosers compare only their gross return $\theta F_T^e A \bar{f}$ against the enclosure cost c , ignoring the other two components in equation (21).

The first ignored component is the value of displaced rents. Absent enclosure, the land is not idle; it generates output under customary tenure, with rents $F_T^c A \bar{f}$ captured by existing users through possession. Because enclosers appropriate these rents without compensation, they enclose whenever $\theta F_T^e A \bar{f} > c$, even when the net social return $(\theta F_T^e - F_T^c) A \bar{f}$ falls short of c . This drives excessive enclosure.

The second ignored component is the labor reallocation gain. In the unenclosed sector, labor enters to capture possession rents, until the average product equals the market wage. This drives the marginal product $A F_L^c \bar{f}$ below that of the enclosed sector $\theta A F_L^e \bar{f}$. Enclosure releases workers from this low-productivity congestion. But private enclosers pay the full market wage ($w = \theta A F_L^e \bar{f}$) regardless of workers' inefficiency, so they fail to capture this efficiency dividend. This drives insufficient enclosure.

The balance of these two opposing forces determines the social efficiency of decentralized enclosure. When the displaced rents effect dominates, enclosers capture more than the social surplus and the decentralized process leads to inefficiently high levels of enclosure. This characterizes economies in the red-hatched regions of Figure 5 below the high-TFP threshold. Conversely, when the labor reallocation effect dominates, enclosers capture less than the social surplus and the decentralized economy produces inefficiently low levels of enclosure, as seen in the blue-hatched regions to the right of

12. Recall from (16) that $z_0(t_e) = [\theta F(t_e, l_e^0(t_e)) + F(1 - t_e, 1 - l_e^0(t_e))] \cdot AF(\bar{T}, \bar{L})/\bar{T}$. In the expression, $A \bar{f} = AF(\bar{T}, \bar{L})/\bar{T} = A l^\alpha$ denotes potential output per unit of land with no land enclosure.

the high-TFP threshold. In the next section we introduce institutional parameters that can close these wedges.

5 The extended model

The benchmark model follows the literature in making two strong simplifying assumptions: (1) that unenclosed areas are characterized by unregulated open access and (2) that enclosures occur without compensation to existing or potential customary users. The decomposition in equation (21) revealed that these assumptions generate two distinct wedges between private and social returns: the displaced rents that enclosers capture without cost, and the labor productivity gain not captured by the encloser. We now relax these assumptions by introducing two parameters, μ and τ , that modify these wedges to capture the diversity of institutional arrangements observed historically and across cultures. The parameters capture two dimensions of power and organizational capacity: parameter $\mu \in [0, 1]$ captures the community’s internal capacity to regulate access to the commons and reduce rent dissipation, and $\tau \in [0, 1]$ the de facto or de jure power of customary users to resist displacement or extract compensation from enclosers. When both parameters equal one, private enclosure decisions align with social efficiency.

5.1 The regulated commons

Real-world customary regimes differ markedly from pure open access. Our benchmark model, like much of the literature on the “tragedy of the commons,” treats the customary sector as an unregulated resource characterized by excessive entry and rent dissipation. Yet empirical research emphasizes that many customary systems are neither open access nor chronically mismanaged (Ostrom 1990; Bromley 1992). Communities regulate entry and use through membership restrictions, plot rights, and internal markets that may even allow for rental or conditioned transfers (Baland and Platteau 1996; Goldstein et al. 2018; Onoma 2009). We now extend the model to take this institutional variation seriously.

We capture the effectiveness of local customary institutions such as village chiefs, land councils, and community norms, with a governance parameter $\mu \in [0, 1]$, which measures the degree to which land rents are decoupled from physical possession. When $\mu = 0$, rights are purely possessory, and a household that withdraws its labor forfeits its claim entirely. As μ rises, local governance institutions recognize and enforce claims with

less need for continuous presence or investment in “guard labor.” Now a household that leaves the commons retains a fraction μ of the land rent it would otherwise surrender. Labor market equilibrium then requires:

$$w_e - w_c = (1 - \mu) \cdot r_c \cdot \frac{T_c}{L_c} \quad (22)$$

The term on the right is the possession rent, the portion of land rents that can be captured only by physically deploying labor in the customary sector, and hence what the marginal household forfeits by leaving. The term on the left, the wage gap, is the opportunity cost of that decision, measured as the difference between marginal products in the enclosed and common sectors, respectively, where the latter is the marginal product term in equation (8).

As governance improves (μ rises), the wedge between enclosed and common wages shrinks. Evidence confirms this mechanism. Peruvian titling freed labor from guarding claims (Field 2007), while Ghanaian farmers with weaker local standing avoided soil-replenishing fallow for fear of losing possession (Goldstein and Udry 2008). The effective return to labor in the customary sector takes the form:

$$\omega_c(\mu) = \mu MP_L^c + (1 - \mu) AP_L^c = (1 - \mu(1 - \alpha)) A \left(\frac{T_c}{L_c} \right)^{1-\alpha} \quad (23)$$

At $\mu = 0$ workers earn the full average product, as the entire product, land rents included, is effectively shared among the workers crowded onto the commons. This is the mirror image of the team-production problem of Holmstrom (1982). There, sharing output leaves each member’s pay below the marginal product of effort, so effort is undersupplied. Here, sharing land rents (at any $\mu < 1$) leaves each entrant’s earnings above the marginal product of labor, so entry is oversupplied.

In both settings the remedy is to establish a residual claimant who breaks the budget. Community leaders and governance structures of the kind Ostrom (1990) documents play this role. A chief or land council that charges an implicit access fee equal to a share μ of the land rent absorbs the residual, moving entrants’ earnings from average toward marginal product, until at $\mu = 1$ workers earn their marginal product exactly. What matters is that the fee proceeds not be returned contingent on deploying labor in the commons. Redistribution in the form of lump-sum transfers to member households, or as investment in valued local public goods, preserves the correction, whereas rebates proportional to commons participation would not.

Strong governance is not, however, equivalent to formal enclosure. Perfect gov-

ernance eliminates static misallocation, equalizing marginal products across sectors ($MP_L^e = MP_L^c$), but it does not deliver the technological transformation ($\theta > 1$) often associated with private consolidation. Whether customary regimes could have matched those gains is contested, as Allen (1992) and others argue. In our framework that debate concerns technology alone. The distributional verdict turns on the governance-dependent threshold $\theta_H^\mu \geq 1$ (equation 27). Equilibrium labor earnings fall with uncompensated enclosure whenever $\theta < \theta_H^\mu$, so even enclosures that raise productivity can lower wages. Whether total labor income falls depends also on who receives the governance rents. Private enclosure decisions may diverge from the social optimum in either case, as we analyze in Section 6.2.

5.2 Power and compensation

The second simplifying assumption of the benchmark model is that enclosure occurs without having to overcome resistance from, or offer compensation to, displaced users. While this might describe extreme cases of state-backed dispossession, it excludes many important scenarios: enclosers who are existing customary users seeking to formalize control, outsiders required by state policy to compensate locals, or landlords converting customary tenancies to commercial leases. To capture this sort of institutional diversity, we introduce a parameter $\tau \in [0, 1]$. Whether τ reflects formal compensation rules or informal bargaining power, higher values reduce the private returns to enclosure and thus the incentive to enclose.

For each enclosed unit of land, enclosers must now compensate existing users by $\tau \cdot r_c$, where $r_c = F_T^c A \bar{f}$ denotes the customary land rent. The private enclosure condition therefore becomes

$$(\theta F_T^e - \tau F_T^c) A \bar{f} - c \geq 0. \quad (24)$$

Enclosers thus internalize a fraction τ of the displaced rents in equation (21), provided the payment reaches the displaced. Resistance that instead consumes real resources would deter enclosure in the same way, but without removing the social cost.

The level of τ reflects the power of customary users to assert their claims, or what Brenner (1976) termed the “balance of class forces.” Following Anderson and McChesney (1994) and Umbeck (1981) on the American frontier, τ need not be a legal rule. It can reflect the capacity to mount credible threats of resistance or political pressure, threats that operate in equilibrium through the compensation they extract. This framing connects to their distinction between “raid” and “trade” as modes of property

transfer: when $\tau \rightarrow 0$, enclosure resembles a coercive raid in which existing users are displaced without compensation; when $\tau \rightarrow 1$, it resembles a negotiated trade in which enclosers fully compensate existing users.

5.3 The extended wedge

The previous two subsections introduced governance parameter μ and compensation parameter τ , one for each of the wedges in equation (21). With compensation requirements ($\tau > 0$), enclosers now internalize a portion of the displaced rents. With regulated access ($\mu > 0$), less labor is misallocated in the first place, reducing the reallocation gain that private enclosers fail to capture. The social return to enclosure, written to separate the encloser's private net margin from the two remaining wedges, becomes:

$$\underbrace{(\theta F_T^e - \tau F_T^c) A \bar{f} - c}_{\text{private net return}} - \underbrace{(1 - \tau) F_T^c A \bar{f}}_{\text{uncompensated displaced rents}} + \underbrace{(1 - \mu) F_T^c A \bar{f} \frac{T_c}{L_c} \cdot \bar{l} \cdot \frac{dl_e^\mu}{dt_e}}_{\text{uncaptured labor reallocation gain}} \geq 0 \quad (25)$$

Here $l_e^\mu(t_e)$ is the labor reaction function when the community regulates access at level μ , derived in Section 5.4. At $\mu = \tau = 0$ the left side reduces to the decomposition of $z'_0(t_e) - c$ in equation (21). The first term is the encloser's net private return, the gross return less compensation paid and enclosure costs, exactly the left side of equation (24). The second term represents the uninternalized social cost of displacement, as analyzed in Section 4.2. This wedge vanishes under full compensation, when $\tau = 1$. Note that $\tau = 1$ when existing customary users enclose their own plots, since they already capture these rents, regardless of the legal environment. The third term is the labor reallocation gain. From the equilibrium condition (22), the marginal product gap $(\theta F_L^e - F_L^c) A \bar{f}$ scales with $(1 - \mu)$, so the gain is largest under open access and vanishes at $\mu = 1$, where labor is efficiently allocated across sectors.

When both $\mu = 1$ and $\tau = 1$, both wedge terms vanish and only the private net return remains. Enclosure then raises social output if and only if it is privately profitable, $\theta F_T^e A \bar{f} - F_T^c A \bar{f} - c \geq 0$, which is precisely the condition for socially efficient enclosure (Section 3.2).

This framework clarifies the power foundations of institutional change. Following Brenner (1976), a transition to private property need not be driven by an increase in the relative productivity of enclosed land (higher θ). A political shift that reduces the

compensation requirement (τ), or a successful effort by the community to regulate access and create rents (increasing r_c via higher μ), can both increase the private pressure for enclosure. We develop these connections to historical and contemporary settings in Section 6.

5.4 Power, policy, and the second-best

For labor allocation with regulated access ($\mu \in [0, 1]$), the labor reaction function (10) generalizes to:

$$l_e^\mu(t_e) = \frac{\Lambda_\mu t_e}{(1 + (\Lambda_\mu - 1)t_e)} \quad \text{where} \quad \Lambda_\mu = \left(\frac{\alpha\theta}{1 - \mu \cdot (1 - \alpha)} \right)^{\frac{1}{1-\alpha}} \quad (26)$$

As μ increases from 0 to 1, the enclosed-to-unenclosed labor-intensity ratio Λ_μ moves from $(\alpha\theta)^{\frac{1}{1-\alpha}}$ to $\theta^{\frac{1}{1-\alpha}}$, reflecting reduced labor misallocation. Improved governance makes any given enclosure less labor-displacing. The high-TFP threshold is correspondingly modified:

$$\theta_H^\mu = \frac{1}{\alpha} - \mu \cdot \frac{1 - \alpha}{\alpha} \quad (27)$$

By equation (23), this threshold is precisely the premium the commons pays labor over its marginal product (divide $\omega_c(\mu)$ by $MP_L^c = \alpha A(T_c/L_c)^{1-\alpha}$ and the land-intensity factors cancel), which regulation shrinks from $1/\alpha$ under open access toward one. Regulation of the commons lowers the bar for enclosure by removing the wage premium it must overcome. This also governs distributional consequences. As shown in Section 6.1, absent compensation and where access fees accrue to non-labor claimants, labor income rises with enclosure when $\theta > \theta_H^\mu$ and falls when $\theta < \theta_H^\mu$. When $\mu = 1$, labor is efficiently allocated within the customary sector regardless of the enclosure rate, and $\theta_H^{\mu=1} = 1$. At this point, the second-best planner's problem from Section 4.1 coincides with the first-best and the decision thresholds in Section 3.2 apply exactly.

Incorporating both parameters, the private enclosure decision becomes:¹³

$$r_\mu^e(t_e) - \tau \cdot r_\mu^c(t_e) - c \geq 0 \quad (28)$$

where $r_\mu^e(t_e)$ is the rental rate on enclosed land and $r_\mu^c(t_e)$ is the rental rate in the customary sector. The encloser compares the return to enclosed land against the compensation owed to displaced users plus enclosure costs. Propositions 2 and 3 carry over with appropriately modified boundary loci.

13. See the supplementary materials for derivations.

The four panels of Figure 6 illustrate how these modifications affect equilibrium outcomes across combinations of μ and τ , with panel (a) reproducing the benchmark.

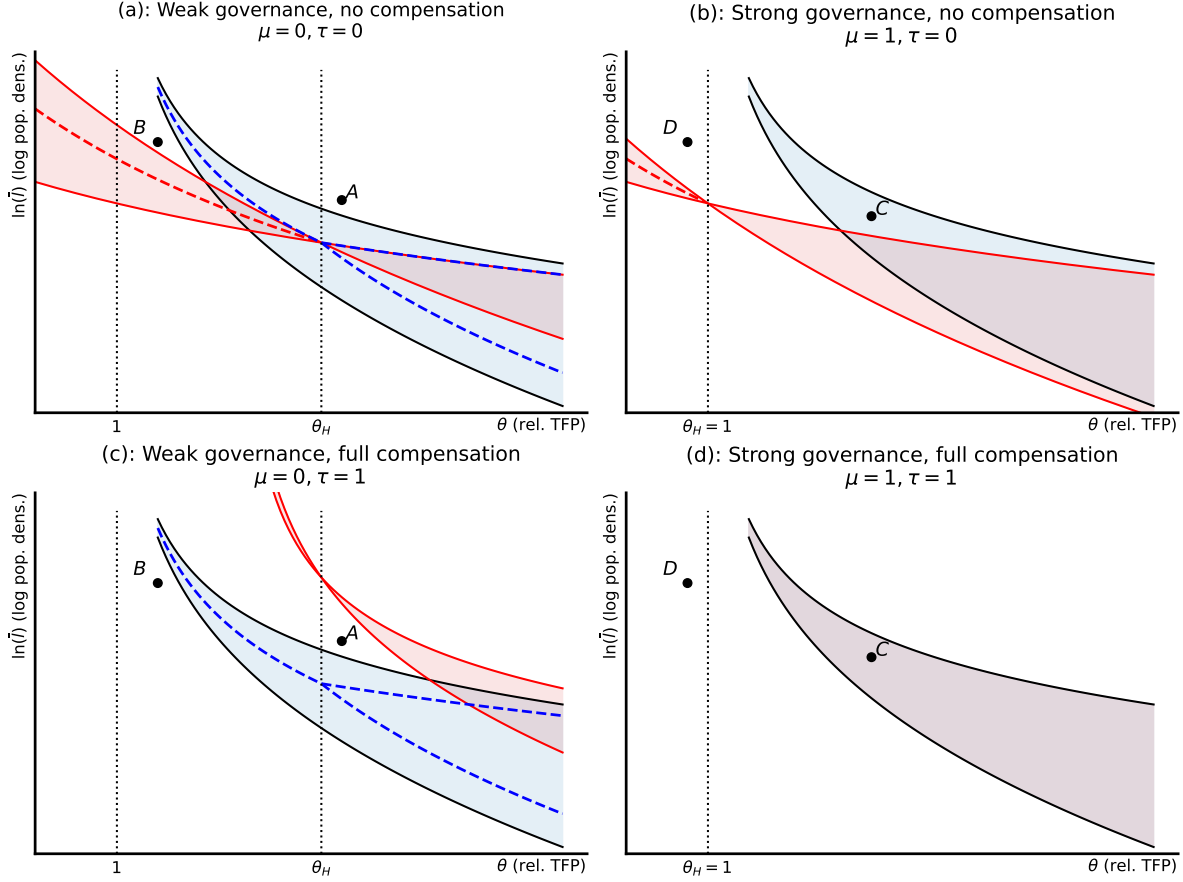


Figure 6: Decentralized and socially optimal enclosure under four institutional regimes. Red shading marks decentralized enclosure outcomes and blue shading socially optimal partial enclosure; in low-TFP regions the red band is the multiplicity region, resolved at the dashed tipping locus; dashed blue lines in panels (a) and (c) mark the second-best thresholds of Section 4.1, and points A–D mark representative economies discussed in Section 6.2. (a) Benchmark, unregulated commons and no compensation ($\mu = \tau = 0$). (b) Regulated commons ($\mu = 1, \tau = 0$). (c) Full compensation ($\mu = 0, \tau = 1$). (d) Both reforms ($\mu = \tau = 1$)

Panel (b) shows the case of a well-regulated commons ($\mu = 1$) without compensation ($\tau = 0$). Better governance reduces labor misallocation and entry into the customary areas, increasing labor supply to the enclosed sector. This lowers wages and raises enclosure returns since operators no longer need to pay high premiums to draw labor away from possession activities. The range of inefficient under-enclosure disappears as enclosure becomes more profitable across a wider range of parameters. However, the range of over-enclosure expands, as enclosers still capture displaced rents without

compensation. Higher μ lowers the threshold θ_H^μ below which enclosure decisions exhibit strategic complementarity, making sudden property races less likely; when $\mu = 1$, $\theta_H^{\mu=1} = 1$, and cascades arise only where enclosure would reduce productivity ($\theta < 1$).

Panel (c) shows the opposite case: open-access ($\mu = 0$) but full compensation ($\tau = 1$). The compensation requirement forces enclosers to internalize the cost of displaced activities, eliminating the rent-seeking motive that drove excessive enclosure. However, the range of inefficient under-enclosure expands. This creates an important tension: weaker compensation requirements ($\tau < 1$, as in panel a) may facilitate higher output in some regions via increased enclosure with technological transformation, albeit at the cost of greater inequality and displacement.

Finally, panel (d) shows the case where both regulation and compensation are complete ($\mu = \tau = 1$). Here, both wedges identified in equation (21) close. Enclosers now fully compensate displaced users, and labor is efficiently allocated within the customary sector. Decentralized decisions align perfectly with the first-best outcome from Section 3.2.

The contrast between panels (b) and (c) versus panel (d) illustrates the theory of the second-best. Each parameter addresses one source of inefficiency, but addressing only one while neglecting the other can worsen outcomes. Improving governance without compensation requirements (panel b) expands over-enclosure; requiring compensation without improving governance (panel c) expands under-enclosure. Only when both institutional failures are addressed do private incentives align with social welfare.

6 Applications and extensions

We now apply the framework to historical and contemporary cases. Our benchmark model, with an unregulated commons ($\mu = 0$), no compensation ($\tau = 0$), no technological transformation ($\theta = 1$), and costless enclosure ($c = 0$), yields the results of Weitzman (1974); adding $c > 0$ and endogenous enclosure decisions yields de Meza and Gould (1992). Adding population density $\bar{l}$ allows us to explore the Boserupian association between scarcity and privatization documented across settings (e.g., Hayami and Ruttan 1985; Ensminger 1996; Holden, Otsuka, Place, et al. 2010), while also identifying when transitions prove inefficient, whether through dissipative property races (Umbeck 1981; Alston, Harris, and Mueller 2012) or coordination failures that block beneficial change (Libecap 1993). The model does not resolve these empirical debates but clarifies the conditions under which competing predictions hold.

The following subsections illustrate this organizing capacity. Section 6.1 addresses

the distributional consequences of enclosure, engaging Weitzman’s comparison of free access and private ownership and the Marxian literature on primitive accumulation. Section 6.2 examines how shifts in political power interact with pre-existing institutional quality to determine efficiency outcomes, drawing on Anderson and McChesney (1994)’s distinction between “raid” and “trade.” Section 6.3 analyzes encompassing interests in frontier settings, connecting to Domar’s trilemma and Wakefield’s theory of systematic colonization.

6.1 Labor release and wages

A central controversy concerns the impact of enclosure on labor. Weitzman (1974) argued that labor “will always be better off with (inefficient) free access rights than under (efficient) private ownership,” a conclusion echoed by Samuelson (1974), who answered the question “Is the rent-collector worthy of his full hire?” in the negative. Marxian interpretations also stress expropriation and labor displacement (Tawney 1912; Humphries 1990), whereas “Tory” accounts argue enclosure increased labor demand through more intensive farming (Chambers 1953). Our framework shows that these views represent different parametric regions of the same model.

The Weitzman-Samuelson result assumes enclosure offers no productivity improvement ($\theta = 1$) and that the commons is unregulated ($\mu = 0$), so labor captures the entire output through possession and any enclosure necessarily harms workers. Cohen and Weitzman (1975) recast Marx’s account of primitive accumulation in a related model, analyzing a costless, exogenously imposed switch from communal to fully private tenure that raises rents and measured output while depressing wages; in our terms their analysis is confined to the $\theta = 1$, $\mu = \tau = 0$ corner of the parameter space, with no role for the endogenous enclosure decisions at the center of our analysis. Our framework instead endogenizes the enclosure decision and relaxes both restrictions, allowing for productivity gains ($\theta > 1$) and regulated commons ($\mu > 0$), which generate conditions under which labor could gain from enclosure even without direct compensation.

To trace the distributional effects, we examine uncompensated displacement ($\tau = 0$) and study how total labor income Y_L varies with the enclosure rate t_e . As explained in Section 5.1, when $\mu > 0$, access fees of $\mu \cdot MP_T^c \cdot T_c$ are collected to regulate the commons. We consider two possible ways this income is distributed: access fees may be redistributed to labor, or they may be captured by third parties such as chiefs or customary landlords.

Suppose first that access fees are redistributed to member households. Then labor

effectively earns the full average product on common land, and total labor income is:

$$Y_L = AF(\bar{T}, \bar{L}) \cdot \frac{1 + (\alpha\theta\Lambda_\mu^\alpha - 1)t_e}{(1 + (\Lambda_\mu - 1)t_e)^\alpha} \quad (29)$$

where Λ_μ is defined in equation (26). When $t_e = 0$, labor receives the entire output $AF(\bar{T}, \bar{L})$. When $t_e = 1$, labor earns only the neoclassical share $\alpha\theta \cdot AF(\bar{T}, \bar{L})$. Labor gains from full uncompensated enclosure if and only if $\alpha\theta > 1$, or equivalently $\theta > \theta_H = 1/\alpha$. In the benchmark economy with $\mu = 0$, the threshold for labor to benefit coincides with the threshold separating strategic substitutes from strategic complements (Proposition 1).

Alternatively, access fees accrue to village chiefs, landlords, or other non-labor claimants. In this case, labor in the enclosed sector earns w_e , while labor on common land earns the wage plus a fraction $(1 - \mu)$ of possession rents, as in equation (22). Total labor income is then:

$$Y_L = (1 - \mu(1 - \alpha))AF(\bar{T}, \bar{L})(1 + (\Lambda_\mu - 1)t_e)^{1-\alpha} \quad (30)$$

Under full enclosure ($t_e = 1$) labor again earns $\alpha\theta AF(\bar{T}, \bar{L})$, but now, when $t_e = 0$, labor earns only a share $(1 - \mu(1 - \alpha))AF(\bar{T}, \bar{L})$, with the residual accruing to local authorities as a governance interest. Labor income therefore increases with uncompensated enclosure if and only if $\alpha\theta > (1 - \mu(1 - \alpha))$, or equivalently $\theta > \theta_H^\mu$ as defined in equation (27).

When fees accrue to non-labor claimants, this threshold depends on customary governance. When governance is weak (low μ), the threshold θ_H^μ is high. Labor crowds into the commons to capture possession rents, and although this dissipates rents inefficiently, it also withdraws labor from the enclosed sector and raises the wage w_e . This rent-seeking acts as an artificial support for labor earnings. Enclosure removes this support: labor is pushed back into the formal market, wages fall, and workers are immiserated unless productivity gains are sufficient ($\theta > \theta_H^\mu$). When governance is effective (high μ), the commons has already regulated entry and released inefficient labor. The threshold θ_H^μ falls toward unity, so even modest productivity gains ($\theta > 1$) allow workers to share in the benefits of enclosure.

Evidence from Mexico's 1990s ejido reforms illustrates the mechanics. When households received parcel certificates, short of full saleable title but effectively raising μ , land rights were decoupled from continued use, freeing labor previously deployed to guard claims. de Janvry et al. (2015) find that certified households were 28 percent

more likely to have a migrant member, with larger effects where initial property rights were weaker.

The analysis readily extends to adding a manufacturing sector that competes for labor (Supplementary materials, Section 6.4). This outside option makes agricultural labor supply elastic but leaves the thresholds derived above unchanged. Only if manufacturing absorbs unlimited labor at a fixed wage does the wage feedback switch off, making each encloser’s return independent of aggregate enclosure. Because possession rents are primarily protected by remaining on customary land, labor there earns more than its marginal product, providing a property-rights microfoundation for dual-economy models in the spirit of Lewis (1954). Customary areas then act as a labor sponge. Labor can be pulled out smoothly by industrial productivity growth, which raises workers’ earnings, or pushed abruptly by enclosure, which lowers them, terms we adapt from Alvarez-Cuadrado and Poschke (2011). The latter operates whenever $\theta < \theta_H^\mu$, hence even absent any agricultural productivity gain ($\theta \leq 1$).

In England, parishes enclosed by act of Parliament had more out-migration, yet their migrants were no more likely to enter manufacturing, even those who moved to the industrial north (Heldring, Robinson, and Vollmer 2024). Labor pushed off the land moves to whatever work it finds. Labor pulled by industry would have entered the mills.

6.2 Power shifts and contested claims

In many historical and contemporary settings, landlords, tenants, and other stakeholders contest the terms of rents, eviction protections, and customary rights (Binswanger, Deininger, and Feder 1995; Byres 1996). As serfdom declined in England after the 14th century, peasants acquired valuable customary protections that landlords sought to erode, making outcomes dependent on both local political conditions and broader demographic forces (Hatcher and Bailey 2001; Allen 1992). Our parameter τ spans Anderson and McChesney (1994)’s spectrum from negotiated “trade” to coercive “raid,” while μ captures the pre-existing quality of commons governance. As we now show, the efficiency consequences of a shift in political power depend on the interaction between these two institutional dimensions.

Consider a shift in political power that favors landlords, perhaps through the capture of state institutions (Marx [1867] 1992; Brenner 1976; Wood 2002). Suppose tenants initially pay only a fraction μ of land’s marginal return ($F_T^c A \bar{f}$) to the landlord as customary rent. Through enclosure, landlords might be able to evict tenants and charge the full market rent ($\theta F_T^c A \bar{f}$), but they must weigh these gains against enclosure costs

(c), forgone customary rents ($\mu F_T^c A \bar{f}$), and compensation owed to displaced tenants, assessed on the residual share of customary rents they retain ($\tau(1 - \mu) F_T^c A \bar{f}$). A landlord already receiving a fraction μ internalizes these rents as a forgone flow upon enclosure. Combined with any compensation τ owed to tenants, the landlord's decision follows the generic enclosure rule (equation 24) with an effective internalization rate of $\mu + \tau(1 - \mu)$, which reaches one when either the landlord's rental claim or tenant protections are complete.

Strong tenant protections imply a high τ . Figure 6 shows that the effects of lowering τ depend critically on the quality of commons governance. When commons governance is weak ($\mu = 0$), reducing τ has ambiguous effects. Moving from panel (c) to panel (a), some economies that previously suffered from inefficiently blocked enclosure will now adopt productivity-enhancing technologies. Point *A* on both panel (a) and panel (c) illustrates this case: when $\tau = 1$, the economy remains completely unenclosed even though full enclosure is efficient, whereas lowering τ to zero induces efficient full enclosure. By contrast, other economies, particularly those with low potential productivity gains ($\theta < \theta_H$), become vulnerable to dissipative enclosure races. Point *B* on panels (a) and (c) presents such an example. When $\tau = 1$, this economy remains efficiently unenclosed, but when $\tau = 0$ on panel (a), it becomes fully enclosed despite enclosure being inefficient. The power shift thus cuts both ways: it can unlock beneficial transitions in high- θ settings while triggering destructive cascades in low- θ settings.

When commons governance is strong ($\mu = 1$), reducing τ again produces inefficiency, though the mechanism differs. With $\mu = 1$, labor is efficiently allocated across sectors regardless of the enclosure rate, and $\theta_H^\mu = 1$. Households can earn customary rents as secure, property-like returns rather than through possession effort. In panel (d), with both good governance and strong customary protections, enclosure becomes a pure technology adoption decision: enclose if and only if the productivity gain from the new technology it makes possible exceeds enforcement costs. Moving to panel (b), enclosers can now appropriate these quasi-property rights without compensation. However, some of these enclosures are socially wasteful: they proceed because enclosers capture uncompensated rents, even when the net productivity improvement falls short of enforcement costs c . Point *C* on panels (b) and (d) illustrates this mechanism: an economy that is efficiently partly enclosed when $\tau = 1$ on panel (d) becomes fully enclosed when $\tau = 0$ on panel (b). Point *D* illustrates the extreme case, in which lowering τ induces full enclosure even though the resulting technological change is regressive.

This distinction helps map competing interpretations of the English enclosures to

different regions of the model’s parameter space. Allen (1982, 1992) finds that enclosure allowed landlords to capture higher rents from customary tenants without raising yields, and that the reorganized farms shed labor. In our terms θ was near one, so the private return to enclosure consisted mostly of captured rents and enclosure displaced labor. Clark (1998, p. 77) argues that common-field villages were tightly governed and nearly as productive as enclosed land, corresponding in our model to a high μ and modest θ . He also argues that enclosure paid only once rents driven by rising food demand outran wage-tied enclosure costs. In the model this is a parish crossing its enclosure threshold as population density grows relative to c/A . In the most comprehensive causal estimates to date, Heldring, Robinson, and Vollmer (2024) exploit quasi-experimental variation in Parliamentary approval of enclosure bills and find that wheat yields rose by roughly 45 percent in the parishes induced to enclose, but far less on average, because parishes that had already enclosed piecemeal stood to gain little and so rarely petitioned. We predict precisely this kind of discontinuous sorting: enclosure arrives all at once, parish by parish, as returns cross the threshold. The acts replaced unanimity with a supermajority weighted by landholding value, a shift in political power that lowered τ and let large landlords push through enclosures long blocked by fragmented ownership.

The evidence points to heterogeneity of the kind our threshold crossings generate. Parishes enclose when returns clear costs, so enclosed parishes disproportionately represent higher-return places, while parishes that had already realized gains from earlier enclosure do not petition. This explains why earlier cross-sectional comparisons understated the gains the acts offered at the margin. The model also clarifies what the evidence measures. A rise in rents measures the encloser’s private return in equation (25), but because this return bundles productivity gains with recaptured customary rents, higher rents need not imply large efficiency gains, as Clark cautions. Nevertheless, Heldring, Robinson, and Vollmer, using Clark’s own records, provide causal evidence that enclosure generated real productivity gains. The joint rise in yields, land inequality, and out-migration is consistent with uncompensated enclosure in the region $1 < \theta < \theta_H^\mu$, where enclosure raises output but displaces labor.

The U.S. frontier presents two entangled property transitions with sharply differing compensation regimes. First, as Anderson and McChesney (1994) argue, Indian-white relations were governed by the relative capacity for violence. Where tribes could credibly threaten resistance (high τ), the government tended to negotiate treaties (“trade”). Conversely, farther West and after the Civil War, as the U.S. cavalry reduced tribal military power (lowering τ), the dynamic shifted toward coercive displacement (“raid”).

Second, among white settlers, institutions evolved differently. Organized squatter pressure secured the Preemption Acts, which effectively raised their bargaining power and compensation requirements (τ) vis-à-vis speculators and the state. Since squatters were themselves the subsequent enclosers, the displaced-rents term was already internalized. The higher τ protected their claims against outsiders without distorting their own formalization incentives.¹⁴ Claim clubs complemented this by strengthening local governance (μ) (Murtazashvili 2013). As Carlos, Feir, and Redish (2022) note, this produced a dual regime: orderly transition for settlers (Anderson and McChesney 1994; Libecap 1993), contrasted with dissipative races to claim land from displaced Native Americans. Finally, technological shocks also played a role: the introduction of barbed wire lowered enclosure costs (c), shifting the equilibrium further toward enclosure regardless of the compensation regime (Hornbeck 2010).

6.3 Encompassing interests and frontier colonization

Enclosure processes often involved actors with more unified and encompassing interests than atomistic decision-makers. Colonial governments, companies, and other centralized authorities frequently shaped enclosure policy to advance particular objectives. In the early and mid-nineteenth century, Edward G. Wakefield’s theory of “systematic colonization” framed frontier land policy in ways that influenced both British colonial practice and classical political economy.

Wakefield emphasized a core tension of land-abundant frontiers: laborers’ easy access to independent holdings raised their outside options, rendering capitalist wage-labor operations unprofitable (Wakefield 1849). He proposed asserting preemptive control over “wastelands” and selling land at a “sufficient price” to artificially lower this outside option. This policy addresses the trilemma of Domar (1970), which holds that sustaining a rent-collecting landed elite amidst land abundance requires restricting either labor (slavery) or land availability (restricted access to the frontier). Marx ([1867] 1992, chap. 33) sardonically cited this logic to argue that capital is a social relation predicated on the separation of direct producers from their means of subsistence. While squatter resistance often thwarted these proposals in settler colonies (e.g., the U.S., Canada, Australia), restrictive versions were imposed in parts of Sub-Saharan Africa and Latin America (Binswanger and Deininger 1993; Solberg 1969; LeGrand 1984).

14. If households were heterogeneous in non-traded farming skill, as in Lucas (1978) span-of-control models, more capable operators would enjoy higher returns to enclosure, and measured productivity gains from enclosure would partly reflect this selection (Adamopoulos et al. 2022).

To formalize these ideas about encompassing interests, consider a syndicate, such as Wakefield's proposed colonization companies, that is granted exclusive rights to unenclosed land and acts as a monopolistic encloser. The syndicate maximizes land rents through enclosure and subsequent leasing or selling to competitive farmers.¹⁵ For simplicity, we assume unenclosed areas remain under free access ($\mu = 0$) and compensation to displaced users is zero ($\tau = 0$).

The syndicate chooses an enclosure rate t_e to maximize:

$$\pi(t_e) = r(t_e) \cdot t_e - c \cdot t_e, \quad (31)$$

where $r(t_e)$ is the market rental rate from (11). In low-TFP economies, $\pi(t_e)$ is convex, generating a choice between full enclosure and no enclosure. Full enclosure is chosen when $\pi(1) > 0$, or

$$\pi(1) > 0 \quad \Leftrightarrow \quad \bar{l} \geq \left[\frac{c}{A\theta} \cdot \frac{1}{1-\alpha} \right]^{\frac{1}{\alpha}} = \bar{l}^m. \quad (32)$$

Condition (32) matches the decentralized boundary $\bar{l}_1^d$ in (14), from Proposition 3. However, unlike the atomistic case, where economies with $r(1) > c > r(0)$ exhibit multiple equilibria, the monopolist internalizes these effects and jumps directly to $t_e = 1$ throughout the multiplicity region, including below the $\bar{l}_{gg}^d$ locus where the global games selection leaves the decentralized economy unenclosed and where full enclosure is socially inefficient. This corresponds closely to Wakefield's objective: restricting workers' access to free land to expand the supply of wage labor and raise land rents.

In high-TFP environments ($\theta \geq \theta_H$), the monopolist behaves differently. Enclosure begins when $\pi'(0) > 0$, where

$$\pi'(t_e) = r(t_e) + r'(t_e)t_e - c, \quad (33)$$

yielding at $t_e = 0$ the same threshold as the decentralized economy:

$$\pi'(0) \geq 0 \quad \Leftrightarrow \quad \bar{l} \geq \frac{1}{(\alpha\theta)^{\frac{1}{1-\alpha}}} \left[\frac{c}{A\theta} \cdot \frac{1}{1-\alpha} \right]^{\frac{1}{\alpha}} = \bar{l}_0^m. \quad (34)$$

15. This abstracts from the labor market power an encloser gains as a major employer. Conning (2026) treats concentrated ownership as given but shows how land-market power over smallholders of heterogeneous farming skill delivers wage markdowns, tied tenancy, and a derived demand for coercion to restrict workers' mobility. That demand is the labor plank of Domar's trilemma, complementing the land plank studied here.

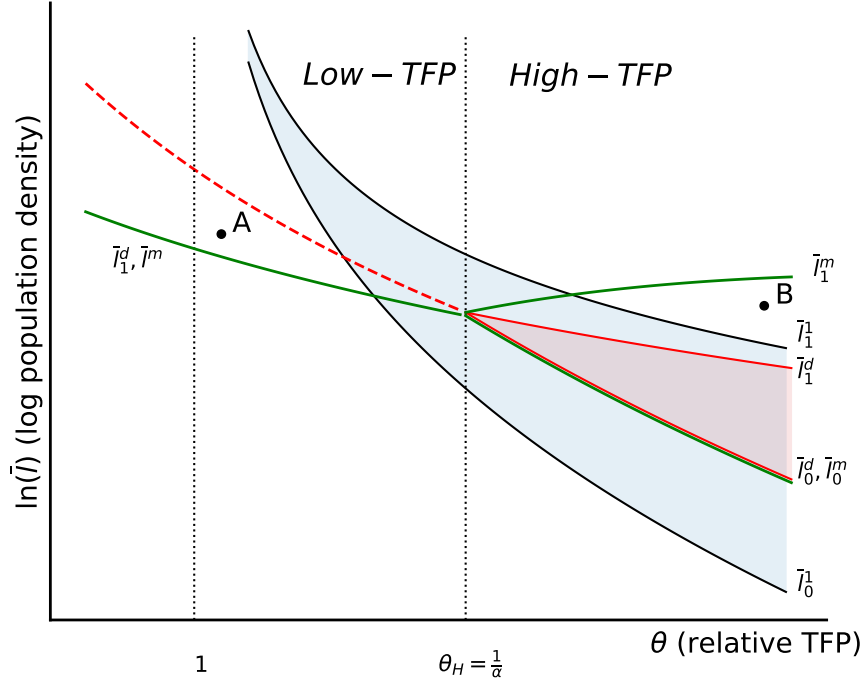


Figure 7: Monopolistic versus competitive and optimal enclosure. The monopolist encloses fully above the thick green line in low-TFP regions, but chooses partial enclosure between $\bar{l}_0^m$ and $\bar{l}_1^m$ in high-TFP regions

But as density rises, the monopolist diverges from decentralized enclosers: it internalizes the depressing effect of higher t_e on $r(t_e)$ and thus fully encloses only when

$$\pi'(1) \geq 0 \quad \Leftrightarrow \quad \bar{l} \geq \left[\frac{1}{1-\alpha} \frac{c}{\theta A} \frac{(\alpha\theta)^{\frac{1}{1-\alpha}}}{(\alpha\theta)^{\frac{1}{1-\alpha}}(1-\alpha) + \alpha} \right]^{\frac{1}{\alpha}} = \bar{l}_1^m. \quad (35)$$

As Figure 7 illustrates, the encompassing interest exploits two distinct mechanisms to suppress wages, depending on regional productivity. In low-TFP regions, it inefficiently pushes to full enclosure at points such as A , mirroring Wakefield's supply-side strategy of artificially restricting the commons to depress the outside option where decentralized economies would not yet enclose. In contrast, in high-TFP regions ($\theta \geq \theta_H$), enclosure is labor-absorbing and raises the market wage. Here the strategy flips to the demand side: the monopolist restricts enclosure, stopping at partial enclosure points such as B , to limit competition for labor and prevent rising wages from eroding land rents. The resulting outcome sustains a dual economy, with a modern enclosed sec-

tor alongside a stagnant unenclosed sector, closely paralleling the “functional dualism” described by de Janvry (1981) for parts of Mexico and Latin America, where commercial agriculture benefited from preserving a low-productivity peasant sector to ensure a steady supply of cheap labor.

7 Conclusion

Our analysis provides a unified framework for evaluating the transformation of property rights. By modeling enclosure as a decentralized aggregative game, we reconcile mechanisms emphasized in Neoclassical efficiency arguments with the distributional conflicts and power dynamics highlighted by Marxian and political economy perspectives. We identify the precise conditions under which property regimes evolve smoothly, tip into dissipative races, or fall short of socially beneficial transformation.

Although our framework acknowledges that customary regimes can impede productivity, our results urge caution regarding the modern push for hasty formalization. Critics following Scott (1998) have long argued that top-down attempts to make property “legible” often ignore the complex accommodations that govern customary resources. National legislation increasingly recognizes rural communities as collective owners and, moving away from doctrines of *terra nullius*, prioritizes resolving community claims and village boundaries before pursuing individualization (Alden Wily 2018; Takeuchi 2022; Deininger 2003). Our model validates this sequence: strengthening customary governance (increasing μ) is often a prerequisite for efficient privatization. It is, however, a prerequisite rather than a substitute, since better governance without stronger compensation protections raises the private return to enclosure and can expand rent-driven over-enclosure.

Without such protections, well-intentioned interventions focused solely on reducing enclosure costs (c) can push economies from stable customary arrangements into destructive enclosure races. Such races are most likely where productivity gains are modest or governance is weak, and they concentrate wealth while displacing labor onto increasingly crowded margins.

Ultimately, our analysis suggests that the “tragedy of the commons” and the “tragedy of enclosure” are not inevitable features of resource regimes, but endogenous outcomes of the interaction between population, technology, and local institutions. Effective policy requires more than drawing lines on a map; it requires aligning the private returns to enclosure with its social costs, often by strengthening the governance and protections of the very customary rights that formalization seeks to replace.

Data Availability Statement

The code used to generate the figures in the paper is available in the replication package on Zenodo at <https://doi.org/10.5281/zenodo.22144387>.

References

- Acemoglu, Daron, and Martin Kaae Jensen. 2013. "Aggregate Comparative Statics." *Games and Economic Behavior* 81:27–49.
- Acemoglu, Daron, Simon Johnson, and James A. Robinson. 2005. "Institutions as a Fundamental Cause of Long-Run Growth." *Handbook of Economic Growth* 1:385–472.
- Adamopoulos, Tasso, Loren Brandt, Jessica Leight, and Diego Restuccia. 2022. "Misallocation, Selection, and Productivity: A Quantitative Analysis with Panel Data from China." *Econometrica* 90 (3): 1261–1282.
- Alchian, Armen A., and Harold Demsetz. 1973. "The Property Right Paradigm." *The Journal of Economic History* 33 (1): 16–27.
- Alden Wily, Liz. 2018. "Collective Land Ownership in the 21st Century: Overview of Global Trends." *Land* 7, no. 2 (June): 68.
- Allen, Robert C. 1982. "The Efficiency and Distributional Consequences of Eighteenth Century Enclosures." *The Economic Journal* 92 (368): 937–953.
- . 1992. *Enclosure and the Yeoman: The Agricultural Development of the South Midlands 1450-1850*. Oxford University Press.
- Alston, Lee J., Edwyna Harris, and Bernardo Mueller. 2012. "The Development of Property Rights on Frontiers: Endowments, Norms, and Politics." *The Journal of Economic History* 72 (3): 741–770.
- Alvarez-Cuadrado, Francisco, and Markus Poschke. 2011. "Structural Change out of Agriculture: Labor Push versus Labor Pull." *American Economic Journal: Macroeconomics* 3 (3): 127–58.
- Anderson, Terry L., and Peter J. Hill. 1990. "The Race for Property Rights." *The Journal of Law & Economics* 33 (1): 177–197.
- Anderson, Terry L., and Fred S. McChesney. 1994. "Raid or Trade? An Economic Model of Indian-White Relations." *Journal of Law and Economics* 37 (1): 39–74.
- Augustinus, Clarissa. 2003. *Handbook on Best Practices, Security of Tenure, and Access to Land: Implementation of the Habitat Agenda*. UN-Habitat.
- Baker, Matthew J. 2003. "An Equilibrium Conflict Model of Land Tenure in Hunter-Gatherer Societies." *Journal of Political Economy* 111 (1): 124–173.

- Baker, Matthew J. 2008. "A Structural Model of the Transition to Agriculture." *Journal of Economic Growth* 13 (4): 257–292.
- Baland, Jean-Marie, and Jean-Philippe Platteau. 1996. *Halting Degradation of Natural Resources: Is There a Role for Rural Communities?* Oxford University Press.
- Barbier, Edward B. 2010. *Scarcity and Frontiers: How Economies Have Developed through Natural Resource Exploitation*. Cambridge University Press.
- Berry, Sara. 1993. *No Condition Is Permanent: The Social Dynamics of Agrarian Change in Sub-Saharan Africa*. University of Wisconsin Press.
- Binswanger, Hans P., and Klaus Deininger. 1993. "South African Land Policy: The Legacy of History and Current Options." *World Development* 21 (9): 1451–1475.
- Binswanger, Hans P., Klaus Deininger, and Gershon Feder. 1995. "Power, Distortions, Revolt and Reform in Agricultural Land Relations." *Handbook of Development Economics* 3:2659–2772.
- Borras Jr, Saturnino M., and Jennifer C. Franco. 2012. "Global Land Grabbing and Trajectories of Agrarian Change: A Preliminary Analysis." *Journal of Agrarian Change* 12 (1): 34–59.
- Boserup, Ester. 1965. *The Conditions of Agricultural Growth. The Economics of Agrarian Change under Population Pressure*. London: George Allen & Unwin.
- Brenner, Robert. 1976. "Agrarian Class Structure and Economic Development in Pre-Industrial Europe." *Past & Present* 70 (1): 30–75.
- Bromley, Daniel W. 1992. "The Commons, Property, and Common-Property Regimes." *Making the Commons Work*, 3–16.
- Byres, Terence J. 1996. *Capitalism from above and Capitalism from below: An Essay in Comparative Political Economy*. New York & London: St. Martin's Press.
- Carlos, Ann M., Donna L. Feir, and Angela Redish. 2022. "Indigenous Nations and the Development of the US Economy: Land, Resources, and Dispossession." *The Journal of Economic History* 82 (2): 516–555.
- Carlsson, Hans, and Eric van Damme. 1993. "Global Games and Equilibrium Selection." *Econometrica* 61 (5): 989–1018.
- Chambers, Jonathan David. 1953. "Enclosure and Labour Supply in the Industrial Revolution." *The Economic History Review* 5 (3): 319–343.
- Chen, Chaoran, Diego Restuccia, and Raül Santaeuilà-Llopis. 2023. "Land Misallocation and Productivity." *American Economic Journal: Macroeconomics* 15 (2): 441–465.
- Clark, Gregory. 1998. "Commons Sense: Common Property Rights, Efficiency, and Institutional Change." *The Journal of Economic History* 58 (1): 73–102.

- Coase, R. H. 1960. "The Problem of Social Cost." *The Journal of Law and Economics* 3:1–44.
- Cohen, Jon, and Martin Weitzman. 1975. "A Marxian Model of Enclosures." *Journal of Development Economics* 1 (4): 287–336.
- Conning, Jonathan. 2026. "Agrarian Market Power: A General Equilibrium Theory of Misallocations and Coercion." Working paper, Hunter College and The Graduate Center, City University of New York.
- Cornes, Richard, and Todd Sandler. 1996. *The Theory of Externalities, Public Goods, and Club Goods*. Cambridge University Press.
- Dasgupta, Partha S., and Geoffrey M. Heal. 1979. *Economic Theory and Exhaustible Resources*. Cambridge University Press.
- de Janvry, Alain. 1981. *The Agrarian Question and Reformism in Latin America*. Baltimore: Johns Hopkins University Press.
- de Janvry, Alain, Kyle Emerick, Marco Gonzalez-Navarro, and Elisabeth Sadoulet. 2015. "Delinking Land Rights from Land Use: Certification and Migration in Mexico." *American Economic Review* 105 (10): 3125–49.
- de Meza, David, and J. R. Gould. 1992. "The Social Efficiency of Private Decisions to Enforce Property Rights." *Journal of Political Economy* 100 (3): 561–580.
- de Soto, Hernando. 2000. *The Mystery of Capital: Why Capitalism Succeeds in the West and Fails Almost Everywhere Else*. New York: Basic Books.
- Deininger, Klaus. 2003. *Land Policies for Growth and Poverty Reduction*. World Bank Publications.
- Demsetz, Harold. 1967. "Toward a Theory of Property Rights." *American Economic Review* 57 (2): 347–359.
- Domar, Evsey D. 1970. "The Causes of Slavery or Serfdom: A Hypothesis." *The Journal of Economic History* 30 (1): 18–32.
- Ensminger, Jean. 1996. *Making a Market: The Institutional Transformation of an African Society*. Cambridge University Press.
- Field, Erica. 2007. "Entitled to Work: Urban Property Rights and Labor Supply in Peru." *Quarterly Journal of Economics* 122 (4): 1561–1602.
- Goldstein, Markus, Kenneth Hounghbedji, Florence Kondylis, Michael O’Sullivan, and Harris Selod. 2018. "Formalization without Certification? Experimental Evidence on Property Rights and Investment." *Journal of Development Economics* 132 (May 1, 2018): 57–74.
- Goldstein, Markus, and Christopher Udry. 2008. "The Profits of Power: Land Rights and Agricultural Investment in Ghana." *Journal of Political Economy* 116 (6): 981–1022.

- Gordon, H. Scott. 1954. "The Economic Theory of a Common-Property Resource: The Fishery." *Journal of Political Economy* 62 (2): 124–142.
- Gottlieb, Charles, and Jan Grobovšek. 2019. "Communal Land and Agricultural Productivity." *Journal of Development Economics* 138:135–152.
- Greer, Allan. 2018. *Property and Dispossession: Natives, Empires and Land in Early Modern North America*. Cambridge, New York, Port Melbourne: Cambridge University Press.
- Hafer, Catherine. 2006. "On the Origins of Property Rights: Conflict and Production in the State of Nature." *The Review of Economic Studies* 73 (1): 119–143.
- Hatcher, John, and Mark Bailey. 2001. *Modelling the Middle Ages: The History and Theory of England's Economic Development*. OUP Oxford.
- Hayami, Yūjirō, and Vernon W. Ruttan. 1985. *Agricultural Development: An International Perspective*. Johns Hopkins University Press.
- Heldring, Leander, James A. Robinson, and Sebastian Vollmer. 2024. *The Economic Effects of the English Parliamentary Enclosures*. Working Paper 29772. National Bureau of Economic Research.
- Holden, Stein T., Keijiro Otsuka, Frank M. Place, et al. 2010. *The Emergence of Land Markets in Africa: Impacts on Poverty, Equity, and Efficiency*. Routledge.
- Holmstrom, Bengt. 1982. "Moral Hazard in Teams." *The Bell Journal of Economics* 13 (2): 324–340.
- Hornbeck, Richard. 2010. "Barbed Wire: Property Rights and Agricultural Development." *The Quarterly Journal of Economics* 125 (2): 767–810.
- Humphries, Jane. 1990. "Enclosures, Common Rights, and Women: The Proletarianization of Families in the Late Eighteenth and Early Nineteenth Centuries." *The Journal of Economic History* 50 (1): 17–42. JSTOR: 2123436.
- LeGrand, Catherine. 1984. "Labor Acquisition and Social Conflict on the Colombian Frontier, 1850–1936." *Journal of Latin American Studies* 16 (1): 27–49.
- Lewis, W. Arthur. 1954. "Economic Development with Unlimited Supplies of Labour." *The Manchester School* 22 (2): 139–191.
- Libecap, Gary D. 1993. *Contracting for Property Rights*. Cambridge University Press.
- Lucas, Robert E. 1978. "On the Size Distribution of Business Firms." *The Bell Journal of Economics* 9 (2): 508–523.
- Marx, Karl. (1867) 1992. *Capital: A Critique of Political Economy, Volume 1*. Penguin Classics.
- Morris, Stephen, and Hyun Song Shin. 2003. "Global Games: Theory and Applications." In *Advances in Economics and Econometrics: Proceedings of the Eighth World Congress of the Econometric Society*, 56. Cambridge University Press.

- Murtazashvili, Ilia. 2013. *The Political Economy of the American Frontier*. Cambridge University Press.
- North, Douglass C., and Robert Paul Thomas. 1973. *The Rise of the Western World: A New Economic History*. Cambridge University Press.
- North, Douglass Cecil. 1990. *Institutions, Institutional Change, and Economic Performance*. Cambridge ; New York: Cambridge University Press.
- Onoma, Ato Kwamena. 2009. *The Politics of Property Rights Institutions in Africa*. Cambridge University Press.
- Ostrom, Elinor. 1990. *Governing the Commons: The Evolution of Institutions for Collective Action*. Cambridge University Press.
- Pearce, Fred. 2016. *Common Ground: Securing Land Rights and Safeguarding the Earth*. Oxfam International.
- Platteau, Jean-Philippe. 1996. "The Evolutionary Theory of Land Rights as Applied to Sub-Saharan Africa: A Critical Assessment." *Development and Change* 27 (1): 29–86.
- Samuelson, Paul A. 1974. "Is the Rent-Collector Worthy of His Full Hire?" *Eastern Economic Journal* 1 (1): 7–10.
- Scott, James C. 1998. *Seeing like a State: How Certain Schemes to Improve the Human Condition Have Failed*. Yale University Press.
- Sjaastad, Espen, and Ben Cousins. 2009. "Formalisation of land rights in the South: An overview." *Land Use Policy* 26 (1): 1–9.
- Solberg, Carl E. 1969. "A Discriminatory Frontier Land Policy: Chile, 1870-1914." *The Americas* 26, no. 2 (October): 115–133.
- Takeuchi, Shinichi. 2022. *African Land Reform Under Economic Liberalisation: States, Chiefs, and Rural Communities*. Springer Nature.
- Tawney, Richard Henry. 1912. *The Agrarian Problem in the Sixteenth Century*. Longmans, Green and Company.
- Thompson, Edward Palmer. 2015. *Customs in common: Studies in traditional popular culture*. New Press/ORIM.
- Tullock, Gordon. 1967. "The Welfare Costs of Tariffs, Monopolies, and Theft." *Western Economic Journal* 5 (3): 224–232.
- Umbeck, John. 1981. "Might Makes Rights: A Theory of the Formation and Initial Distribution of Property Rights." *Economic Inquiry* 19 (1): 38–59.
- Vives, Xavier. 2005. "Complementarities and Games: New Developments." *Journal of Economic Literature* 43 (2): 437–479.

- Wakefield, Edward Gibbon. 1849. *A View of the Art of Colonization: With Present Reference to the British Empire: In Letters Between a Statesman and a Colonist*. J. W. Parker.
- Weitzman, Martin L. 1974. "Free Access vs Private Ownership as Alternative Systems for Managing Common Property." *Journal of Economic Theory* 8 (2): 225–234.
- Wood, Ellen Meiksins. 2002. *The Origin of Capitalism: A Longer View*. Verso.