AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search
http://ageconsearch.umn.edu
aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

The Transformations of Customary Property Regimes in Africa: An Analytical Framing

by Matthew J. Baker and Jonathan Conning

Copyright 2021 by Matthew J. Baker and Jonathan Conning. All rights reserved. Readers may make verbatim copies of this document for non-commercial purposes by any means, provided that this copyright notice appears on all such copies.

The Transformations of Customary Property Regimes in Africa: An Analytical Framing*

Matthew J. Baker and Jonathan Conning
Hunter College and the Graduate Center, CUNY

August 22, 2021

Abstract

More than half the world's lands are collectively held by rural communities and indigenous groups, supporting the livelihood of 2.5 billion people (WRI, 2018). While a growing number of states claim to offer statutory recognition of the property of these existing users, land rights often remain insecure. This has often contributed to vulnerability, economic and environmental mis-allocations, predations, and conflict. Such issues have been especially manifest in Africa where rising population, the effects of resource degradation and climate change, and the opportunities and challenges presented by new technologies and markets have all multiplied the competition of claims over lands and driven up land values. Customary tenure regimes have come under pressure to adapt and transform. In some cases such pressures have spurred relatively efficient institutional and technological responses but in others, in others regimes have failed to adapt, and in yet others it has triggered conflict, inefficient property races, and land grabs. We study the sometimes policy-triggered, but largely decentralized enclosure processes that may lead individuals to act to establish more private and exclusive, and possibly also more transferable, land claims, and their equilibrium efficiency and distributional consequences. The framework helps organize a survey of topics and enduring debates on the potential benefits, costs, and mis-allocations that can arise in the transformations of customary tenure and policies to recognize, strengthen, and transform rights. One cautionary lesson that emerges is that even well-intentioned schemes to formalize property rights can end up exacerbating problems of income inequality, land degradation, and technological stagnation unless general equilibrium spillover effects are considered.

*Very Preliminary Draft. Code to replicate figures and other supporting materials is available at https://jhconning.github.io/enclosure_book.

Contents

1 Introduction

The nuances of land ownership across the variegated landscape of the vast continent of Africa have proven to be as diverse as the continent itself. African land tenure systems have proven at times adaptive yet at other times stubborn in responding to the opportunities and challenges of a very fast changing continent. Rising population, the effects of resource degradation and climate change, and the opportunities and challenges created by new technologies and markets have multiplied the competition of claims to lands and driven up land values. This has created pressures and political demands for both customary tenure regimes and statutory legal systems to adapt and transform and resolve the clash of claims. In some cases, this has spurred relatively efficient institutional and technological responses, in others opportunities for change have been missed, and in still others the wrong type of change has come, as conflicts and messy and inefficient races for property rights have been triggered.

It will be useful to start with a definition of property, which we borrow from Bromley (1992): "Property is a benefit (or income) stream, and a property right is a claim to a benefit stream that some higher body –usually the state– will agree to protect through the assignment of duty to others who may covet, or somehow interfere with, the benefit stream ... Property is a triadic social relation involving benefit streams, right holders, and duty bearers."

There may, of course, be different ways to establish and protect property in a given society, and at the heart of our framework is the idea that at any given moment different *property regimes* are may co-exist and interact, and that individuals and groups will chose diferent regimes for particular purposes and under different circumstances.

As circumstances change people may begin to find it in their interest to switch to a different property regime, if the choice is available and attractive. As in other situations of technological or institutional adoption, however, there typically are spillovers and strategic complementarities in adoption decisions: my incentive to switch may depend on others switching as well. Complicating matters further is the fact some may have incentive to switch because it allows them to appropriate new claims: for example, the local or outsider that claims title under statutory law to lands that under customary law had belonged to others. The possibility of multiple equilibria and coordination failures arise in such switching games. In practical terms this means that while decentralized processes could lead a community to transform their property regime to take advantage of new opportunities or challenges, it is also possible that they could end up in a situation they fail to transform because even though most members would be made

collectively better off by switching to a new property regime they fail to so because it is not in the interest of any one group to lead the way. Or, in different circumstances, decentralized processes might tip members into making choices that lead them to switch away from a property regime that is relatively efficient and provides other benefits toward another one that is less efficient and much more inequitable.

One difference between property regimes may be the extent to which they rely on local and community recognition and protection, and how much on the state. In most countries it is possible to invoke the protection of the state and its police and courts to help enforce exclusive claims to many types of land by having the land officially surveyed and titled, though usually is a relatively expensive process. Yet many, indeed most individuals in many African countries, chose to instead hold or transact land claims under customary tenure even though this may mean their claims remain largely invisible to the central state. Any process of recognizing and formalizing land claims under customary tenure is therefore also a process of extending and redefining the presence of the state. This is a complicated topic because as James C. Scott reminds us:

> "Most states ... are 'younger' than the societies they purport to administer ... patterns of settlement, social relations, and production, not to mention a natural environment ... have evolved largely independent of state plans ...
>
> The result is typically a diversity, complexity, and unrepeatability of social forms that are relatively opaque to the state, often purposefully so. (Scott, 1998)"

As this suggests, the perception that outsiders and state agents may hold, that rural society and property regimes are complex and opaque is partly a reflection of the long evolution and adaptation of local property regimes to the interwined histories and circumstances of local residents that usually only they have the full knowledge to understand but also, perhaps at times, is a strategy to protect local property claims against the possible predations of outsiders or the state itself (Murtazashvili and Murtazashvili, 2021). Local elites such as chiefs who may earn rents as intermediaries under customary law may also want to keep local structures difficult to penetrate by outsiders and the state or, under different circumstances, may be motivated to turn to the state for protection (Onoma, 2009).

Even this brief discussion suggests the importance of turning to detailed ethnographies and case studies and directly involving local stakeholders when trying to understand the issues. There is , however, value to also trying to understand issues using

economic frameworks, if for no other reason that so many positions and policy formulations are justified by reference to economic claims, some of them simplistic and misguided. Although the conceptualization we offer below will be, of necessity, stylized, it offers insight to a few key tradeoffs.

2 Property Rights to land and their transformation

Overlapping theoretical, historical and empirical literatures have studied the transformation of institutions and property rights to land. A common analytical narrative attributed to many economic historians including Boserup (1965) is that under conditions of low population density the costs to establishing and enforcing clearly demarcated property rights to land tend to fall short of their costs and for that reason, in conditions of land abundance, land and resources tend to remain governed only lightly by communal land governance mechanisms, or even in conditions approximating 'open-access.' As population density rises and/or as new technologies and market opportunities become available, the narrative continues, the benefits to establishing more clearly defined and more strictly enforced property rights begins to rise. This creates pressure to establish stronger regulation of communal lands and, over time, more individuated forms of land use rights and, perhaps eventually, the emergence of more fully private rights including the rights to enclose and transfer lands (Binswanger et al., 1995).

For some, transformations of property rights over time of this sort are viewed in evolutionary terms, as a succession of Coasian bargains to take advantage of new opportunities and reduce transactions costs or externalities to achieve greater resource allocation efficiency. Others, including but not limited to marxists, argue that the process is more conflictual than evolutionary, driven often by the efforts of well placed individuals or members of a class to capture or shift new or existing rents.

Economists also differ on the general advisability or ultimate superiority of private property rights compared to communal or other land tenure regimes in different contexts. Those associated with the so called Property Rights School (e.g. Alchian and Demsetz, 1973) have generally argued to emphasize the claims that open access and many communal property regimes may lead to inefficient resource over-exploitation and make the claim that private property solutions offer better allocative efficiency. Policy advocates such as Hernando de Soto (2000) have been widely successful at promoting land privatization and titling programs around the world. However, Ostrom (1990), Platteau (1996) and many others have pushed back to argue with theory and the support of empirical evidence that communal property may in some circumstances lead

to outcomes equal or preferable to private property and have strongly questioned the promised efficiency gains of many privatization programs. They argue that customary tenures are often capable of adapting to conditions of increasing land scarcity and typically permit gradual individualization of rights. They have questioned the promised efficiency gains of many state-led land registration and titling reforms and these can compensate for the real and distributional costs they may involve, particularly in situations where state capacity is weak, or the state opens the door to predatory actors (Sjaastad and Bromley, 1997).

Such opposing perspectives can be discerned in the voluminous literature on historical and contemporary efforts around the world to transform lands held under communal or customary law regimes into more individualized, alienable forms of property holding. The English enclosures, taking place over many centuries transformed open fields once farmed under communal arrangements, as well forests and other common areas, into new enclosed private properties. Parts of this process unfolded slowly and organically over many centuries via a myriad of locality-specific changes, but the process was accelerated at times via Parliamentary acts of enclosure. The more neo-smithian or neo-classical interpretation is that enclosures led to improved incentives and allocative efficiency in agriculture which, by promoting agricultural productivity growth and the release of labor and other resources to the expanding manufacturing sectors, in turn propelled the industrial revolution. As Allen (1992) points out many marxist and conflict-based interpretations do not fundamentally disagree with the productivity promoting claim but view the enclosure movement also fundamentally as an act of property theft which dispossessed the peasant classes of communal land use rights. By some accounts, this in turn forced laborers off lands and created cheap labor forces which, they claim, helped to jump start the industrial revolution (**??**Wood, 2002).

The debates for or against each of these positions have been extensive and, at times, ferocious. In this paper our purpose is not to necessarily take a side or settle disputes but rather to demonstrate a unified theoretical framework flexible enough to allow for each of these potentially competing mechanisms to be at work at the same time in order to study tradeoffs and their relative importance under difference circumstances.

We build upon models of the land enclosure decision by de Meza and Gould (1992) on 'The Social Efficiency of Private Decisions to Enforce Property Rights' and by Weitzman (1974). Both papers study the general equilibrium effects of private decisions to enclose lands on which other households had previously enjoyed use rights under open access or communal tenure taking account of spillovers in the enclosure decision. Through a series of mostly graphical examples de Meza and Gould demonstrated the possibility

of multiple equilibria and inefficient enclosure equilibria. Working with a more formal mathematical model but also some strong assumptions to rule out multiple equilibria Weitzman (1974) studied how privatization via enclosure generally raises output but can also place strong downward pressure consequences for workers wages, a result also highlighted by Samuelson (1974).

Each of these models illuminates important aspects of the problem but imposed strong simplifying which ruled out some interesting cases or comparative statics on the role of some factors emphasized in historical and policy debates. For example whether enclosures will be socially valuable and/or privately profitable must clearly hinge in part on population density. Similarly, whether enclosures raise or lower wages in equilibrium clearly must hinge in part on whether they facilitate the adoption of better technologies, on the extent of market competition, and other determinants of relative bargaining power.

We build a more general and flexible, but still highly tractable, model to study how such factors might determine the extent and the efficiency and distributional impacts of enclosure. We draw from the modern theory of global games to handle and parameterize the possibility of multiple equilibria and derive comparative statics that show how, depending on parameter values, the private economy may lead to equilibria with either inefficiently high, inefficiently low, or efficient levels of enclosure and structural transformation. We end by describing several possible applications and extensions.

3 Property Regimes

Property is a social relation that depends, to varying degrees, on the recognition and sanction of the community or the state. At the same time, as common expressions such as "possession is nine-tenths of the law" remind us, the establishment and maintenance of property claims is also almost always and everywhere dependent on the costly private actions of individuals, wheter it be to establish physical possession via occupation or investment or via direct or indirect but also costly appeals to, the community or the law for recognition and protection.

The nature and cost of such property creation and enforcement efforts and how effectively they will be at producing secure and exclusive claims, will depend on the context. They will depend on such factors as the potential value of the resources involved, the number of other potential claimants, and on the available physical, organizational, or institutional 'technologies' for protecting rights.

It will be useful to distinguish two broad types of privately-initiated strategies to

claim 'property' within this spectrum of possibilities. We label one **strategies of membership and possession** and the other **strategies of exit and formalization**.[1]

Both types of strategies are used in the same economy and indeed our primary focus below will be to study the general equilibrium implications of changes that tip the patterns of relative adoption. The choice between strategies is modeled as binary at first but later we show how to model it as more of a continuous choice.

The first refers to strategies where claims are established and maintained primarily through acts of possession and efforts to maintain membership in organized groups or a community that can offer recognition and added protection. As in any form of organization, the benefits of membership are typically made contingent upon fulfilling certain roles and obligations. The organization, whether it be organized along the lines of tribe, or clan, political movement, or community of neighbors, will recognize and possibly come to the defense of your claims against the encroachment of others. In exchange it expects that you will abide by the rules of the organization, including respect the rights of others, agree to adjudication of disputes within the organization, and help the organization in the provision and governance of local public goods, including for the collective protection of property rights.

The primary costs to the individuals involved in this type of property rights creation and protection are the opportunity costs of the resources associated with maintaining continued physical possession and active engagement and contribution to groups and community. Since people usually want to live and work in these communities anyway and many may not have many options outside of the community, these costs may start out low at first, and this is part of what gives customary or informal law a cost advantage over the alternative of statutory law.

In frontier situations, use rights may often be simply taken with little fear of challenge, for example by the hunter, gatherer, or pastoralist who moves through a territory. The intent to establish more substantial claims, for example claiming more exclusive use of lands to lay traps for hunting or to clear the land for agricultural production, might be be signalled by establishing visible markers of possession. These claimed preemption rights may be respected by others due to adherence to norms and the desire to avoid conflicts, and facilitated by the fact that enough other open lands remain. As many studies have argued, if they hadn't already done so to begin with, frontier

[1]We've placed the term 'property' in quotation marks in this sentence and chosen these labels in allusion to debates about the definitions and origins of property. Some, in the tradition of Hume see property as an institution that evolves from social practices and convention, where others, in the tradition of Hobbes, argue that there can be no 'property' rights prior to the state. In this latter view rights of possession are distinct from rights to property and its only through formalization possession rights are transformed into property rights (Waldron, 2004; Alden Wily, 2018; Merrill, 2017).

settlers soon organize around norms of possession and form organizations to provide local public goods including, first and foremost, the collective defense of their claims. [Something about ahoi and negotiated absorption into existing structures]

Under most customary land tenure arrangements land use rights are more likely to depend on recognized membership in the community as well as demonstrated continued approved use of lands (Shipton and Goheen, 1992; Goldstein and Udry, 2008). Although the relationships are usually more complex than the term suggests, these are often referred to as "use-it-or-lose-it" or possessory land rights. Although the community may regulate access to rights 'strangers' may be incorporated into the community over time (Bates, 1987; Berry, 1992; Kanogo, 1987).

The main costs of maintaining land use rights in these situations are the opportunity cost of the resources associated with maintaining a physical presence on the land and active maintained relationships and engagement in the community that helps to regulate access to and protection of those rights. Since people usually want to live and work in these communities anyways, and they may not have that many outside options, these costs are often low and that may be one of the advantages of informal or customary law.

Motivation and opportunity to claim more secure and exclusive non-possessory rights (rights that stay protected and free from challenge or encroachment from others even in the absence of possession) may become available, or might be seized. For example, by changes in customary law rules to allow more exclusive control, or because of the establishment of new mechanisms for individuals to establish statutory legal claims. It is useful to think of individuals as now being able to make new costly 'enclosure' investments of a different kind, for instance they can now hire guards or fences to protect their lands when they are gone, or they might pay the costs associated with purchasing or establishing harder more exclusive claims maybe now via the avenue of appeal to more expensive statutory law, rather than customary law. These new 'enclosure' costs help establish more secure exclusive, and possibly more transferable, rights to land, and in effect substitute for the protections that had needed to be established through continued possession. These enclosure decisions therefore potentially free the individual from having to continue to pay these opportunity costs. They may now be free to leave the community for better opportunities in the city, without fear of losing lands while collecting rent from leasing lands out to others. Or they may now be more able to imply 'cash out' the value of these rights by selling them or renting them out?

4 A Model Framework

4.1 Resources and technology

Consider an economy with an initial total endowment of $\bar{T}$ units of land and $\bar{L}$ units of labor.[2] Let $\bar{l} = \frac{\bar{L}}{\bar{T}}$ refer to the labor population density per unit of land, T_e to the total amount of land enclosed and L_e to the total amount of labor employed on those enclosed lands. Further define $t_e = \frac{T_e}{\bar{T}}$ and $l_e = \frac{L_e}{\bar{T}}$ so now $t_e \in [0, 1]$ refers to the *share* of land that has been enclosed and $l_e \in [0, 1]$ to the share of total labor employed on enclosed lands.

Production of a numeraire good can occur on either 'unenclosed' or 'enclosed' lands with the production technologies:

$$F(T, L) = T^{1-\alpha} L^{\alpha} \tag{1}$$

$$G(T, L) = \theta F(T, L) \tag{2}$$

where T and L represent land and labor inputs, and F and G represent production on village-accessible unenclosed fields or enclosed fields, respectively. The function $F(T, L)$ is linear homogenous in its two inputs (constant returns to scale). Parameter θ measures a potential gain (or loss) in total factor productivity from enclosing land. It measures relative Total Factor Productivity (TFP) between the enclosed and the unenclosed sector. On the other hand $\theta > 1$ might capture the idea that 'enclosure' could facilitate the adoption of new technological or organizational improvements that raise TFP on enclosed lands relative to unenclosed lands. For example, establishing more secure exclusive/transferable rights to a land plot might provide incentives to a farmer to adopt higher-yield tree crops. Or, to borrow from a famous example, building a fence that prevents cattle from trampling crops in a field can raise total yields (Coase, 1960).

On the other hand, $\theta \leq 1$ is also a possibility. Though we have characterized production in terms of single production good, it could be the case that these two functions measure different bundles of goods and benefits accruing to contrasting land uses and forms of organization. For example, it could be the case that community members attach additional value to communal ownership of traditional village lands, or enjoyment from sharing the commons. This can be captured by a value of θ less than

[2] For now this is an agricultural economy only but we later add the option for household members to migrate to a non-agricultural sector.

one to reflect the downward adjustment to those values as lands are privatized.

From these definitions we can express total output on enclosed lands as a function of the aggregate level of enclosed land T_e and labor working in the enclosed sector L_e as:

$$\begin{aligned} G(T_e, L_e) &= \theta F(T_e, L_e) = \theta T_e^{1-\alpha} L_e^{\alpha} \\ &= t_e^{1-\alpha} \bar{l}_e^{\alpha} \cdot \theta \bar{T}^{1-\alpha} \bar{L}^{\alpha} \\ &= t_e^{1-\alpha} \bar{l}_e^{\alpha} \cdot \theta F(\bar{T}, \bar{L}) \end{aligned}$$

Total output on enclosed lands can thus be written as a fraction of potential agricultural output (since $F(t_e, l_e) = t_e^{1-\alpha} \bar{l}_e^{\alpha} \in [0, 1]$).

We model the process and costs of enclosure in a very simple linear manner. Each unit of land in the economy will have a potential 'owner-claimant' who can, if they pay enclosure cost c per unit land, win a claim contest that allows them to establish exclusive possession. In later sections we will layer on more institutional detail and interpret this as anything costs that help transform conditional rights of possession through membership into more secure externally enforced rights to exclude others. For the purposes of this section however it will be useful to think of the cost c as representing a physical investment such as the cost of building a fence around a plot of land to keep cattle from trampling a crop, or the cost of planting a new stand of trees and setting up mechanisms to exclude others from harvesting its fruit. If T_e units of land are enclosed, $c \cdot \ T_e$ resources must be expended to maintain exclusion.[3] We'll return to suc. are also leaving vague who the claimants might be. We'll return all these possibilities, but for now we abstract from that to understand some of the interesting complications that can emerge even from this most simple of models.

4.2 Planner's problem: Enclosure as technology adoption

We have said little thus far of the institutional arrangements that might govern resource allocations on 'enclosed' or 'unenclosed' lands. Will the lands in the 'unenclosed' sector be 'open access' frontier lands or regulated by customary law? Likewise, will production be allocated efficiently in the enclosed sector on competitive markets or markets distorted by market power or other imperfections. The literature records a wide range

[3]More complicated enclosure technologies can be imagined – private enclosure costs could display increasing or decreasing returns to scale, and there may be important publicly funded fixed costs. We return to some such possibilities below after first demonstrating the effects of this simplest of enclosure costs.

of institutional possibilities and we want to begin with a framework capable of spanning many of these (Ostrom, 1990; Binswanger et al., 1995; Baland and Platteau, 1996).

We start with the familiar artifice of a "Social Planner's problem' to construct a benchmark against which allocations under different institutional arrangements can be compared. A Social Planner may attach different consumption welfare weights to groups in society but will attempt to organize resource allocation efficiently on both enclosed or unenclosed lands and then redistribute appropriately. Stripped down to its essence, a Planner's choice of whether to 'enclose' lands boils down to a simple technology adoption decision: build new fences or new property rights mechanisms to if it generates new benefits that exceed the resource costs of these new arrangements. Seen this way, the planner's problem is to choose the share of lands to be enclosed t_e and the share of labor allocated to the enclosed sector l_e to maximize:

$$Y = [\theta \cdot F(t_e, l_e) + F(1 - t_e, 1 - l_e)] \cdot F(\bar{T}, \bar{L}) - cTt_e \tag{3}$$

and then redistribute. A necessary condition for an interior optimum will be that *marginal products* of land and labor be equated between farms both across sectors and within the enclosed and unenclosed sectors. We could solve for this directly, but we will gain insight by solving in steps to facilitate comparison to private market solutions in later sections which can be cast as aggregative games.[4] In the first step, we find an expression for $l_e^o(t_e)$ or the efficient allocation of labor to the enclosed sector from any given land enclosure share t_e. To find this we differentiate (3) with respect to l_e, taking t_e as given. Setting this first-order condition to zero and re-arranging gives us the condition that marginal products of labor must be equalized across uses:

$$\theta \left(\frac{t_e}{l_e}\right)^{1-\alpha} = \left(\frac{1 - t_e}{1 - l_e}\right)^{1-\alpha} \tag{4}$$

Solving we find

$$l_e^o(t_e) = \frac{\Lambda^o t_e}{1 + (\Lambda^o - 1)t_e}, \text{ where } \Lambda^o = \theta^{\frac{1}{1-\alpha}} \tag{5}$$

Note $l_e^o(t_e)$ tells us the efficient way to allocate labor between enclosed and unenclosed lands conditional on a given initial enclosure share t_e, whether or not that enclosure level is optimal or not. The properties of this function will help us determine

[4] An aggregative game is one where every player's payoff can be described as a function of the player's own strategy and an aggregate of all players' strategies (Acemoglu and Jensen, 2013). In our economy the aggregate of all players enclosure strategies will be summarized by the fraction lands enclosed t_e.

this optimum. Note that when $\theta = 1$ there's no TFP gain to costly enclosure and the only way to equalize marginal products is to have all farms operate with the same labor-land intensity. When $\theta > 1$ the term $\Lambda^0 > 1$ and it is easy to show that $l_e^o(t_e)$ will be concave and $l_e^o(t_e) > t_e$ for all $t_e \in [0, 1]$. This implies that at any level of partial-enclosure $t_e \in [0, 1]$ the efficient allocation requires a *higher* labor-land intensity on enclosed lands. The reason is that when $\theta > 1$ enclosure raises demand for both labor and land on enclosed lands but land is 'taxed' by the cost of enclosure c.

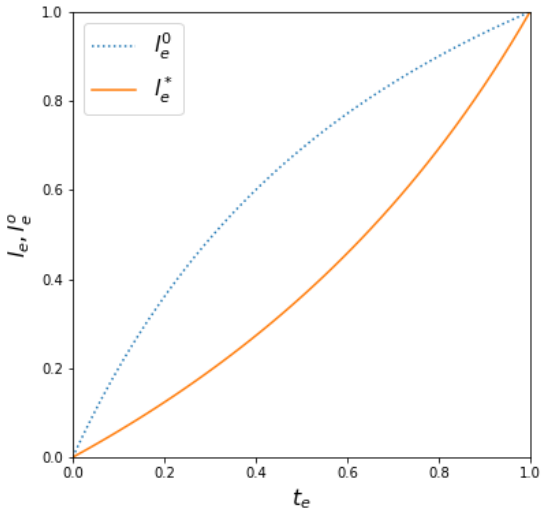

Figure 1: Labor intensity under Planner (dashed) and decentralized private allocation

This is an important property in theory and in practice. As writers such as Otsuka and Place (2014) and Headey and Jayne (2014) have emphasized, the observed degree of intensification of production may be viewed as a barometer for how well property rights transformation is serving a local community. Yet strikingly, to anticipate a result we will demonstrate in section **??**, this desired intensification effect will fail to occur across the board in many decentralized private enclosure equilibria. Farms on enclosed lands adopt *less* labor intensive techniques unless θ, the expected TFP increase from adopting new technology on enclosed lands, is very large. This potential for a 'labor expulsion' rather than a labor absorbtion effect has been at the heart of many historical critiques of enclosure processes and will also be determinant of the distributional consequnces of enclosures (Brenner (1976); **?**); Allen (1992); Cohen and Weitzman (1975)).

Back to the planner's problem. Let's now find the optimal enclosure (or technological adoption rate). Plugging $l_e^o(t_e)$ from (5) into Y in (3), dividing by $\bar{T}$, and simplifying

we obtain an expression for output net of enclosure costs per unit land:

$$z(t_e) = \bar{l}^{\alpha} \cdot [1 + (\Lambda^o - 1)\, t_e]^{1-\alpha} - ct_e \tag{6}$$

It will also be useful to study the derivative of this function:

$$z'(t_e) = (1-\alpha)\,(\Lambda^o - 1)\,\bar{l}^{\alpha}\,[1 + (\Lambda^o - 1)\, t_e]^{-\alpha} - c \tag{7}$$

A few properties of $z(t_e)$ in (6) are immediate. If $\Lambda^o = \theta^{\frac{1}{1-\alpha}} \geq 1$, $z(t_e)$ is concave down in t_e. Because of this, when $\Lambda^o \geq 1$, we just need to check the derivative $z'(t_e)$ assessed at its endpoints to see whether land enclosure should be zero, partial, or full. There are three possibilities: (1) if $z'(0) < 0$ then the $z(t_e)$ curve is everywhere downward sloping over $t_e \in (0, 1)$ and it will be efficient to have no enclosure; (2) if $z'(1) > 0$ then the curve is everywhere increasing in the rate of enclosure $t_e \in (0, 1)$ so it must be optimal to have $t_e = 1$ or full enclosure; and (3) if $z'(0) > 0$ and $z'(1) < 0$ there must be an interior optimum with partial enclosure.

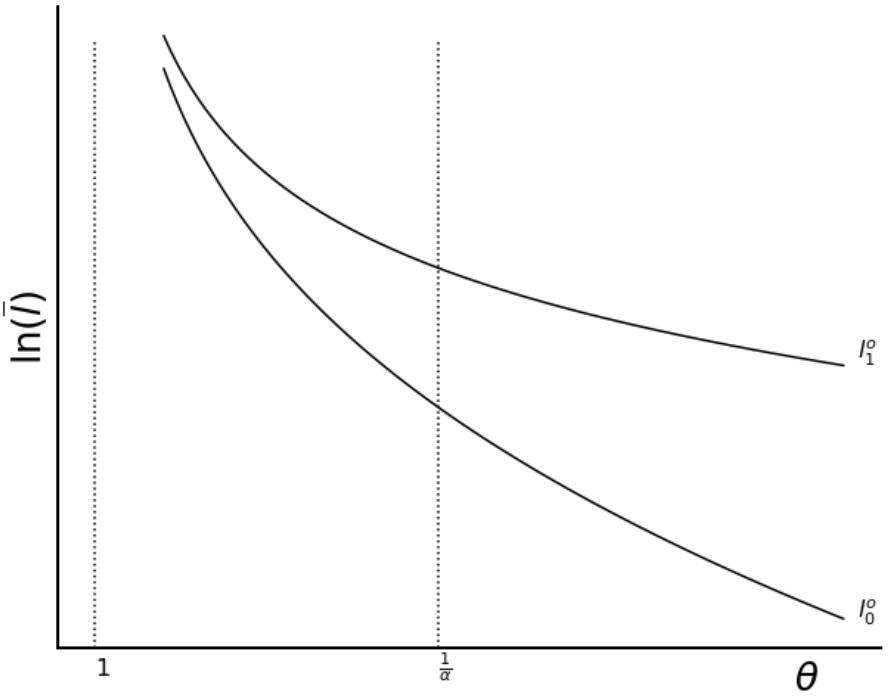

Figure 2: Optimal Enclosure boundaries

Let's partition the parameter space. Consider the first case where $z'(0) \leq 0$ using

(7). This inequality gives us the parameters that are such that marginal benefits to enclosure fall short of marginal costs over all $t_e \in (0,1)$, and it will be efficient to have no enclosure. Writing out the inequality the boundary in $\theta - \bar{l}$ parameter space is found to be:

$$\bar{l} \leq \left[\frac{c}{(1-\alpha)(\Lambda^o - 1)}\right]^{\frac{1}{\alpha}} = l_0^o(c,\theta) \tag{8}$$

Inequality (8) defines a region of the parameter space below which there should be no enclosure. This boundary is shown in Figure 2. This has an intuitive Boserupian interpretation: when population densities measured by $\bar{l}$ are sufficiently low, land is abundant and the productivity gains to enclosure insufficient to justify the cost of enclosing any land. As population density begins to rise however, the opportunity cost of drawing labor out of unenclosed fields begins to fall (due to diminishing returns to labor) and this raises the societal net returns to enclosure.

Consider now the second case. When $z'(1) > 0$ in (7), the marginal benefit of enclosure exceeds the marginal cost of enclosure for all $t_e \in (0,1)$, so the optimum is $t_e^o = 1$ with all lands enclosed. Writing out the $z'(1) \geq 0$ inequality and rearranging terms gives this boundary:

$$\bar{l} \geq \left[\frac{c\Lambda^0}{(1-\alpha)(\Lambda^o - 1)}\right]^{\frac{1}{\alpha}} = l_1^o(c,\theta) \tag{9}$$

The parameter region carved out between the l_0^o and l_1^o loci correspond to the third possibility that an interior, or partial, amount of enclosure is optimal. To understand this, suppose the economy was at a point somewhere just below the lower l_0^o boundary where it is not yet optimal to have any enclosure. Suppose fresh new migrants arrive to to the economy and this pushes population density $\bar{l}$ up by just enough to place us over the threshold. With more labor per unit land in the economy the marginal product of land on enclosed land can now be raised above the cost of enclosure and it becomes worthwhile to enclose some land. Since land that becomes enclosed becomes more productive ($\theta > 1$) it becomes efficient to operate enclosed lands in more labor-intensive ways compared to unenclosed (recall our earlier observation that $l_e^0(t_e) > t_e$ when $\theta > 1$). Since there are diminishing returns to land and enclosure is costly it will however generally make sense to enclose only a fraction of the lands to accommodate the small increase in the population density.

The artifice of the social planner has allowed us to assume away many of the more interesting, complicated aspects of the realities of property rights transformations in

Africa, to say nothing of the distributional issues. Nonetheless it shines light on the most basic of cost-benefit tradeoffs namely that adopting new property systems may not be worth the costs if land isn't sufficiently scarce as measured by $\bar{l}$ or the expected TFP gains small. When enclosure is worthwhile it should generally result in more not less labor intensive land use. In the next sections we study decentralized market-driven enclosure processes and find that, under a quite a range of circumstances, the equilibria that emerge may fall short of these efficiency benchmarks, raising concerns for a wide range of issues including wasteful property races, environmental degradation, and worsening inequality and dispossession.

4.3 Decentralized enclosure processes – in simple diagrams

It will be useful to start our study of decentralized enclosure processes by describing typical simpler narratives of resource allocation on 'open-access' or 'communal' lands. For the moment we will also assume that enclosure is a costless process but also one that does not transform the technology. In such a setting the only possible motive for enclosure would be the belief that privatization to establish stronger rights of exclusion could eliminate mis-allocations – the 'tragedies of the commons' – that many observers seem to believe are inherent to any situation with open-access or common property lands.

The purpose of this section is to twofold. Firstly, to examine the logic of such arguments employing simple diagrams reminiscent of Samuelson (1974) and **?**de Meza and Gould (1992). This will help us trace out and intuitively explain basic mechanisms and results that we will examine in a richer framework and with more formal detail in later sections. The second purpose is to establish some structure for a richer interpretation of the unenclosed sector, one that maps more closely to property rights protection and resource allocation mechanisms within modern customary tenure, and allows us to trace and interpret changes in the factoral distribution of incomes triggered by enclosure processes.

Production technology $F(T, L)$ can now be put to use on any piece of land or production site on enclosed or unenclosed lands. Note that with land held fixed at any arbitrary level $\bar{T}_i$ on any given 'production site,' production on that site $Y_i(L_i) = F(\bar{T}_i, L_i)$ will display diminishing returns to labor. This implies downward sloping (Value) Marginal Product of Labor (MPL) and (Value) Average Product of Labor (APL) curves are downward sloping.

Figure 3 depicts labor demand and supply and can be used to identify an equilibrium mis-allocation that typically has been attributed to a failure to exclude or limit access

to lands in the 'unenclosed' sector. In this interpretation workers are free to enter any unenclosed land site on the frontier and collect output in proportion to their share of total labor input on that site. Hence, if site i attracted L_i workers (or hours of work), each worker (or hour of labor) would earn the Value Average Product of Labor $\frac{Y(L_i)}{L_i}$ on the site. The reward to each worker is the same if we instead interpret workers as receiving equal land allocations or shares of output under 'communal' organization.

Suppose some lands have been enclosed. The owners of these privatize land plots now hold property rights that allow them to exclude all others from access. They now act as 'landlords' to maximize profits by hiring labor up to the point where the value MPL of the last worker hired is equal to the cost of hiring. Alternatively, they can now lease out or sell the enclosed land to tenants/buyers who on competitive markets will raise their bids to pay the same amount in the form of land rent.

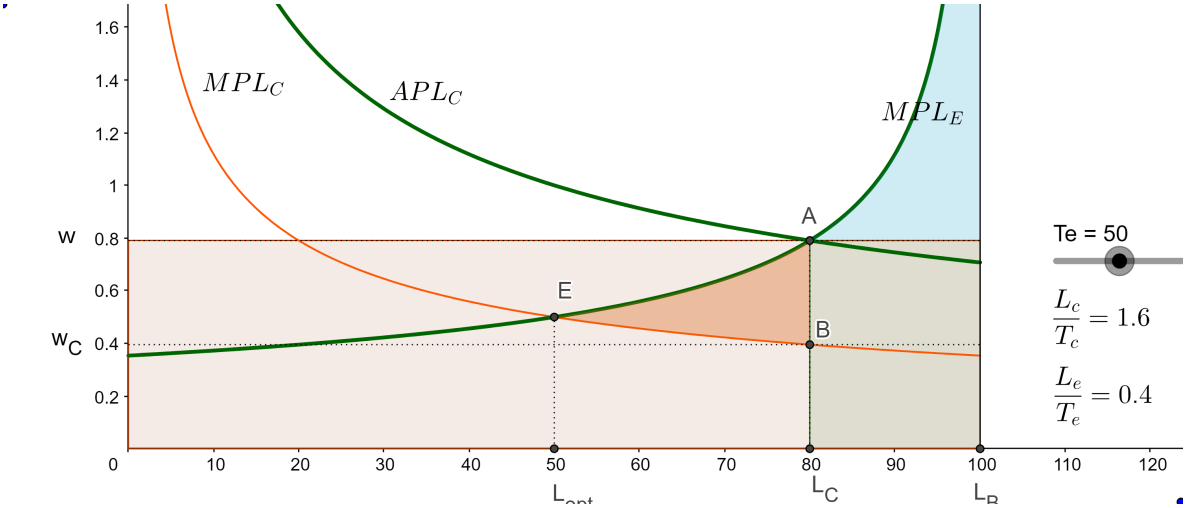

Figure 3: Equilibrium with 50 percent enclosed lands

The labor demand use curves in figure 3 are drawn for an economy with Cobb-Douglas production technology F with $\alpha = \frac{1}{2}$ and endowments of $\bar{T} = 100$ units of land and $\bar{L} = 100$ units of labor (represented by the length of the base of the figure). As depicted, $T_e = 50$ or half the $\bar{T} = 100$ units of land have been enclosed. For now we maintain the assumptions that the technology is the same on enclosed and unenclosed lands and there is zero cost of enclosure.

Labor use in the unenclosed sector is given by the horizontal sum of the value average product of labor in that sector, indicated in the figure simply by APL_C. This curve can also however be viewed as labor supply to the enclosed sector, since employers there will have to offer wages sufficient to draw workers out of the unenclosed sector where they earn the value average product of labor. The MPL_E curve represents total

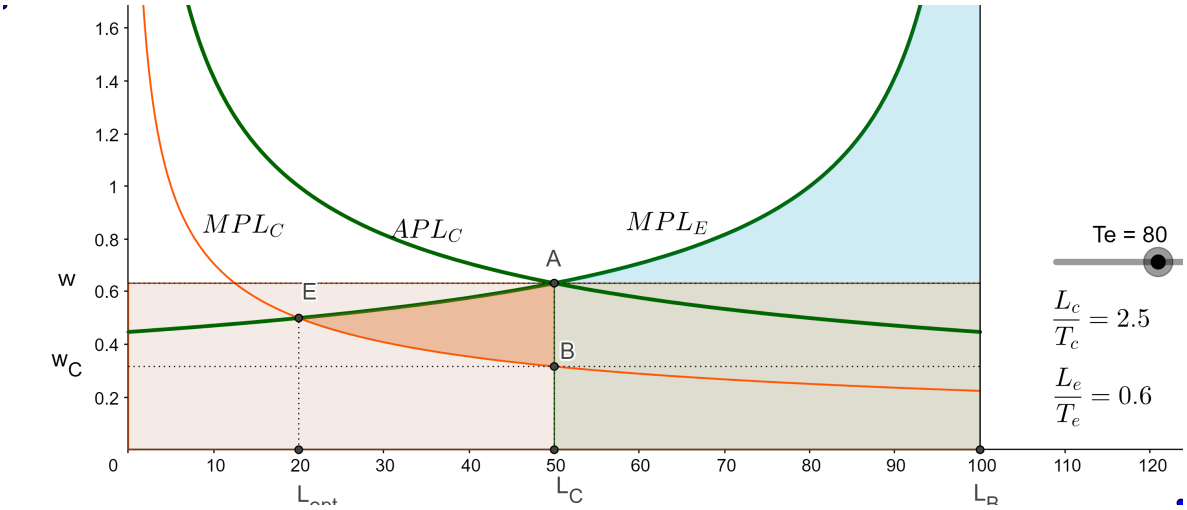

Figure 4: Equilibrium with 80 percent enclosed lands

demand for labor by the profit-maximizing farms in the enclosed sector and is given by the horizontal sum of value marginal product of labor curves from each of the farms operating on enclosed lands.

A market equilibrium wage in the enclosed sector is found where labor demand matches supply at point A, with $L_C = 80$ units of labor in the unenclosed or customary sector, and $L_E = \bar{L} - L_C$ units of labor in the enclosed sector. In equilibrium workers earn wage w_E that will be equal to both the value marginal product of labor in the enclosed sector and the value average product of labor on the frontier or unenclosed sector.

$$MPL_E = w_E = APL_C > MPL_C \tag{10}$$

This last inequality, which follows simply from the property that the value marginal product lies everywhere below the value average product, tells us that the marginal product of labor do not equalize.

4.3.1 Tragedy of the commons or a tragedy of enclosures?

This well recognized mis-allocation is represented by deadweight loss area AEB in the figure and reflected in workers being 'crowded' or 'congested' into unenclosed lands where the value marginal product of labor is low, compared to enclosed lands. With zero enclosure costs, efficiency in production would have required labor-land intensities to be the same in the two sectors but in this simple parameterized example we see four times as many workers in the unenclosed sector even though the two sectors have the

same land surface. This 'overuse' or resources is the commonly described 'tragedy of the commons' and is typically attributed to the inability of the community of users in the unenclosed sector to limit entry due to the absence of rights of exclusion. Each new entrant to a site in the unenclosed enters to capture rent from using land but disregards the negative crowding externality or rent-dissipating effect they impart upon others.

This is the usual story but, in a general equilibrium setting, it seems partial. The 'problem' of 'too much' labor in the unenclosed sector is, after all, just the other side of a 'problem' of 'too little' labor employed in the enclosed sector. If we placed the emphasis more on the second side of this description, should we not perhaps relabel this 'a tragedy of the enclosures'?

In fact in this economy, where everyone has access to the same technology, it is trivial to demonstrate that there would be no mis-allocation at all if all lands had remained unenclosed, since then average products and therefore also marginal products would equalize. In a very real sense the mis-allocation we see here has been driven by the fact that half the lands have become enclosed. We could blame the crowding into the unenclosed sector on a supposed failure of exclusion 'attracting' workers into that sector, but it would be just as valid to describe enclosers' reduced demand for labor per unit of land as 'driving' workers there.

4.3.2 Land use rights under customary tenure

Thus far we've simplistically described lands in the unenclosed sector as either open-access, or communal possibly along the lines of an 'egalitarian output-sharing economy ... with no markets in labor or land (Cohen and Weitzman, 1975, p.307).' These are strong, unrealistic, and unecessary behavioral and institutional assumptions. We prer to instead draw inspiration from the rich literature on customary land tenure in Africa to advance a different interpretation. As a rich anthropological and case study literature makes clear, particularly in areas where commercialization is already advanced, it is common to find individuated use-rights and even fairly active land and labor markets within the customary sector of many countries (Ostrom, 1990; Platteau, 1996; Berry, 1993; Ensminger, 1996).

In order to fit this description we will assume that households in the 'unenclosed' customary sector hold individualized land-use rights and maximize profits and that land and labor are competitively priced within the local economy. The key friction is that these land use rights are rights of possession conditioned on membership and participation in the community. Such land rights will remain secure only so long as the users continue to live and work those lands in the community. Under this interpretation

households will compare the income they can earn in the local customary economy to the wages they could earn by moving to work for others outside the community for higher wages on enclosed lands, or in an urban area, but at the expense of losing their land use-rights.

This economy can be described mathematically. From the linear homogeneity assumption and Euler's Theorem:

$$F(T_C, L_C) = F_T \cdot T_C + F_L \cdot L_C$$

where T_C and L_C are total land and labor employed in the customary sector. This just the statement that total factor payments in the customary sector will exhaust total output there. Now divide by L_C and rearrange to obtain:

$$\frac{F(T_C, L_C)}{L_C} = F_L + F_T \cdot \frac{T_C}{L_C}$$

which we can write as:

$$APL_C = MPL_C + MPT_C \cdot \frac{T_C}{L_C} \tag{11}$$

If land and labor are competitively priced *within* the unenclosed economy then the local competitive wage and land rental rate can be written as $w_C = MPL_C$ and $r_C = MPT_C$, respectively and this can be rewritten as:

$$APL_C = w_C + MPT_C \cdot \frac{T_C}{L_C} \tag{12}$$

A representative household with one unit of labor earns factor income equal to the wage w_C the earn on their unit of labor plus land rental income from their share of land use rights, or $\frac{T_C}{L_C}$ units of land.

Euler's decomposition can be seen in figure 3. Total income of households in the customary sector represented by the rectangular area $APL_C(L_C) \cdot L_C$ can also be decomposed or represented as the sum of implied land-rents (or profits) $r_C \cdot T_C$ from customary land use-rights given by the area beneath the value marginal product of labor curve and above the w_C line, and wage income in the sub-economy represented by rectangular area $w_C \cdot L_C$.

If we substitute our decomposition of APL_C from (12) into our earlier labor market equilibrium condition in the enclosed sector from (10) we can write

$$w_C + r_C \cdot \frac{T_C}{L_C} = w_E \tag{13}$$

A worker compares the wage they could earn in the enclosed sector to the earnings they would have to give up in the customary sector which can be thought of as made up of a low local wage w_C and the implied rental income from the land use-rights they claim by possession and membership there. Rearranging slightly

$$r_C \cdot \frac{T_C}{L_C} = (w_E - w_C) \tag{14}$$

This makes clear that land use-rights in the customary sector come at the cost of the foregone wages that the representative member in effect gives up by devoting themselves to the protection of their use-it-or-lose-it rights. Household will enter or remain in the customary sector until the opportunity costs of the resources foregone equal the value of the land rents captured. Explained this way, this is akin to a situation of open-access as it assumes that the community is unable to collectively organize to limit access and protect the value of rents. There is of course a very large and important theoretical and empirical literature on how well communities can overcome transactions costs and free-rider problems to regulate access (Baland and Platteau, 1996; Ostrom, 1990). Later in the paper we will study how allocations change when households are assumed to be able to better regulate access by new entrants, and strategies to strengthen that capacity are key.

But to mangle a saying, you don't enter into battle to improve resource allocations with the institutions that you wish you could have, you enter into battle with the institutions you actually have (and ask how can these be transformed). What we seek to demonstrate in the following sections is that even when we seemingly stack things *against* favoring customary tenure by assuming that entry *cannot* be regulated, market driven enclosure or privatization processes may or may not lead to improvement, and sometimes they can make things worse.

4.3.3 Enclosure, wages, and property rights scrambles

Armed with our new interpretation of the customary sector, let's return to figure 3 and now 4 to loosely outline here some arguments that we will argue more formally in the richer model of section 5. As we've argued, households are willing to work and remain in the customary sector, where the labor productivity and the local wage w_C are lower than the wage in the enclosed sector w_E, because they are compensated by the implied land rents from access to customary lands. From the standpoint of employers in the enclosed sector the wage of labor is 'high' (distance AB above w_C) which limits the sizes of the rents from land that they can capture. The wage gap is what drives the

lower demand for labor on a unit of enclosed land compared to labor use on a similar unit of land in the customary sector. This implies that if a new unit of land is enclosed, net demand for labor in the economy will fall and with it the equilibrium wage w_E and therefore also earnings in the now more crowded unenclosed sector. This last effect is an external general equilibrium effect that an individual encloser would typically ignore, but notice that the lower equilibrium wage w_E will also raise profits or rents to be captured from enclosing lands, potentially setting off a new round of enclosure.

If there were a cost to enclosing land, as we will study below, then this sets things up for a potential strategic complementarity between enclosers, since the costly act of enclosure by one raises the marginal return to enclosure for the other. As is well understood, this sets things up for multiple pareto ranked equilibria, the possibility that the private economy could get 'stuck' at an inefficient equilibrium, and sudden cascades as the economy quickly transitions from one equilibrium to the other, which here can be interpreted as property rights scrambles.

We model these possibilities precisely below but we can get a visual sense of why decentralized enclosure processes might exhibit such behaviors. Compare figure 3 where half of all lands had been enclosed to figure 4 where eighty percent of lands are enclosed. The total value of land rents captured by landlords in the enclosed sector is the area under the MPL_E curve above the wage line w_E. Recall that we'd noted that resource allocation would be efficient at zero enclosure, so the enclosure of fifty percents of lands generated rents for new landlords while increasing deadweight loss. Now as enclosure increases from fifty to eighty percent of the land area the size of these rents increases significantly further yet the deadweight loss area in the two scenarios hardly changes. Landlords here are driving an enclosure process to capture land rents even as this at first increases mis-allocation. Mis-allocation will be eventually eliminated in this simple example the enclosure of lands proceeds to one hundred percent. However, the equilibrium wage w_E in the enclosed sector, which also measures what a household can earn in the customary tenure sector falls steadily as lands are enclosed. What is driving many of these results is that the way we have described thus far each act of enclosure in effect reduces land available to land-use holders in the customary sector and transfers it to private property claimed by an encloser. Enclosure in effect includes an act of dispossession, allowing one individual to grab as new private property land that had previously been held under communal tenure.

If the enclosers were the customary land use-right holders themselves, which is the aim of many land formalization policies, then many of these strongly regressive impacts might be avoided. Unfortunately, many of the same strategic incentives will still be at

work and costly inefficient scrambles for property rights can also result.

4.3.4 The labor expulsion argument and colonial settler policies

Before moving to the a more general model it's worth briefly commenting on the 'labor expulsion' effect noted above. It's a topic that has been at the center of many commentaries and critiques of historical enclosure processes, from Henry Moore, to Marx and Brenner.[5]

Writing in his 1516 *Utopia* Sir Thomas More famously described the 16th century processes by which "nobility and gentry, and even those holy men, the abbots..." had taken lands previously farmed or accessed by villagers under customary law, and converted them via enclosures into pastures. Noting the sharp collapse in labor use that followed he wrote that English sheep 'may be said now to devour men, and unpeople, not only villages, but towns." Historian R.H. Tawney is one of many to note how "The displacement of a considerable number of families from the soil accelerated, if it did not initiate, the transition from the medieval wage problem, which consisted in the scarcity of labour, to the modern wage problem, which consists in its abundance (Tawney, 1912, p.3)"

The concern that smallholder access to frontier or customary tenure lands might drive up the cost of labor and thereby lower the rents captured by landlords was also an important if not a primary, focus of attention of political economists in the 19th century and later debates concerning the transitions to agrarian capitalism. A strong case can also be made that white colonial settler land and labor policies in Africa, as well as land policies by some post-colonial governments many years later, were driven by similar concerns about the 'problem' of limited labor supply when native populations had access to lands. This was clearly recognized by the visting Reverend J.E. Casalis who, observing Boer campaigns against the Sotho in South Africa in the 1860s noted that the Boers took every opportunity to:

> add farm to farm, pasture to pasture...to force the natives...to live in such narrow limits that it becomes impossible to subsist on the produce of agriculture and livestock and to be compelled to offer their services to the farmers in the capacity of domestic servants and laborers (quoted in Feinstein, 2005, , p34)

[5]Sir Thomas More in his 1516 *Utopia* s More lyrically described English enclosure processes in which "nobility and gentry, and even those holy men, the abbots..." had acted to enclose lands , that had previously often been farmed by villagers under customary law, and covert them into pastures. Noting the sharp collapse in labor use that followed he wrote that English sheep 'may be said now to devour men, and unpeople, not only villages, but towns."

As argued by Binswanger and Deininger (1993) and many others, South African land and labor policies, exemplified by the Natives Act of 1913 sought to actively dispossess communities of land rights, limit black African farmers access to land through tenancies, and tax and suppress successful black African smallholder farmers all in an effort to maintain labor supply and profitability to white settler farms and mines. This in turn over time evolved into the system of Apartheid.[6]

5 Decentralized Private Enclosure

We now present a more complete formal analysis, building on Baker and Conning (2020) adding back two important elements we turned off for the simple diagram analysis: the possibility that enclosure could lead to a change of TFP on the newly enclosed lands, captured by TFP parameter θ, and the fact that the enclosure process is costly, captured by c.

Note that the marginal product of labor in the enclosed sector, given a fraction of land t_e enclosed, will be:

$$w = MPL_E = \alpha\theta\left(\frac{T_e}{L_e}\right)^{1-\alpha} = \alpha\theta\left(\frac{t_e}{l_e}\right)^{1-\alpha}\cdot\bar{t}^{1-\alpha} \tag{15}$$

Labor in the customary sector, by contrast, earns an average product:

$$APL_C = \frac{T_c^{1-\alpha}L_c^{\alpha}}{L_c} = \left(\frac{1-t_e}{1-l_e}\right)^{1-\alpha}\cdot\bar{t}^{1-\alpha} \tag{16}$$

In equilibrium the wage in the enclosed sector must equal average product on the commons, so t_e, l_e must satisfy:

$$\alpha\theta\left(\frac{t_e}{l_e}\right)^{1-\alpha} = \left(\frac{1-t_e}{1-l_e}\right)^{1-\alpha} \tag{17}$$

Note how this mirrors the labor allocation condition (4) used in the last section to solve the planner's problem except that now the left hand side is pre-multiplied by $\alpha < 1$. Solving equation (17) for l_e gives us the equilibrium fraction of labor allocated to the enclosed sector in the private economy, which mirrors that in equation (5):

$$l_e^*(t_e) = \frac{\Lambda t_e}{1+\Lambda t_e - t_e}, \quad \Lambda = (\alpha\theta)^{\frac{1}{1-\alpha}} \tag{18}$$

[6]See also Conning (2012) for a formal modeling of labor monopsony power distorted markets via land access manipulation.

We now have a new function describing the share of labor l_e that will be allocated to enclosed lands in the private economy as a function of t_e. The function once again maps the unit interval onto itself. A more subtle property is that $l_e^*(t_e)$ can be either concave or convex, depending on whether or not $\Lambda \lessgtr 1$ or equivalently as $\theta \lessgtr \frac{1}{\alpha}$. If the productivity gain $\theta < 1/\alpha$ then $l_e^*(t_e)$ must be convex.

This implies, strikingly, that at any level of partial enclosure t_e, the market economy employs *less* labor intensive methods on enclosed lands compared to unenclosed lands even though, as pointed out above from our analysis of equation (5) it would be efficient to employ *more* workers per unit of land on the now higher productivity enclosed sites! Figure 1 compares efficient labor use (top dashed line) versus private sector labor use at any given enclosure share.

Now that we understand how labor will be allocated, for any given level of enclosure, let's turn to the question of how that is determined in a decentralized equilibrium. We assume that each unit of land in the economy will have a potential 'owner-claimant' who can, if they pay enclosure cost c per unit land, win a claim contest that allows them to establish exclusive possession of that land. For the moment we think of these as outsiders (say politicians from the city or other elites) and not existing use-rights, although later we will return to ask how things change if they were. We imagine the following sequence of events describing the enclosure decision:

1. The owner-claimants acting independently and simultaneously decide whether or not to enclose each parcel in $\bar{T}$. Once enclosed the land may be operated by the encloser or rented out at the new market equilibrium land rental rate. The private parcel is enclosed if the expected land rental rate on enclosed lands is greater than or equal to the cost of enclosure.

2. Labor moves between enclosed and unenclosed plots until the market wage paid on enclosed lands equals what labor can earn on unenclosed lands.

The private return to enclosure will given by marginal product or land or land rental rate which we can express as a function of the enclosure rate:

$$r = MPT_E = (1-\alpha)\theta F_T \tag{19}$$

$$= (1-\alpha)\left(l \cdot \frac{l_e^*(t_e)}{t_e}\right)^{\alpha} \tag{20}$$

Substituting in the equilibrium expression l_e^* from (18) gives r in (19) strictly as a function of the fraction of enclosed land:

$$r(t_e) = \theta \cdot (1-\alpha) \cdot \Lambda^{\alpha} \cdot \bar{l}^{\alpha} \cdot (1 + (\Lambda - 1)t_e)^{-\alpha} \tag{21}$$

where $\bar{l} = \frac{\bar{L}}{\bar{T}}$ is population density. Anyone making an enclosure decision - whether in concert or in atomistic fashion, will consider the return on land given in (21) relative to the enclosure cost. Inspection of (21) shows that it owes its characteristics to those of (18). In particular, r, the rental rate on land, is increasing in t_e whenever $\Lambda < 1$ (or equivalently $\theta < 1/\alpha$), mirroring the conditions under which $l_e^*(t_e)$ is convex. The opposite is true when $\Lambda > 1$, and in this case r is decreasing in t_e.

We can arrive at a corresponding expression for the equilibrium wage, conditional on t_e:

$$w(t_e)^* = \left(\frac{t_e}{l_e(t_e)^*}\right)^{1-\alpha} \cdot \bar{t}^{1-\alpha} = (1 - t_e + \Lambda t_e)^{1-\alpha} \cdot \bar{t}^{1-\alpha} \tag{22}$$

We model decentralized enclosure as a game played by a continuum of atomistic players, and search for Nash equilibria. Each owner takes the fraction of enclosed land t_e as given in making its decision to enclose. If c is the cost of enclosure, the owner finds it in their interest to enclose if:

$$r(t_e) \geq c$$

where $r(t_e)$ is given by (5). The nature of the Nash equilibria of the game turns on whether or not $r'(t_e) > 0$; if the rental rate on enclosed land is increasing in the fraction of land enclosed then there are strategic complementarities between owners in the decision to enclose. As each owner encloses they release laborers into the market lowering the wage and hence raising the land rental rate to be captured by other would-be enclosers. This leads to the possibility of multiple equilibria and contagion effects. One then has to check the $r(t_e)$ function at its endpoints. If $r(0) > c$, and $r'(t_e) > 0$, then the unique equilibrium is complete enclosure. If $r(1) < c$, and $r'(t_e) > 0$, then the unique equilibrium is no enclosure. Finally, if $r(0) < c$ but $r(1) > c$, then there are multiple equilibria; either no enclosure or all enclosure occurs. This case is illustrated in Figure 5. In this parameter configuration if the economy starts with no enclosure at $t_e = 0$ then it will be privately unprofitable for any one owner or small group of owners to enclose land because as can be seen $r(0) < c$. However if a large enough fraction of land were to suddenly become enclosed (in the diagram, more than $t_e = 0.6$ then

all owner-claimants would find it now profitable.[7] Notice also that as the return to enclosure steadily increases with the enclosure rate in the private economy the market equilibrium wage falls as more and more workers are dispossessed of use rights.

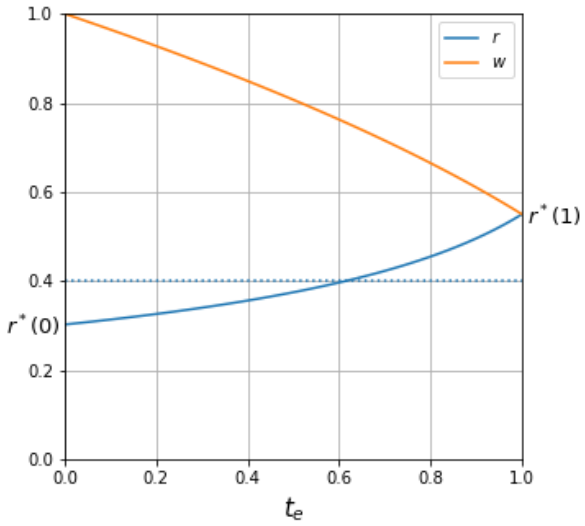

Figure 5: Equilibrium Rental rate and wage as a function of enclosure rate

This diagram is similar to one in de Meza and Gould (1992) but our model allows for considerably richer comparative statics and results. Consider the case where the improvement in technology is large enough that $\Lambda > 1$ (or equivalently $\theta > 1/\alpha$). This results in $r'(t_e) < 0$ so that the rental rate would be decreasing in the fraction of enclosed land. In this situation, enclosures will occur up until the point that $r(t_e) = c$, if such a point is attainable. We can then say that if $r(0) > c$, there will be some enclosure, and if then $r(1) > c$ there will be full enclosure. The first case (partial enclosure) requires:

$$r(0) \geq c \quad \rightarrow \quad \frac{1-\alpha}{\alpha}\Lambda \bar{l}^{\alpha} \geq c$$

Again using $\bar{l} = \frac{\bar{L}}{\bar{T}}$, to represent the labor/land ratio, we can rearrange the above to give:

$$l \geq \left[\frac{\alpha c}{(1-\alpha)\Lambda}\right]^{\frac{1}{\alpha}} = l_0^d \tag{23}$$

The condition $r(1) > c$ will lead to full enclosure in the private economy. Repeating

[7] There is an additional interior equilibrium with partial enclosure at $t_e = 0.6$ but that equilibrium can be seen to be unstable – a slight perturbation above or below would lead to a cascade either toward rapid total enclosure, or un-enclosure of already enclosed lands.

the logic above gives us this boundary:

$$p \geq \left[\frac{c}{(1-\alpha)\theta}\right]^{\frac{1}{\alpha}} = p_1^d \tag{24}$$

So long as $\Lambda > 1$, which requires $\theta > \frac{1}{\alpha}$, then one can show that the p_0^d locus lies below the p_1^d locus in p, θ space. For those p, θ combinations above both loci, we have full enclosure occurrence in the decentralized model. For those combinations below p_0^d, we have no enclosure, and between the two lines, some enclosure in the decentralized equilibrium. See Figure 6.

5.1 Private Enclosure as a Global Game

In the remaining case where $\Lambda < 1$, or when $\theta < \frac{1}{\alpha}$, the p_0^d locus lies *above* the p_1^d locus, which means there are strategic complementarities and the possibility of multiple equilibria: given there is no enclosure, all owners prefer to not enclose, but if a large enough fraction encloses, then all owners prefer to enclose. As a practical matter, it is then useful to have a means to choose one of the two possible pure strategy equilibria. One way of selecting a single equilibrium is described in the literature on Global Games as originally described in Carlsson and van Damme (1993), and extended by Morris and Shin (2003).

This literature demonstrates the remarkable result that if each player observes a noisy signal of the true payoffs (e.g. there is a small amount of uncertainty about a fundamental), then we can replace the multiple Nash equilibria with a single Bayes-Nash equilibrium. We formalize this idea here as follows. Suppose there is some uncertainty about θ, which could be drawn from an arbitrary distribution. Each owner receives a signal about θ with some additive noise parameterized by σ. As σ gets arbitrarily small, a unique equilibrium survives iterated deletion of dominated strategies, and this equilibrium can be found by finding the value of θ at which agents are indifferent between enclosing or not, given a uniform expectation over the fraction of others that will enclose. In our case, the critical θ is found by solving (remembering that $\Lambda = (\alpha\theta)^{\frac{1}{1-\alpha}}$):

$$\int_0^1 \left[(1-\alpha)\frac{\Lambda}{\alpha}\bar{l}^{\alpha}(1+\Lambda t_e - t_e)^{-\alpha} - c\right] dt_e = 0 \tag{25}$$

Performing the integration in (25), allows us to say that the unique outcome is

enclosure if:

$$l \geq \left(\frac{\alpha c}{1 - \alpha\theta} \frac{1 - \Lambda}{\Lambda} \right)^{\frac{1}{\alpha}} = l_{gg}^{d} \tag{26}$$

The interpretation of (26) is best assessed by reference to Figure 6.

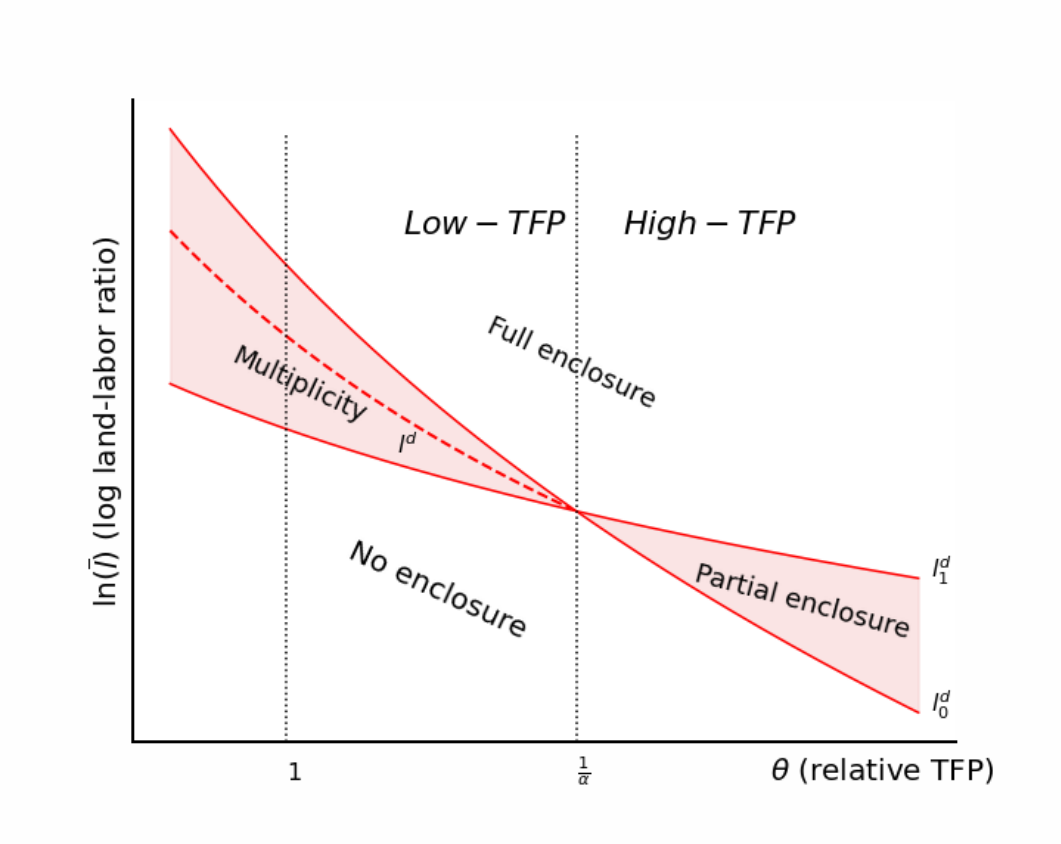

Figure 6: Equilibrium Atomistic Enclosures

This Figure shows how changes to the parameters change the nature of competitive equilibria. To the right of the $\frac{1}{\alpha}$ line, we get either full, some or no enclosure, while to the left of the critical line $\frac{1}{\alpha}$, we have either full enclosure or no enclosure, where there is a region where either could be an equilibrium outcome. In this region, the dashed line divides the parameter space according to the global games result (26).

We can now turn to the question of the social efficiency and distributional consequences of private decisions to enclose lands. Depending on the starting configuration of parameters, ownership regimes may emerge which from a social standpoint may involve either (1) too little enclosure; (2) too much enclosure, or (3) the efficient level of enclosure. We can see these regions by graphically superimposing the loci of figure 6 over those from our earlier Figure 2 with one small change to simplify the diagram: we

have removed the solid segments of loci l_1^d and l_0^d to the left of the $\theta = 1/\alpha$ line that had previously been used to identify the region where multiple equilibria might arise. To keep the diagram simple we lean on our application of the theory of global games trace out loci l_0^0 . The resulting diagram, figure 7, indicates a plethora of interesting cases.

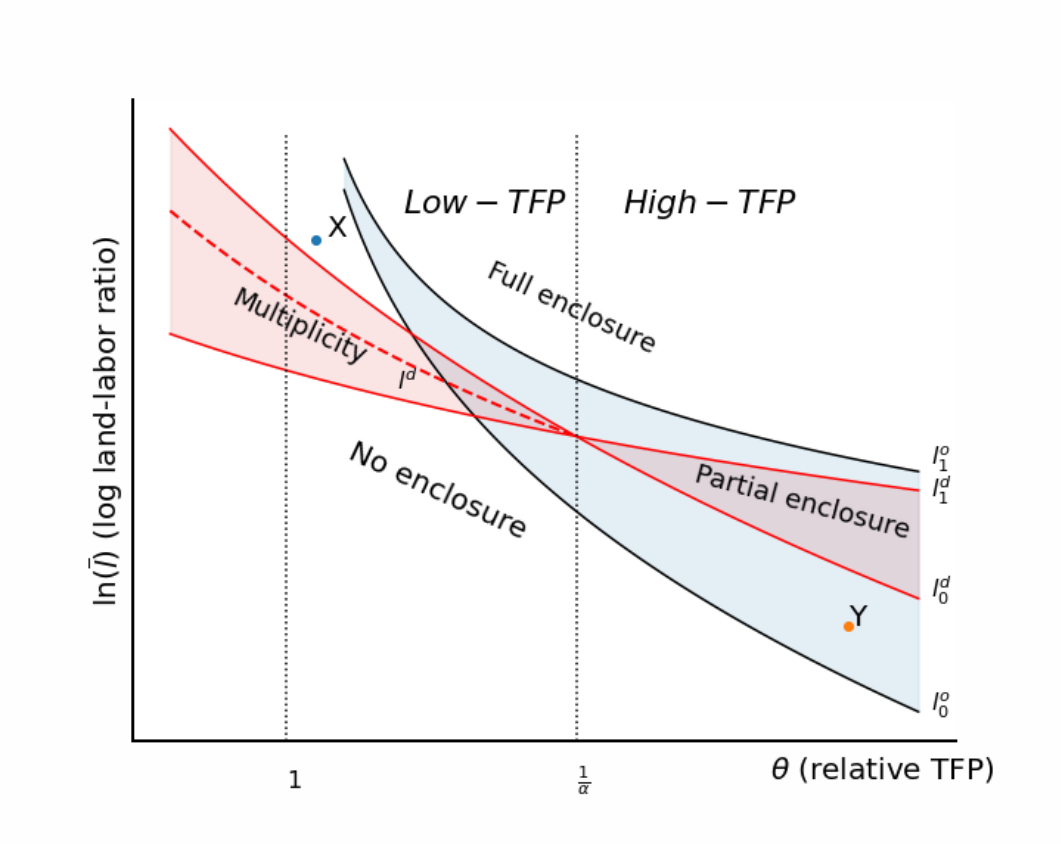

Figure 7: Competitive and Optimal Enclosures Compared

5.1.1 Inefficiently High Enclosure - A race for property rights

If the economy starts with parameters that place it above the private l_0^d loci but below the social l_0^0 loci then the private economy will lead to full enclosure even though the social optimum is to have no enclosure. More strikingly, the sacred $\theta = 1$ line has been crossed. It should never be efficient to enclose lands when $\theta < 1$ yet at high enough population density private actors push ahead to enclose all lands even though in this case it leads to the adoption of *worse* production technologies!

This happens because enclosure accomplishes three things: (1) technological transformation: it allows the adoption of different technologies, (2) allocative transformation:

by establishing exclusion rights it changes allocative decisions in society; and (3) redistributive transformation: enclosure in effect settles a latent property rights conflict in favor of the encloser, redistributing land from use-rights held by the community to now privately enclosed land held by the owner.

The last motivation dominates in this last case: even though enclosure here is actually destroys value the population density is high enough that the rental rate of enclosed lands exceeds the cost of enclosure making the seizing of claims worthwhile.

5.1.2 Inefficiently Low Enclosure – A failure to transform

The model also points to the possibility of the opposite outcome. Economies in the parameter space above the l_0^o locus marks where it is socially desirable that some enclosure occur. However, the set of points below the l_o^d locus indicate that no enclosure in fact occurs in this region of the parameter space. This occurs because the rental rate guides decisions on land enclosure, and this rental rate depends in part on how easy it is to hire labor into the enclosed sector. At the set of points between the l_0^o and l_o^d lines, labor/land density is low, and hence returns in the commons are relatively high. An individual encloser could be using an improved technology, but enclosing and adopting this technology is too costly given relatively scarce labor. From society's perspective, however, this adoption and increase in output is worth it.

5.2 Enclosure by an Encompassing interest

It is interesting to study the situation where a monopolist 'owner-claimant' is put in charge of all enclosure decisions. The monopolist will enclose lands to maximize profits (per unit land) from land sales/rentals,[8] which can be written, using (21):

$$\begin{aligned} \pi(t_e) &= r(t_e)t_e - ct_e & (27)\\ &= t_e\left[\frac{1-\alpha}{\alpha}\Lambda p^{\alpha}(1+(\Lambda-1)t_e)^{-\alpha} - c\right] & (28) \end{aligned}$$

This is like a double-marginalization problem in industrial organization, where a monopolist chooses the price of an input. From inspection of (27), we see that once again, π could be either concave or convex. In the latter case, the critical matter involves checking slopes at endpoints of the function and once again the critical question is

[8] To simplify we assume the monopolist rents/sells the enclosed lands to a large market of producers who then operate the enclosed lands on competitive labor markets. This allows us to ignore any labor-market monopsony power the landlord also might have had had they operated the land directly.

whether $\Lambda > 1$. If this is not met, then the profit function is convex and the monopolist simply checks whether $\pi(1) > 0$ and if so, encloses all the land. Plugging $t_e = 1$ into (27) and solving as before we find the locus of land pressure and technology parameters:

$$\bar{l} \geq \left[\frac{c}{(1-\alpha)\theta}\right]^{\frac{1}{\alpha}} \tag{29}$$

Interestingly, the locus in (29) exactly replicates the conditional optimality condition (24), so a monopolist encloses exactly when it is optimal to do so. This makes sense as the monopolist internalizes all spillovers.

If, however, $\Lambda > 1$, we the profit function from enclosure in (27) is concave, and could therefore yield none, some, or total enclosure as a monopoly optimum. We again use the derivative test to check whether $\pi'(0) > 0$, so that some enclosure should begin, and whether $\pi'(1) > 0$, indicating that enclosure should be full. Differentiating (29), plugging in $t_e = 0$ and $t_e = 1$, and solving gives us the two loci:

$$\bar{l} \geq \left[\frac{\alpha c}{(1-\alpha)\Lambda}\right]^{\frac{1}{\alpha}} = l_0^m \tag{30}$$

$$\bar{l} \geq \left[\frac{\alpha c \Lambda}{(1-\alpha)(\Lambda(1-\alpha)+\alpha)}\right]^{\frac{1}{\alpha}} = l_1^m \tag{31}$$

On figure 8 we can see where these monopoly lines lie relative to the earlier described social and decentralized private optima. The loci for the monopoly case is plotted in green.[9]

One can see that in the world in which $\Lambda < 1$, the monopolist basically resolves the competitive multiplicity problem and encloses whenever it generates high returns to land. We can see however that the monopolist encloses when it is socially inefficient to do so -including in situations where $\theta < 1$ so enclosure leads to the adoption of less efficient technologies. In fact the monopolist engages in socially destructive enclosures in more situations than the private decentralized economy would. This makes intuitive sense: the landlord is in a better position to raise the rental price and hence will enclose more readily (in these circumstances of relatively high population density). Unlike the decentralized case, the monopolist faces no strategic uncertainty about whether other parcels will also enclose, and hence is able to enclose in situations in which $r(0) < c$, yet $r(1) > c$.

[9]To unclutter our running diagram we have removed segments l_0^d and l_1^d to the left of the $\theta = 1/\alpha$ line which had demarcated the zone of multiple equilibria. We lean here on our global games analysis to justify leaving in only the dashed loci l^d that divides the parameter space into regions where the decentralized private economy would fully enclose or not.

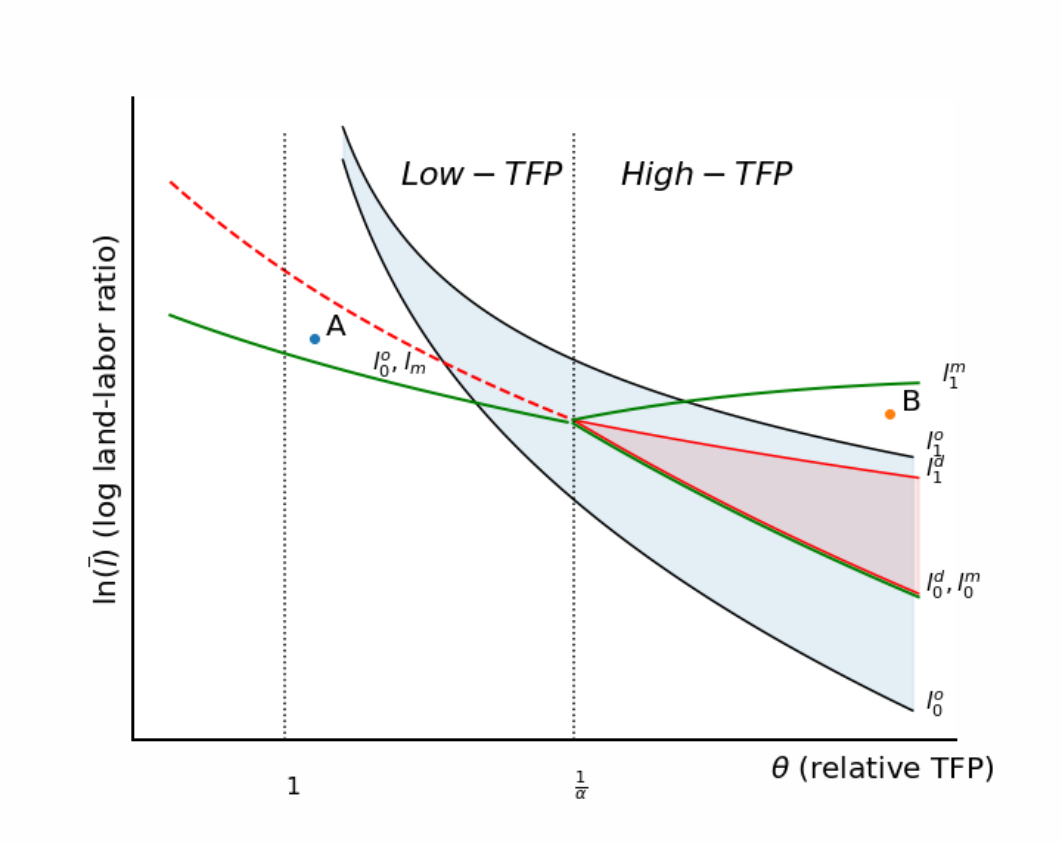

Figure 8: Competitive, Monopolistic, and Optimal Enclosures Compared

The picture is, however, very different when $\Lambda > 1$ or high productivity gains from enclosing lands. In starting enclosures, the monopolist behaves in the same fashion as the decentralized enclosure process, but fails to fully enclose all land when they should. In this sense, the monopolist behaves as one would expect a monopolist to behave - enclosing less land means it can keep the price of enclosed land higher than it otherwise would be.

5.3 The distribution of income

How does enclosure impact the fortunes of the two factors of production in the model? On the one hand each act of enclosure in effect extinguishes workers access to income from land rents and this in turn leads more workers to supply labor to the enclosed sector (and/or manufacturing) lowering the market equilibrium wage. As Samuelson (1974) remarked long ago and described before, with the same technology on enclosed and unenclosed lands, enclosure can only harm workers, even if the pie gets bigger via reduction of deadweight loss. Our model however leaves open the possibility that

new technology on enclosed lands is so improved that it could potentially raise rather than lower wages in equilibrium. To see how incomes change we plot the relative magnitudes of labor and land income as a function of land enclosed. Recall from (18), the equilibrium share of labor allocated to the enclosed sector, and our expressions for the wage (15) and the average product of labor (16). If we multiply these two expressions by $\bar{L}l_e$ and $\bar{L}(1-l_e)$, and substitute in for l_e using (18) we get an expression for total labor income:

$$Y_L = F(\bar{T}, \bar{L}) \left(1 + (\Lambda - 1)t_e\right)^{1-\alpha} \tag{32}$$

We can see that total labor income can be either decreasing or increasing in enclosures, and the critical question is whether or not $\Lambda > 1$. If it is, then total labor income benefits from enclosure, for the simple reason that the marginal product of labor is sufficiently high in the enclosed sector to support wages that are higher than average product on the commons. If we were to divide (32) by $\bar{L}$, and were to then consider per-laborer wages, we would find the same result.

What about relative income? Multiplying (21) by the $\bar{T}t_e$ gives total land income:

$$\frac{1-\alpha}{\alpha}\Lambda\bar{F}(\bar{T}, \bar{L}) \left(1 + (\Lambda - 1)t_e\right)^{-\alpha} t_e \tag{33}$$

Forming the ratio of land-to-labor income using (33) and (32) gives:

$$\frac{1-\alpha}{\alpha}\frac{t_e}{1 + (\Lambda - 1)t_e} \tag{34}$$

and yet again, we see that the relative TFP of the enclosed sector is a key parameter. When $\Lambda < 1$, this expression is increasing in the degree of enclosure and enclosure can only impoverish workers at the expense of rental income.

As we have shown the qualitative nature of many of the results depends on relative TFP in the enclosed sector. When relative TFP differences are small across the two sectors - in terms of our model parameters, when $\Lambda < 1$ or $\theta < \frac{1}{\alpha}$, we find that enclosure (1) has a contagion aspect to it so that for some parameter values, there are multiple equilibria, leading to Pareto-ranked equilibria with either no enclosure or full enclosure, (2) for many constellations of parameter values the private economy leads to inefficient equilibria with either too much or too little enclosure, and (3) consistent with Samuelson (1974) enclosure as models in these papers will generally impoverish labor at the expense of land returns unless enclosure promotes very high productivity gains. Specifically if we assume a Cobb-Douglas share of $\alpha = 1/2$ then the productivity gain from enclosure would need to be $\theta > 1/\alpha = 2)$ or 200 percent. While it's possible

to imagine such situations, most empirical analyses have found far smaller gains. We discuss this issue further in the Applications section below.

If, however, TFP is relatively high in the enclosed sector, a very different picture emerges. Enclosure 1) enclosure can be either full, nonexistent or partial, 2) enclosure might not occur even though some enclosure might be socially desirable, and 3) enclosure increases labor income both in an absolute and relative sense. Thus, in indulging debates on enclosure and its social efficacy, one must be most careful in assessing the relative productivity of enclosure.

5.4 Non-ag employment and Structural Transformation

The analysis has proceeded as if agriculture were the only sector but we can relax this assumption to allow for other outside employment opportunities say in an urban location, or perhaps another previously unused land use area. On the latter possibility, as Otsuka and Place (2014) note that a common problem caused by enclosure in one area is that labor may then leave the village to clear previously unused forest lands, creating environmental damage.

Village labor may be allocated to enclosed lands in the village, open-access lands in the village, or to an alternative use. These three types of labor add up to the total labor allocation of the village:

$$L_e + L_u + L_a = \bar{L} \tag{35}$$

Dividing both sides by $\bar{L}$ to express as shares of total labor, and rearranging gives:

$$l_e + l_u = 1 - l_a \tag{36}$$

Production in the alternative sector is:

$$G(K, L) = \bar{A}^{1-\beta} \cdot L_a^{\beta} \tag{37}$$

Here A is the available manufacturing capital or land in the alternative sector. We can rewrite this in intensive form as:

$$\begin{aligned} G(\bar{K}, L_a) &= G\left(\bar{A}, l_a \bar{L}\right) \\ &= l_a^{\beta} \cdot G(\bar{K}, \bar{L}) \end{aligned}$$

Let p denote the relative price of goods in this sector. If this is a manufacturing sector, a natural assumption is that labor earns its marginal product there. We could then

write:

$$w_a = p \cdot MPL_a = \beta \cdot \left(\frac{1}{l_a}\right)^{1-\beta} \cdot \bar{a}^{1-\beta} \tag{38}$$

Where w_a is the wage earned in the manufacturing sector. We alternatively think of this as not currently used rangeland frontiers, and new appropriative activities there leading users to capture a value average product instead. Either way, we have the marginal product on enclosed land in agriculture as given before by (15):

$$MPL_e = \alpha \cdot \theta \cdot \left(\frac{t_e}{l_e}\right)^{1-\alpha} \cdot \bar{t}^{1-\alpha}$$

And the average product of labor in unenclosed agriculture is now written as:

$$\begin{aligned} APL_u &= \frac{F(t_u, l_u)}{l_e} \cdot \frac{F(\bar{T}, \bar{L})}{\bar{L}} \\ &= \left(\frac{1 - t_e}{(1 - l_a) - l_e}\right)^{1-\alpha} \cdot \bar{t}^{1-\alpha} \end{aligned}$$

Suppose share t_e of land is enclosed. Equilibrium in the labor market requires that workers have no incentive to move from agriculture to the alternative sector, or within the enclosed and unenclosed agricultural sectors:

$$w = p \cdot w_a = MPL_e = APL_u > MPL_u$$

Let's focus on the $w_a = APL_u$ part: so that labor in the alternative use earns the same in enclosed as in unenclosed agriculture. Simplifying:

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

and solving:

$$l_e^*(t_e) = \frac{\Lambda t_e}{(1 - t_e + \Lambda t_e)} \cdot (1 - l_a)$$

which shows how our earlier expression (19) is adapted to account for the presence of an alternative sector. This model clearly nests the earlier one sector one. With a functioning alternative sector the labor supply to agriculture $(1 - l_a(w)) \cdot \bar{L}$ is elastic and increasing in w. If $\bar{A} = 0$ (or $\beta = 0$) then the alternative sector shuts down and the labor supply to agriculture becomes perfectly inelastic at $\bar{L}$ as before.

The other important expressions are also easily adapted. The 'wage' from (22) now

becomes:

$$w(t_e)^* = (1 - t_e + \Lambda t_e)^{1-\alpha} \cdot \left(\frac{\bar{t}}{1 - l_a}\right)^{1-\alpha} \tag{39}$$

In equilibrium this wage must equal the wage in the alternative sector from (38) above:

$$p \cdot \beta \bar{k}^{1-\beta} \left(\frac{1}{l_a}\right)^{1-\beta} = w(t_e)^* \tag{40}$$

from which we can solve for l_a and, with that, then solve for remaining variables as before.

As we've already noted, the cost of protecting property rights in the customary sector and also the size of the potential misallocation will be proportional to the opportunity costs of the resources involved

This last expression show how some of the previous arguments we made about relative TFP and enclosure play out in this setting. Here, whenever $\theta < \frac{1}{\alpha}$, enclosure leads to two things: de-intensification of production on enclosed land, intensification of land use on the commons, and labor movement away from the village. These last two things can be thought of as harbingers of both overuse of the village commons, and degradation of previously unused natural resources.

6 Policy pitfalls and recommendations

In this section, we revisit some of the enduring debates about land privatization and enclosure, viewing them through the lens of our model. The applications serve to accentuate some different details of the model.

6.1 Intensification, Enclosure and Land use in Sub-Saharan Africa

Otsuka and Place (2014, p. 8) write: "If the theory of induced innovation works in the African context, we should be able to observe *simultaneously* (1) investments in land improvement, (2) strengthened individual land rights, and (3) intensification of the farming system." Citing work by Headey and Jane (forthcoming), Otsuka and Place (2014) indeed note that in many parts of Sub-Saharan Africa, have occurred together, citing work by Deininger and Jin (2006) in Ethiopia and Uganda, and Deininger and Ali (2006) in Ethiopia, Kenya and Uganda. In these places, as land has been enclosed for farming, new production methods such as terracing, irrigation, adoption of alternative

animal breeds, and tree-planting have occurred, while at the same time land use has intensified.

In terms of our model, we would say that farms have incurred a cost of c to acquire a relative improvement in technology of θ. This achieved, farms now intensify production by increasing their labor usage on the land. Roughly speaking, this seems to described by the right-hand side of figure 7. While one can't say too much about relative optimality here, we can see that the departures from optimality are likely not too high here, and these three things occurring together are likely good signs.

To be a bit more technical about this, we can formally investigate the relationship between intensity and enclosure. The equilibrium fraction of labor used in the enclosed agricultural sector is given by equation (18), which we rewrite here:

$$l_e^*(t_e) = \frac{\Lambda t_e}{1 + \Lambda t_e - t_e}, \quad \Lambda = (\alpha\theta)^{\frac{1}{1-\alpha}} \tag{41}$$

We can then compute labor intensity on enclosed land as:

$$\frac{l_e^*(t_e)}{t_e} = \frac{\Lambda}{1 + \Lambda t_e - t_e} \tag{42}$$

While labor on common land is:

$$\frac{1 - l_e^*(t_e)}{1 - t_e} = \frac{1}{1 + \Lambda t_e - t_e} \tag{43}$$

We can see from (42) and (43) how relative land intensity changes as land is enclosed depends again on Λ. If Λ is greater than one, enclosure results in land being used more intensively on private parcels and less intensively on the commons. If, however, $\Lambda < 1$, then the opposite is true; enclosure results in land being used less intensively, and we get more crowding on the remaining commons. This argument can be see at its starkest simply by taking the ratio of the two terms (42) and (43), revealing that the relative land intensity ratio is simply given by Λ.

The model further allows us to think about how other quantities change as a result of enclosure. For example, a rough proxy of the degree of inequality and conflict between those who wind up owning land and those who are employed on farms might be the relative payments to land and to labor. We previously computed this expression in equation (34), which we reproduce here:

$$\frac{1 - \alpha}{\alpha} \frac{t_e}{1 + (\Lambda - 1)t_e} \tag{44}$$

We can see that the conditions leading to more intensive use also lead to a tightening of this ratio as enclosures occur. The requirement is simply that $\Lambda > 1$.

What could go wrong? Hayami and Otsuka (1993) note that whatever the technology employed, supporting technologies, such as monitoring technologies, often favor smaller farms. They document a wealth of recent evidence noting an inverse relationship between farm size and productivity. Thus, larger farms operate inefficiently relative to smaller farms, and as a result use land much less intensively. One might imagine situation in which a single entity is encouraged to undertake enclosure of the commons to improve efficiency, given an existing technology. Our positive model shows ho a single, large farm may be able to "solve" the coordination problem in favor of enclosure when such a coordinated act of enclosure increases land returns. It thus may be tempting to recommend from a policy perspective that a large farm take charge. But this risks the very real possibility of a scenario emerging like that described on the left-hand side of figure 8. Here the monopolist faces perverse incentives to enclose when $\Lambda < 1$. And even though available production technology might seem better, the arguments of Hayami and Otsuka (1993) suggest that such technology may not work nearly as well in the hands of a large farm. We can further see that when $\Lambda < 1$, enclosure by the monopolist may reduce intensity of land use, and exacerbate inequality, as now the land/labor income ratio (44) is increasing in enclosures.

An interesting cautionary tale derives from the Tibetan experience. Under the RETPEC (Range Enclosure on the Tibetan Plateau in China) policy directive, the stated objective of policy was to intensify land use on enclosed land, while at the same time relieving pressure on the commons. The reality, however, was exactly the opposite; enclosure resulted in lower land use intensity on enclosed lands, and greater pressure on common land. We can see that this quite clearly corresponds to a case in which $\Lambda < 1$.

6.2 Transformation or Resource Degradation

In section 5.4, we explore the possibility that villagers may leave the village in response to lower wages. In the low-TFP instance, this will indeed be the case, as enclosure de-intensifies production on land, lowering the wage earned on both common land and in the village enclosed sector. As a result, in light of reduced returns, some labor may leave to find new sources of land. This could be analogized with overuse of resources, but it might also result in excessive labor flooding to cities, which may cause problems of its own.

6.3 Assessing enclosure performance

AAU-ECA-AfDB (2011), present a broad picture of land tenure in Sub-Saharan Africa, what has gone right in recent policies, and what has gone wrong in the past. From this record, they present a variety of policy options, which we assess in this section, again using results from our model. They have a variety of recommendations, and most of these are suggestive of a more decentralized, flexible approach that reduces the state role in managing transition of land ownership. Instead, consensus in the community and respect of traditional and customary land ownership institutions should be encouraged.

Our model seems to provide support for these recommendations, with some potential points of caution. When enclosure allows adoption of superior production technology and results in intensification of production on land, other benefits seem to follow, according to our model. The increased demand for labor raises wages and should reduce inequality between landowners and labor. Comparing privately made enclosure decisions with optimal ones doesn't produce profound differences in outcomes. To the extent that small farmers seem to operate much more efficiently than large ones, allowing small decentralized decisions about enclosure to be made seems to allow necessary benefits.

However, in some versions of our model, in which population pressure is extreme and technology on enclosed land is not markedly superior, enclosure of land may push things in the exact opposite direction. Further, corporate enclosure by a unified interest may be more prone to do this than decentralized decision-makers. A sign that enclosure is not working as planned might be a drastic change in which land rapidly goes from common to complete enclosure.

7 Conclusions

The transformation of customary lands over time via various processes of 'enclosure' into more exclusive forms of private property has played an important role in economic history, in debates about land ownership reform, and in arguments over how institutional change impacts relative income distribution. Even today, over half the worlds' lands are held by rural communities and indigenous groups (Alden Wily, 2018), much of it under informal or customary tenure and common property regimes outside of formal property land registries. Under the pressure of rising populations, resource degradation and climate change, and the challenges and opportunities of new technologies, markets, and new state policies, land values have been pushed up often leading to new clashes of competing claims and insecurity, and political pressures to preserve or transform

existing property regimes. Will property customary regimes adapt and transform on their own to to rise to these challenges, or fail to transform. Are state interventions to useful and necessary or do they only open the door to possible wasteful property scrambles or land grabs by the state itself or connected elites?

It seems unlikely any one interpretation can settle these questions and debates. More likely: under some times and circumstances decentralized enclosure processes may emerge to lead institutional innovation that brings the economy to more efficient allocation and higher growth ('from below' or 'from above' and with or without significant shifts in the distribution of income). In other situations, dysfunctional institutions may fail to be transformed, and in yet others, the economy might be tipped into wasteful property scrambles that transform and redistribute property rights without any evident efficiency gain.

? We have shown how many issues in these debates can be usefully framed within an equilibrium model that allows for endogenous property rights transformation and claim-shifting. In contrast to many other treatments before us we have not assumed that customary tenure is inherently less efficient than private property, the relative desirability of managing land under different property regimes boils down to questions of how relative total factor productivity interacts with population density, the costs of enclosure, and market structures which vary greatly across environments. It is our hope that the framework offers a simple tool that sheds light on these complex and fascinating processes.

References

Daron Acemoglu and Martin Kaae Jensen. Aggregate comparative statics. *Games and Economic Behavior*, 81:27–49, September 2013.

Armen A. Alchian and Harold Demsetz. The property Right Paradigm. *The Journal of Economic History*, 33(1):16–27, 1973.

Liz Alden Wily. Collective Land Ownership in the 21st Century: Overview of Global Trends. *Land*, 7(2):68, June 2018.

Robert C. Allen. Enclosure and the yeoman: The agricultural development of the South Midlands 1450-1850. *Oxford University Press*, 1992.

Jean-Marie Baland and Jean-Philippe Platteau. *Halting Degradation of Natural Resources: Is There a Role for Rural Communities?* Oxford University Press, 1996.

Robert H. Bates. The agrarian origins of Mau Mau: A structural account. *agricultural history*, 61(1):1–28, 1987.

Sara Berry. Hegemony on a shoestring: Indirect rule and access to agricultural land. *Africa*, 62(3):327–355, 1992.

Sara Berry. *No Condition Is Permanent: The Social Dynamics of Agrarian Change in Sub-Saharan Africa.* University of Wisconsin Pres, 1993.

Hans P. Binswanger and Klaus Deininger. South African land policy: The legacy of history and current options. *World Development*, 21(9):1451–1475, 1993.

Hans P. Binswanger, Klaus Deininger, and Gershon Feder. Power, distortions, revolt and reform in agricultural land relations. *Handbook of development economics*, 3: 2659–2772, 1995.

Ester Boserup. *The Conditions of Agricultural Growth. The Economics of Agrarian Change under Population Pressure.* Allan and Urwin, London, 1965.

Robert Brenner. Agrarian class structure and economic development in pre-industrial Europe. *Past & present*, 70(1):30–75, 1976.

D. W. Bromley, editor. *Making the Commons Work: Theory, Practice, and Policy.* Institute for Contemporary Studies Press, San Francisco, 1992.

Hans Carlsson and Eric van Damme. Global Games and Equilibrium Selection. *Econometrica*, 61(5):989, 1993.

R. H. Coase. The Problem of Social Cost. *The Journal of Law and Economics*, 3:1–44, 1960.

Jon S. Cohen and Martin L. Weitzman. A Marxian model of enclosures. *Journal of Development Economics*, 1(4):287–336, 1975.

Jonathan Conning. On the Causes of Slavery or Serfdom and the paths to agrarian capitalism: Domar's Hypothesis revisited. 2012.

David de Meza and J. R. Gould. The Social Efficiency of Private Decisions to Enforce Property Rights. *Journal of Political Economy*, 100(3):561–580, 1992. ISSN 0022-3808.

Hernando de Soto. *The Mystery of Capital: Why Capitalism Succeeds in the West and Fails Almost Everywhere Else*. Basic Books, New York, 2000.

Jean Ensminger. *Making a Market: The Institutional Transformation of an African Society*. Cambridge University Press, 1996.

Charles H. Feinstein. *An Economic History of South Africa: Conquest, Discrimination, and Development*. Cambridge University Press, 2005.

Markus Goldstein and Christopher Udry. The Profits of Power: Land Rights and Agricultural Investment in Ghana. *Journal of Political Economy*, 116(6):981–1022, 2008. ISSN 0022-3808. doi: 10.1086/595561.

Tabitha Kanogo. *Squatters and the Roots of Mau Mau, 1905-63*. East African Publishers, 1987.

Thomas W. Merrill. Formalization, Possession, and Ownership. In *Brigham-Kanner Prop. Rts. Conf. J.*, volume 6, page 113. HeinOnline, 2017.

Stephen Morris and Hyun Song Shin. Global Games: Theory and Applications. In *Advances in Economics and Econometrics: Proceedins of the Eight World Congress of the Econometric Society*, page 56. Cambridge University Press, 2003.

Jennifer Brick Murtazashvili and Ilia Murtazashvili. *Land, the State, and War: Property Institutions and Political Order in Afghanistan*. Cambridge Studies in Economics, Choice, and Society. Cambridge University Press, Cambridge, 2021. ISBN 978-1-108-49341-3.

Ato Kwamena Onoma. *The Politics of Property Rights Institutions in Africa*. Cambridge University Press, 2009.

Elinor Ostrom. *Governing the Commons: The Evolution of Institutions for Collective Action*. Cambridge university press, 1990.

Jean-Philippe Platteau. The evolutionary theory of land rights as applied to sub-Saharan Africa: A critical assessment. *Development and change*, 27(1):29–86, 1996.

Paul A. Samuelson. Is the Rent-Collector Worthy of His Full Hire? *Eastern Economic Journal*, 1(1):7–10, 1974. ISSN 0094-5056.

James C. Scott. *Seeing like a State: How Certain Schemes to Improve the Human Condition Have Failed*. Yale University Press, 1998.

Parker Shipton and Mitzi Goheen. Introduction. Understanding African land-holding: Power, wealth, and meaning. *Africa*, 62(3):307–325, 1992.

Espen Sjaastad and Daniel W. Bromley. Indigenous land rights in Sub-Saharan Africa: Appropriation, security and investment demand. *World Development*, 25(4):549–562, 1997.

Richard Henry Tawney. *The Agrarian Problem in the Sixteenth Century*. Longmans, Green and Company, 1912.

Jeremy Waldron. Property and ownership. 2004.

Martin L Weitzman. Free access vs private ownership as alternative systems for managing common property. *Journal of Economic Theory*, 8(2):225–234, June 1974. ISSN 0022-0531. doi: 10.1016/0022-0531(74)90015-5.

Ellen Meiksins Wood. *The Origin of Capitalism: A Longer View*. Verso, 2002.