

Development II

Fall 2021

Jonathan Conning

Hunter College and The Graduate Center*

City University of New York

Introductions

Economic history periodization and schools of thought

(de Janvry and Sadoulet, 2016)

Why isn't the whole world developed?

- Technology and other assumptions
- Neo-classical benchmarks
 - Efficient allocation and convergence
 - Solow Growth
 - Trade
 - Factor movement
- Misallocation
 - Lewis, dualism and its critics
 - enduring puzzles
 - modern takes

Lucas, Robert E. 1990. "Why Doesn't Capital Flow from Rich to Poor Countries?" *American Economic Review* 80 (2): 92–96. [link](#)

Gollin, Douglas. 2014. "The Lewis Model: A 60-Year Retrospective." *Journal of Economic Perspectives* 28 (3): 71–88. [link](#)

Gollin, Douglas, David Lagakos, and Michael E. Waugh. 2013. "The Agricultural Productivity Gap." *The Quarterly Journal of Economics* 129 (2): 939–993. ([link](#))

Also useful: [jupyter notebooks](#) on Specific Factors, Edgeworth Boxes and Lucas 1990.

Week 2 (2/4)

Puzzles and Neoclassical and Institutional Frames

- Lucas, Robert E. "Why Doesn't Capital Flow from Rich to Poor Countries?" *The American Economic Review* (1990): 92-96.
- Gollin, Douglas, David Lagakos, and Michael E. Waugh. 2013. "The Agricultural Productivity Gap." *The Quarterly Journal of Economics* 129 (2): 939–993.

Theories of institutions and institutional change

- North, Douglass. 1990. "An Introduction..," chapter 1 in Institutions, Institutional Change, and Economic Performance. Cambridge; New York: Cambridge University Press.
- (o) Bardhan, Pranab. 1989. "Alternative Approaches to the Theory of Institutions in Economic Development." chapter 1 in The Economic Theory of Agrarian Institutions. Oxford University Press
- (o) Acemoglu, Daron, Simon Johnson, and James A. Robinson. 2005. "Institutions as a Fundamental Cause of Long-Run Growth." Handbook of Economic Growth 1: 385–472. (selections)

Next week (Empirical institutions)

- Dell, Melissa. "The Persistent Effects of Peru's Mining Mita." *Econometrica* 78, no. 6 (2010): 1863-903.[[link to paper](#)] [[to data and code for replication](#)]
- Nunn, Nathan. 2008. "The Long-Term Effects of Africa's Slave Trades." *The Quarterly Journal of Economics* 123 (1): 139–176.[[link to paper and data and code for replication](#)]

contd.

(to further study RDD, interesting, replicable papers)

- Meyersson, Erik. 2014. "Islamic Rule and the Empowerment of the Poor and Pious." *Econometrica* 82 (1): 229–269.
- Bubb, Ryan. 2013. "The Evolution of Property Rights: State Law or Informal Norms?" *The Journal of Law & Economics* 56 (3): 555–94.

Week that follows: modeling Property Rights, Conflict, and Equilibrium agrarian structures.

Neoclassical Models

- Assumptions, Tricks and main Predictions

Homogeneous and Homothetic Production Functions

A function is homogenous of degree k if:

$$F(\tau K, \tau L) = \tau^k F(K, L)$$

Linear-homogeneous or Constant Returns to Scale ($k=1$):

$$F(\tau K, \tau L) = \tau F(K, L)$$

Fix any one factor, diminishing returns to the

Production in intensive form (output per worker).

If $k=1$, set $\tau = \frac{1}{L} : F(\frac{K}{L}, 1) = \frac{F(K,L)}{L} = f(k)$

where $k = \frac{K}{L}$, capital per worker. $f'(k) > 0$, $f''(k) \leq 0$

Homogenous \rightarrow Homothetic

If F is homog. of degree k , marginal products are homog. of degree $k - 1$.

Take derivative of each side of $F(\tau K, \tau L) = \tau^k F(K, L)$ wrt to K and L respectively:

$$F_K(\tau K, \tau L) = \tau^{k-1} F_K(K, L)$$

$$F_L(\tau K, \tau L) = \tau^{k-1} F_L(K, L)$$

Implies that the rate of technical substitution (RTS) or the slope of any isoquant along any ray from the origin is the same:

$$\frac{F_L(\tau K, \tau L)}{F_K(\tau K, \tau L)} = \frac{F_L(K, L)}{F_K(K, L)}$$

The Rate of technical substitution (RTS) or slope of any isoquant along any ray from the origin is the same:

A strong assumption with convenient simplifying implications

Euler's Theorem

Recall

$$F(\tau K, \tau L) = \tau^k F(K, L)$$

Take derivative wrt to τ

$$k \cdot \tau^{k-1} F(K, L) = F_K \cdot K + F_L \cdot L$$

When $k = 1$ (CRS)

$$F(K, L) = F_K \cdot K + F_L \cdot L$$

CRS + competition \rightarrow zero economic profits

On competitive markets $r = p \cdot F_K$ and $w = p \cdot F_L$ so we get

$$F(K, L) = F_K \cdot K + F_L \cdot L$$

$$p \cdot F(K, L) = p \cdot F_K \cdot K + p \cdot F_L \cdot L$$

$$p \cdot F(K, L) = r \cdot K + w \cdot L$$

Factor payments exhaust total product

Factor payments exhaust total product

$$p \cdot F(K, L) = r \cdot K + w \cdot L$$

So firm profits must be zero

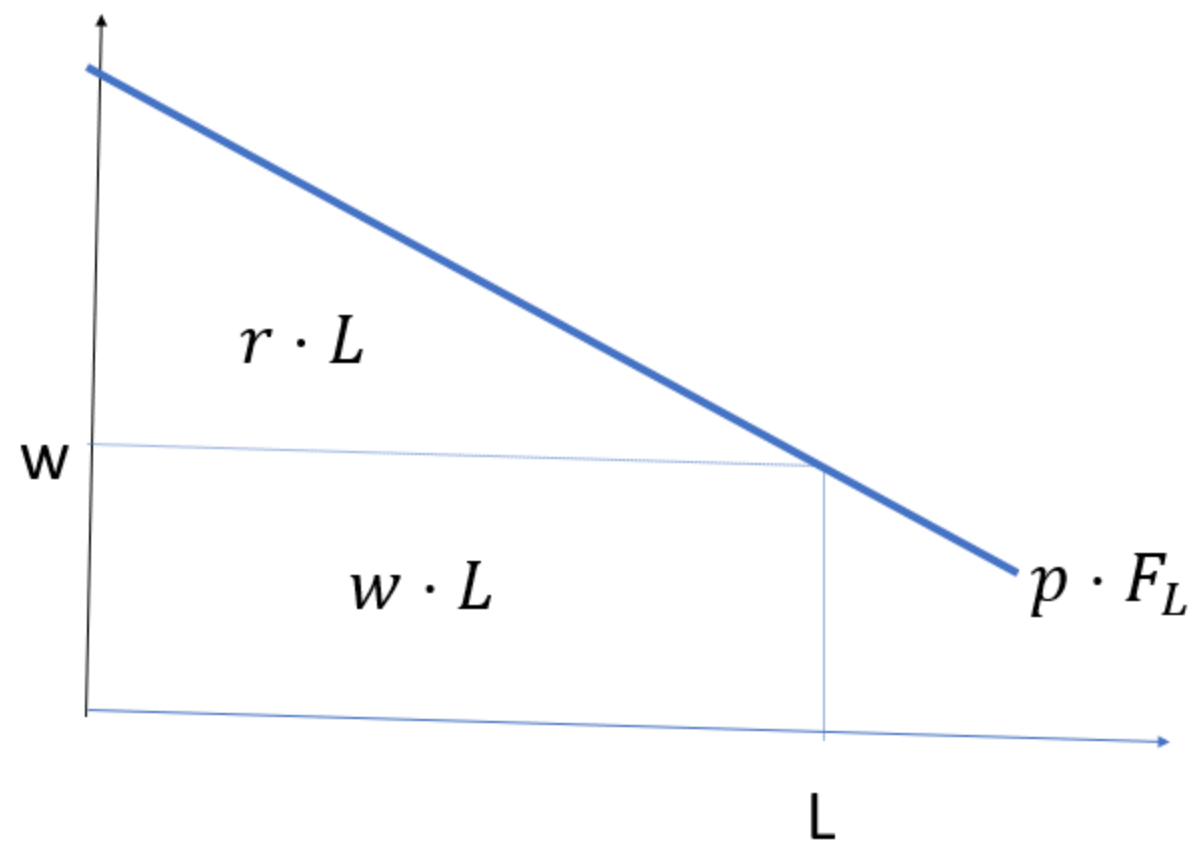
$$\Pi(K, L) = p \cdot F(K, L) - w \cdot L - r \cdot K = 0$$

- K and L only factors used in production, any residual rents competed away.
- Later we'll add 'skill/entrepreneurship' as non-traded factor
 - firm profit then interpreted as return to non-traded factor(s)

Profit Maximization:

$$p \cdot F_L(K, L) = w$$

$$p \cdot F_K(K, L) = r$$



In intensive form:

- $r = f'(k)$
- $w = f(k) - f'(k) \cdot k$
 - wage = output per worker hour minus payments to capital per worker hour equal wage per worker hour.

With Constant Returns to Scale ($k = 1$)

$$F_L(\tau K, \tau L) = F_L(K, L)$$

$$F_K(\tau K, \tau L) = F_K(K, L)$$

In a competitive market firms marginal factor hiring will equalize factor prices.

$$F_L(\tau K, \tau L) = w = F_L(K, L)$$

Can determine $\frac{K}{L}$ ratio but not scale of K and L on each firm.

Any two firms with same have the same $\frac{K}{L}$ have same marginal products F_K and F_L .

Firm scale indeterminate

- CRS \rightarrow the size distribution of firms is *indeterminate*
- Firms could be all same size, some large and other small, etc. We can't tell, nor does it really matter.
- Another way to see: under CRS, $MC(Q)$ and $AC(Q)$ cost are same (horizontal) across firms. So cannot determine firm's optimal scale from $P = MC(Q)$.
- Each firm is a blown up or scaled down version of the next. We can treat sectoral output as if produced by a single competitive firm.

What if we shutdown one market?

- Suppose each firm $F(K_i, L_i)$ is homog of degree 1. Can we still achieve efficient resource allocation despite a total shutdown of capital market?

With CRS technology yes:

- Efficiency requires equalizing capital-labor ratio $\frac{K_i}{L_i} = \frac{K_j}{L_j}$
- So if firms i, j have fixed capital $\bar{K}_i \bar{K}_j$ we can get efficient allocation by just adjusting labor use across firms until:

$$L_i = L_j \cdot \frac{\bar{K}_i}{\bar{K}_j}$$

Cobb-Douglass production

$$F(K, L) = A \cdot K^{\alpha} L^{\beta}$$

- A interpreted as total factor productivity parameter
- Degree of homogeneity $k = \alpha + \beta$

If $k = 1$ then $\beta = 1 - \alpha$, then $F_L = (1 - \alpha)A \cdot \frac{K^\alpha L^{1-\alpha}}{L}$

Marginal products are a constant proportion of average products

$$F_L = (1 - \alpha) \cdot \frac{F(K, L)}{L}$$

and

$$F_K = \alpha \cdot \frac{F(K, L)}{L}$$

Two sector Specific Factors Model

Variations of the model (see [jupyter notebook](#))

- Two-sector model (short-run version of Heckscher-Ohlin-Samuelson)
- Workhorse model:
 - Income distribution and Political economy
 - Migration across countries, sectors
 - dualism, Lewis, Harris Todaro
 - (mis)allocation across and within sectors.

Aggregate Production Function Models

What are 'Egalitarian predictions' of neo-classical model (Lucas, 1990)?

Neo-classical Convergence

- CRS \rightarrow diminishing returns to any one factor when others held fixed.
 - implies $r = f'(k)$ falls as $k = \frac{K}{L}$ increases
 - (with same technology) 'poorer' countries have lower k but higher r , lower w
- Convergence mechanisms
 - Capital or Labor Movement model
 - Solow/Neo-classical Growth model
 - Heckscher-Ohlin-Samuelson (two sector) Trade models

With same technology:

- differences in output per person due to differences in $\frac{K}{L}$
- Lower $\frac{K}{L}$ countries have higher r and lower w
- Market forces (capital and labor movement in search of higher returns, higher return to savings, trade in goods) all push toward factor price equalization and income convergence.

Solow Growth Model

$$y = k^{\alpha}$$

$$\frac{dk}{dt} = s \cdot k^{\alpha} - (n + g + \delta)k$$

Steady state:

$$k^* = \left(\frac{s}{n + g + \delta} \right)^{\frac{1}{1-\alpha}}$$

Convergence regardless of starting point.

Countries further away from steady state grow faster (catch up or converge)

Capital mobility

Diminishing marginal product of capital implies that countries that if there are two countries with the same production technology

- country with less accumulated capital per worker has higher $r = f'(k)$
- capital should flow from rich to poor countries, accelerating convergence.

See Lucas (1990) [jupyter notebook](#)

Institutions as Fundamental

Land property rights and Institutions.

Origins, evolution and long-run impacts

Institutions

Douglas North: Institutions

- "are the rules of the game .. the humanly devised constraints that shape human interaction ... structure incentives"
 - economic, political, social
 - formal and informal (norms, codes of behavior, conventions)
- "reduce uncertainty by providing a structure to everyday life"
- Differential performance of economies over time is fundamentally influenced by the way institutions evolve

North's sports analogy

- **Institutions:** like rules of the game in competitive sport
- **Organizations:** like teams
 - political (parties, village council), economic (firms, unions, cooperatives), social (churches, clubs, families?), educational
 - also provide structure.. but purpose is to 'win/advance interests' of team
 - are agents of institutional change

"The Central puzzle of human history:"

- to account for widely divergent paths of historical change and disparate performance

Diagram on next slide from Binswanger, Deininger, Feder (1995)

How to account for different property rights systems and production relations and trajectories from one form to another?

Land tenure and production relations: trajectories

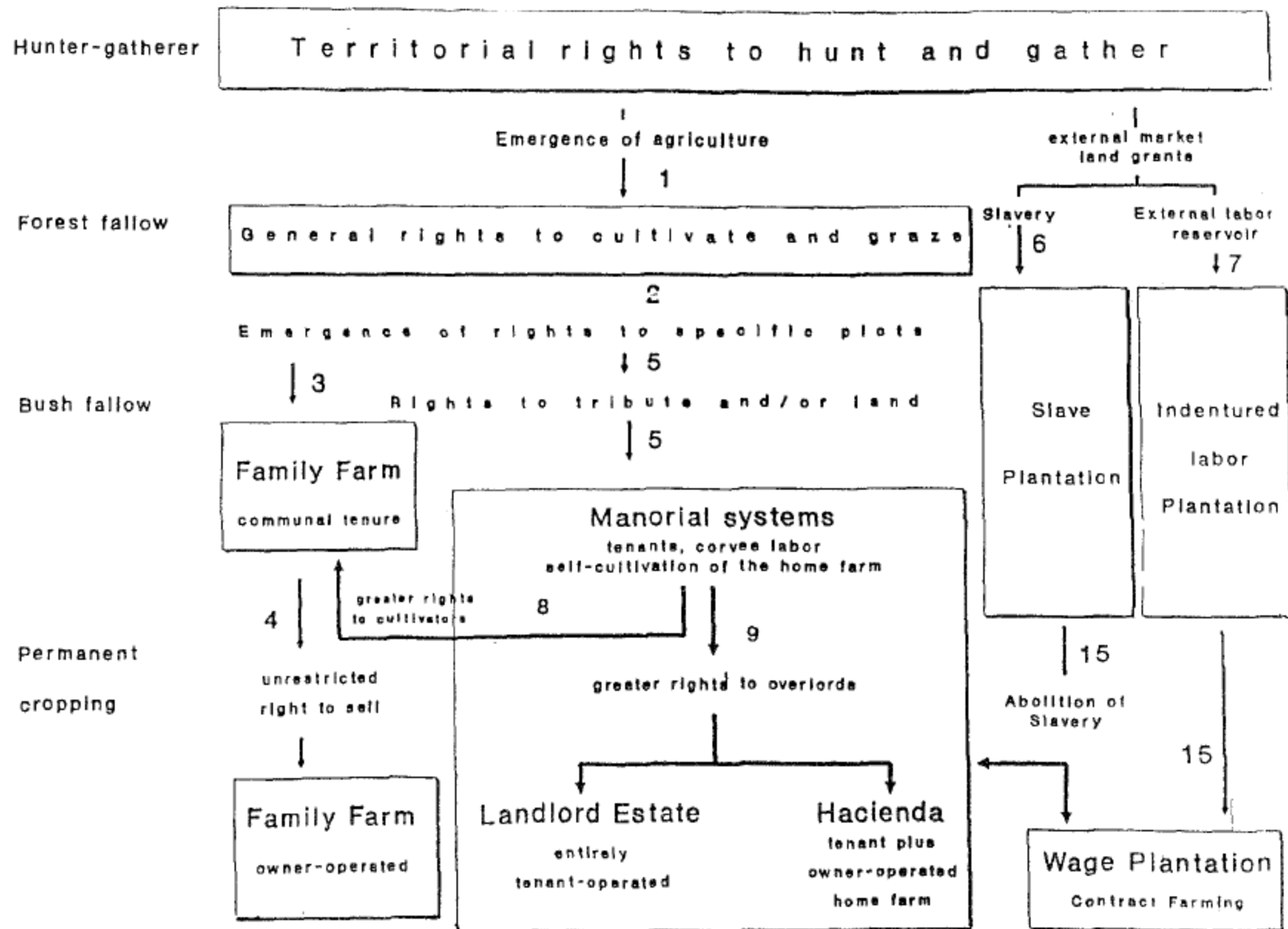
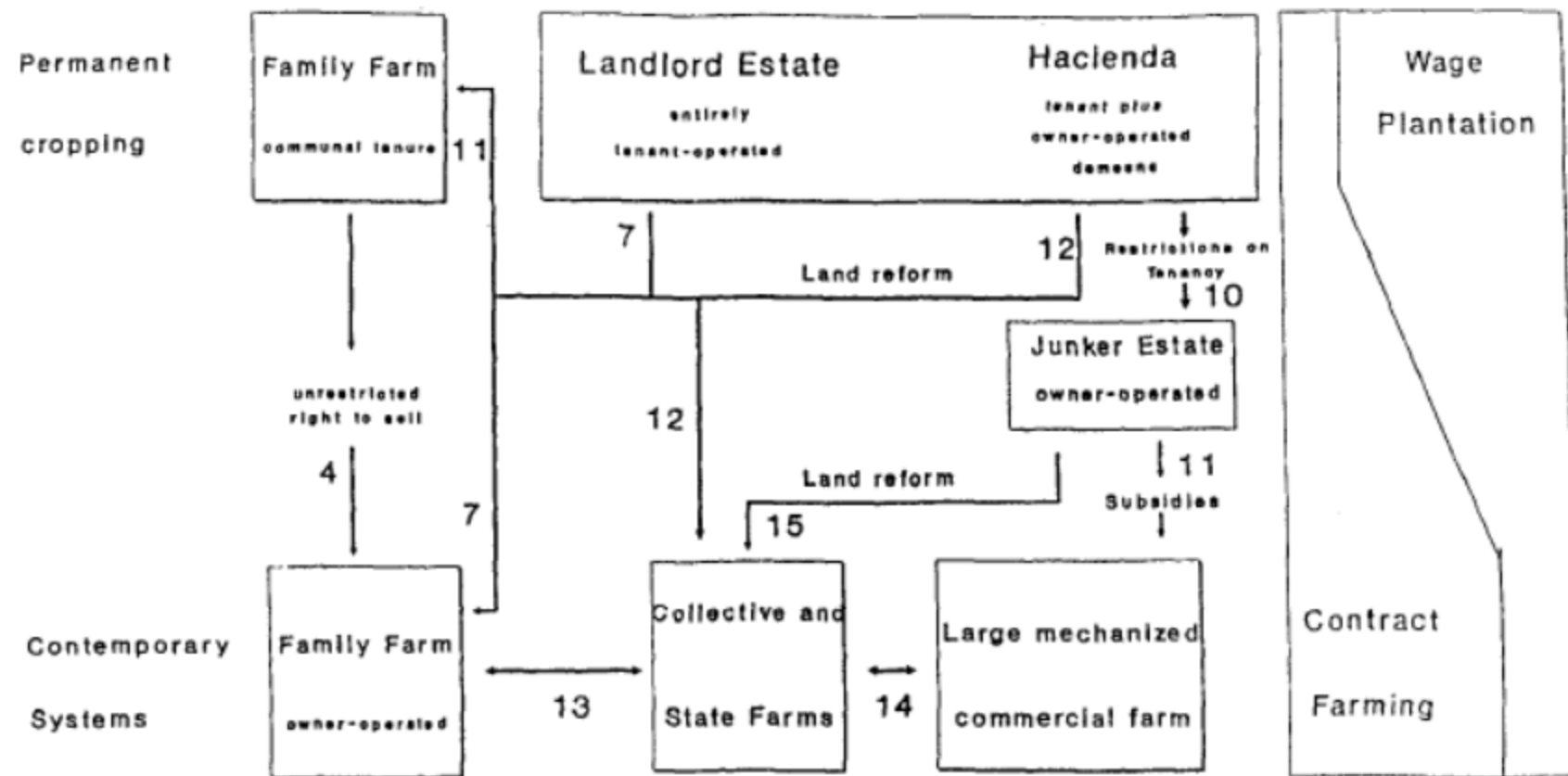


Figure 42.1. Evolution of production relations & property rights.



What drives institutional change?

In most accounts:

- changing relative factor scarcities (e.g. rising population)
- technological innovation and change
- new opportunities for trade, changing relative prices
- State capacity and power, constraints on the state.
- Imposed political and economic change (appropriation, coercion, tribute)

Evolutionary versus non-evolutionary approaches

- Evolutionary adaptations/innovations to take advantage of new opportunities.
Emergent, spontaneous.
- Purposefully imposed reforms, enabling institutions
- Power balance between those who want to impose their interests and those who resist

Do institutions, property rights and land tenure systems evolve to organize production more efficiently over time? Or do dysfunctional institutions arise and persist?

Approaches to study of land institutions

- **Classical** (Smith, Ricardo, Mill...). Great attention to land.
- **Neo-classical** (marginalist revolution). Institutional and organizational problems black-boxed, land just one more factor.
- **New-institutional** (transactions costs; CDAN -Coase, Demsetz, Alchian, Williamson, North). Institutions and contract forms shape incentives; evolve over time.
- **Marxian**: More conflict base model of institutional change. Appropriation and control.
- **Modern contracting** (Stiglitz, Holmstrom, Tirole, Hart). Property rights and contracting matter with asymmetric information.
- **Modern political economy** (later North, Acemoglu/Robinson, Engerman/Sokoloff and others). Institutions fundamental, shaped by political as well as economic interests.

Note some approaches work within a framework that assumes mutually-beneficial bargains. Participation constraints mean that agents can walk away from deals that they don't want.

Coasian solution in effect creates new tradable property claims that are then traded for mutual benefit. Says initial allocation doesn't matter for efficiency, but of course whoever gets the claims ends better off. No concept of prior claim, justice, etc.

Economics of Appropriation and Conflict

Lerner's quote: Neo-classical economics works in the realm of solved political problems.

With appropriation and conflict parties may end up worse, property rights over resources may be challenged/stolen, people may be coerced into situations that may not benefit them.

Both marxian and modern political economy approaches consider these possibilities.

Why no Political Coase Theorem?

- The strong and powerful shape institutions in their interests, extract tax/rent/tribute.
- But why extract resources inefficiently (isn't there more to grab if the pie could be allowed to get bigger). Stationary versus roving bandits
- Why inefficient institutions and production organization might persist:
 - May be easier to grab/extract where institutions weak
 - Credible commitment issues
 - Political Losers as a barrier to economic development.

Marx on institutional change

- Changes in 'relations of production' (institutions/property rights) shaped by rising class' effort to capture benefits from changes in material forces of production (e.g. technological opportunities)

In the social production of their existence, men inevitably enter into definite relations, which are independent of their will, namely relations of production appropriate to a given stage in the development of their material forces of production. The totality of these relations of production constitutes the economic structure of society, the real foundation, on which arises a legal and political superstructure and to which correspond definite forms of social consciousness. ..

- Old institutional order may become a 'fetter' or barrier for rising group to capture new benefits.
- Views changes driven by conflict/revolution

...At a certain stage of development, the material productive forces of society come into conflict with the existing relations of production or – this merely expresses the same thing in legal terms – with the property relations within the framework of which they have operated hitherto. From forms of development of the productive forces these relations turn into their fetters. Then begins an era of social revolution.

Preface to A Contribution of the Critique of Political Economy, 1859

- Marx looking back on collapse of feudalism/manorialism, enclosures, and the rising industry and urban bourgeoisie
- 'Primitive accumulation' (including land grabbing) and monopoly. Enclosure movements broke customary tenure, releasing new landless labor force
- New property forms allow expansion of production possibilities but benefits viewed as captured by rising capitalist class
- Contrast to Adam Smith who more likely stress enclosure as improving resource allocation incentives and competition and free labor as delivering more broad based gains to trade.

Modern Political Economy approaches

- Extractive institutions
- Inequality
- Persistence

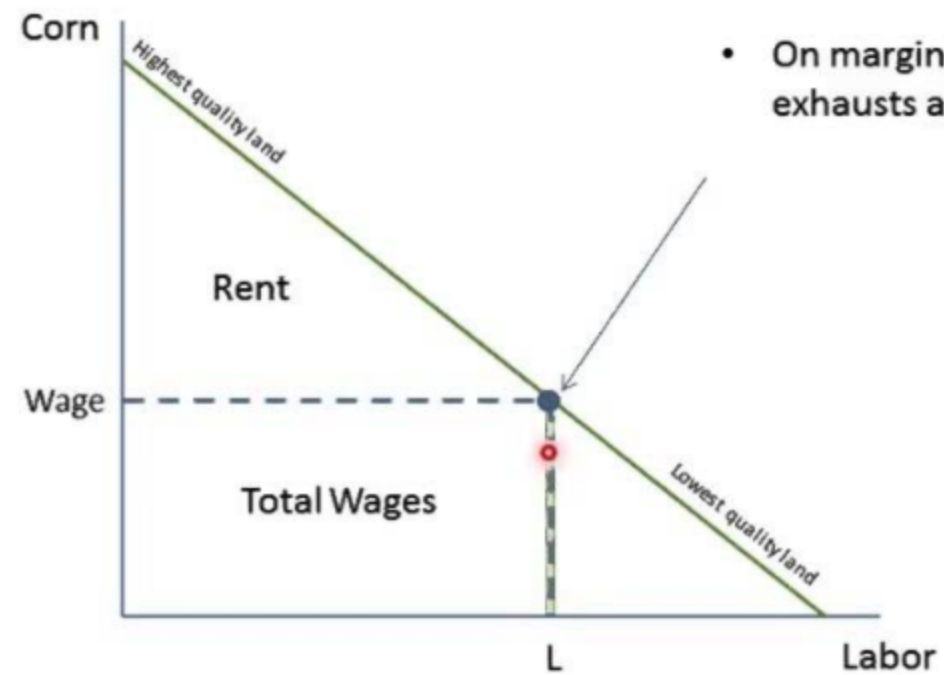
Classical economists on land rents, enclosure and incentives

How land ownership and contracts shaped incentives and divided output a central concern. Writing in 18th and 19th centuries:

- "landlords' right has its origin in robbery (Say)"
- "landlords...love to reap where they never sowed... demands a rent even for unimproved land... when the lease comes to be renewed.. the landlord commonly demands augmentation of rent [made by the tenant] (Smith)"
- "Those laws and customs so favorable to the yeomanry, have perhaps contributed more to the present grandeur of England, than all their boasted regulations of commerce taken together .. the security of the tenant is equal to that of the proprietor (Smith)"
- Marx on transformation of manorialism and enclosure. On Wakefield and land policy in colonies.

Ricardian Rent

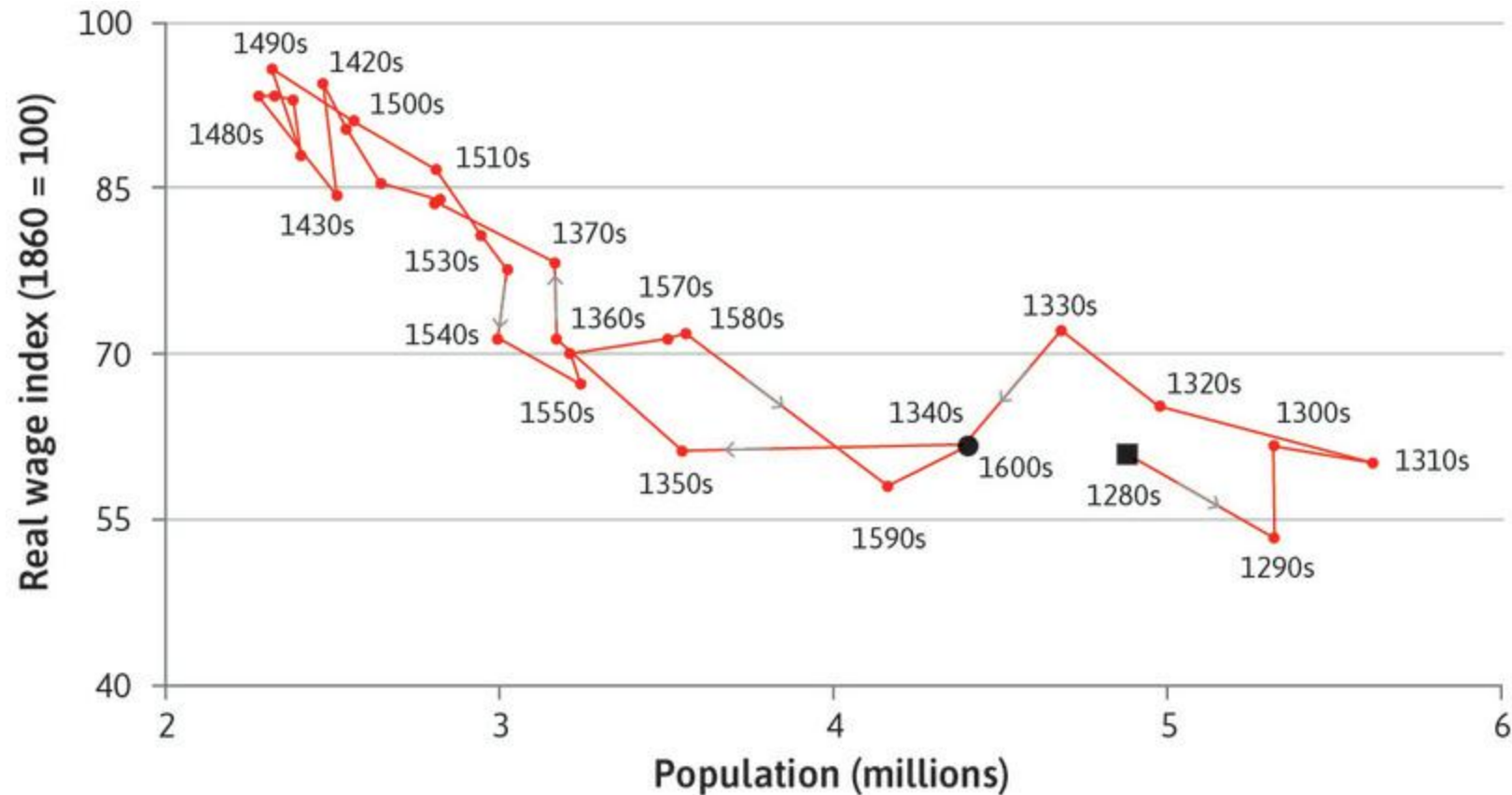
- Most fertile land used first.
- No 'rent' can be charged (above cost of clearing land) can be charged if worker can clear land of same quality on frontier
- Land rent zero on 'marginal' (last to be used) land so long as not-exhausted.
- Positive rent only on infra-marginal land. Rent charged for resource scarcity of higher fertility, better access/location.

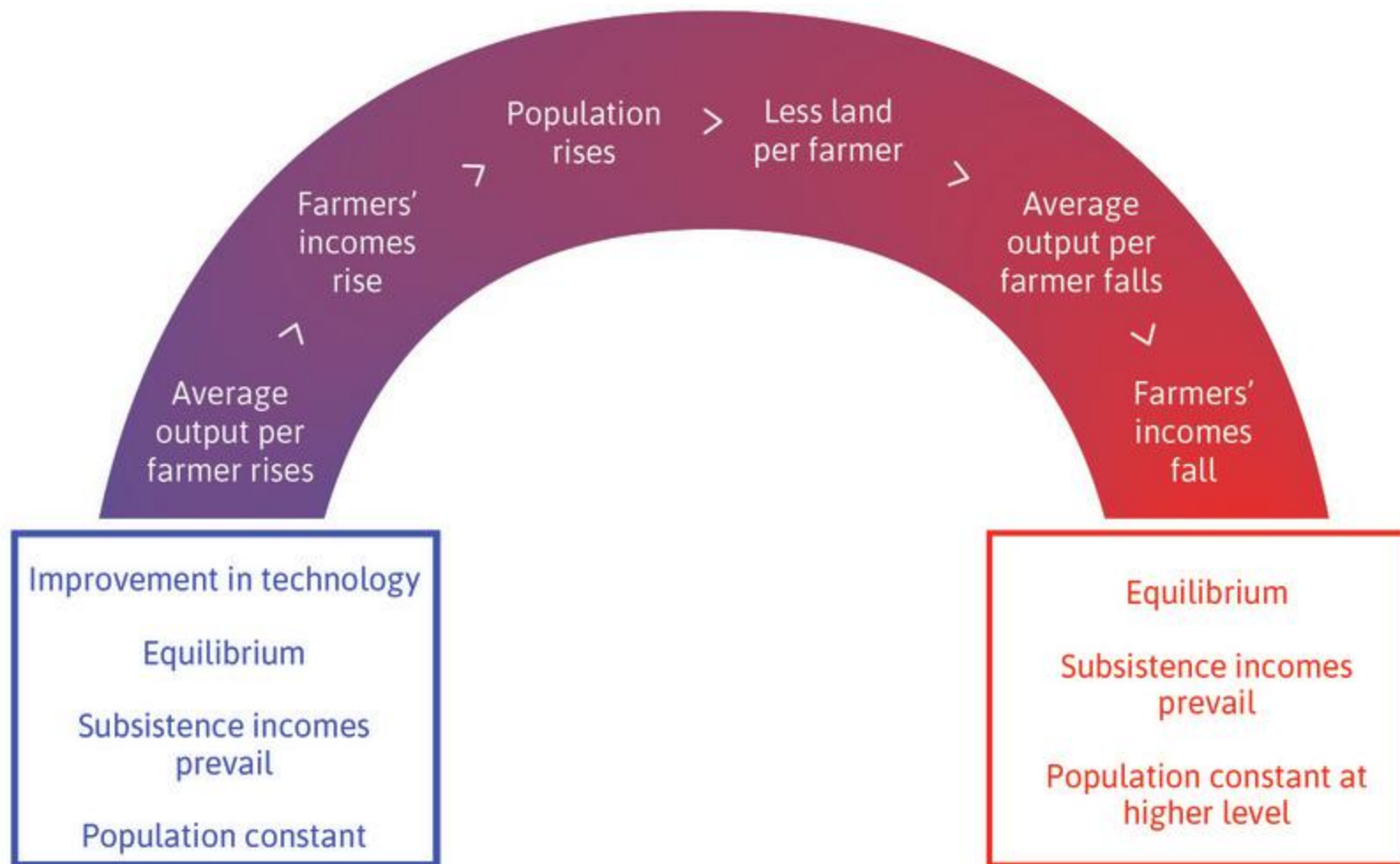


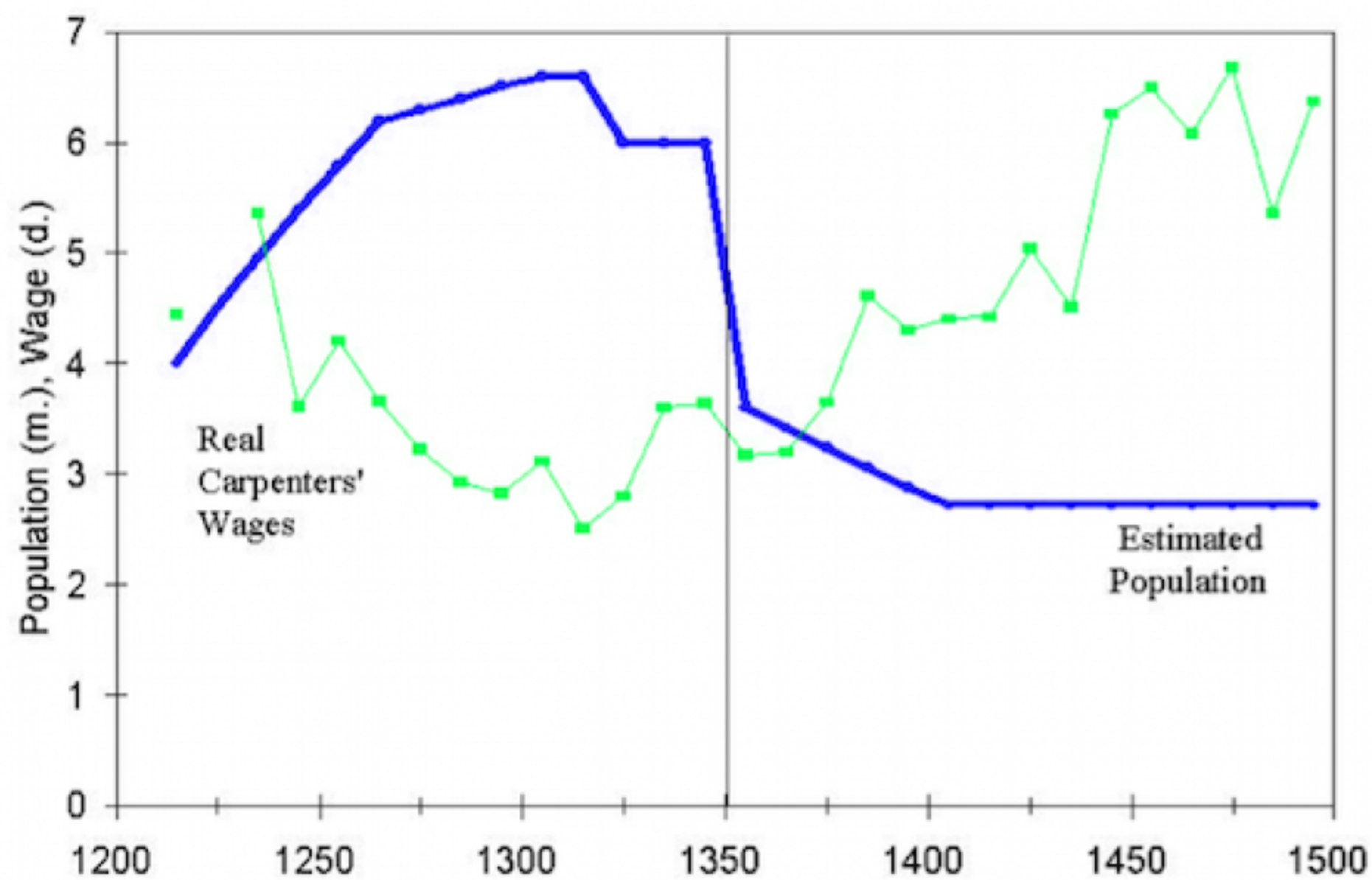
- On marginal land, rent is zero—wage exhausts all product.

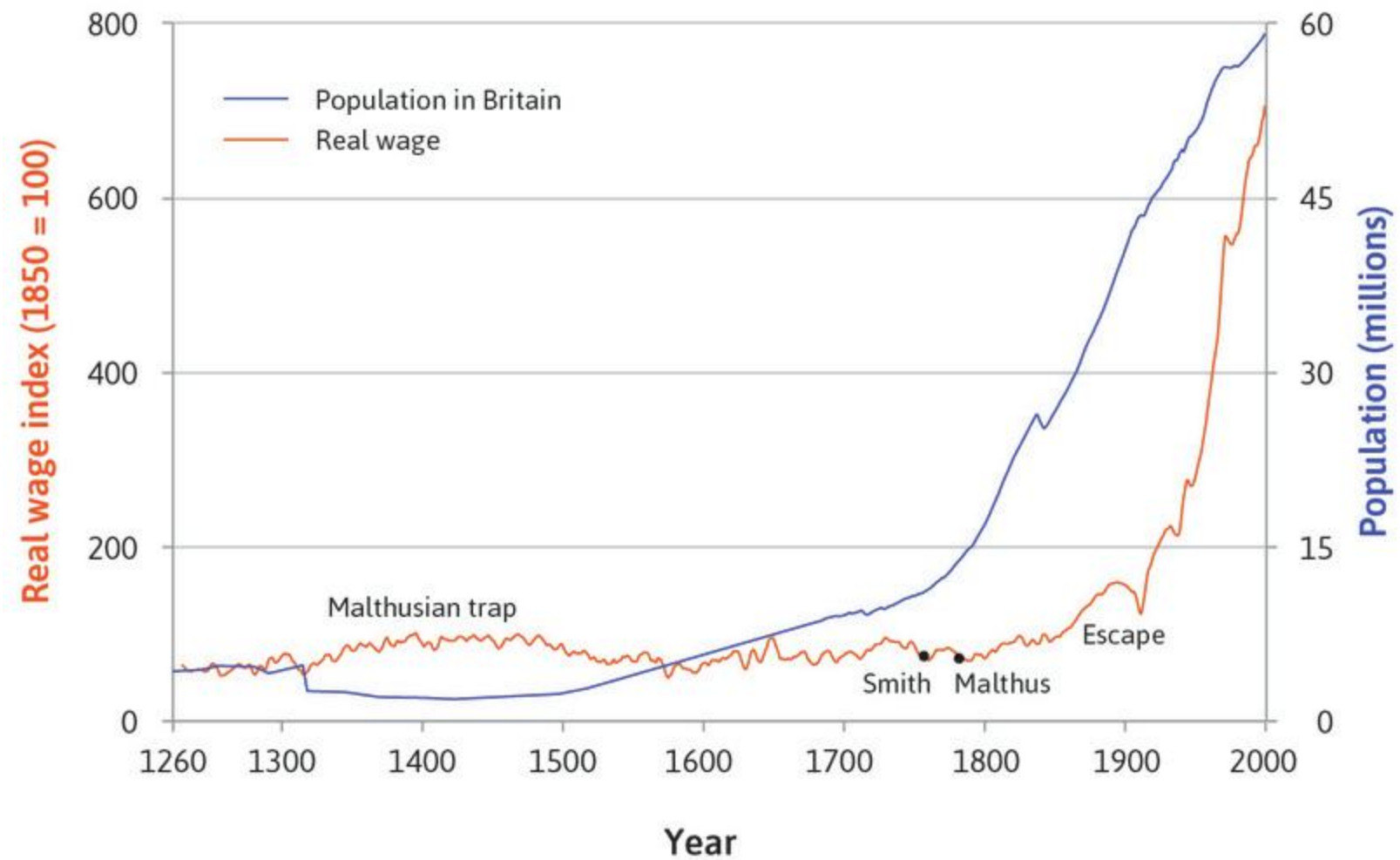
Ricardo, Malthus and diminishing returns

With technology fixed, rising population pushes against fixed land and other natural resources.









Ricardo and Malhus were contemporaries, Marx wrote in late 19th

What allowed this escape?

- Technology, industrialization. But what allowed those to happen
- Structural and institutional transformation
 - What role the transformation of customary land tenure and enclosures in Europe (much more below)?

Neo-classical approaches

Pareto, Walras, Jevons, Marshall. The marginalists.

- Land now treated more symmetrically with other factors
- Contracting and property rights problems assumed away

Neo-classical efficient allocation

- Under strong assumptions about technology and preferences and the perfect and costless enforcement of property rights: complete markets.
- **First-welfare Theorem** (Smith's 'invisible hand'): competitive market equilibria with complete markets will be Pareto efficient (*regardless of the initial distribution of property rights*).
- Abstracts away (assumes too much about) how property and contracts are enforced.
- Institutional and organizational detail erased . Firms are black boxes, contracts are all arms length.
- Claim that efficiency and equity considerations can be separated.

“Economics has gained the title ‘Queen of the Social Sciences’ by choosing solved political problems as its domain.”

Abba Lerner (1972) cited in Bowles and Gintis (1993)

New-institutional Economics

- Coase (1937) 'The Boundaries of the Firm', Coase (1960) "The Problem of Social Cost."
- "Transactions Costs" get in the way of trades. Views:
 - "Property Rights and Markets Paradigm": Institutions and organizations emerge/evolve to economize on transactions costs, capture potential gains to trade. Bad institutions are weeded out via process similar to natural selection (Alchian, Demsetz, early North).
 - Transaction costs may be hard to overcome (coordination, information, etc) so dysfunctional institutions may be slow to change.
 - Those with power try to shape institutions in their interests, may not be efficient.

Spontaneous order versus planning...

Customs are better understood as a living, negotiated tissue of practices which are continually being adapted to new ecological and social circumstances—including, of course, power relations. Customary systems of tenure should not be romanticized; they are usually riven with inequalities based on gender, status, and lineage. But because they are strongly local, particular, and adaptable, their plasticity can be the source of microadjustments that lead to shifts in prevailing practice.

Scott, James C. *Seeing Like a State*, p.34

The Emergence of Property rights to Land

Coase and the Property Rights and Markets paradigm

- Property rights emerge when they become worth enforcing
- Rising land scarcity leads to better definition of rights; over time leading to accessible sale and rental markets
- Perhaps empirically true in some cases, clearly not in others.
- Important grain of truth worth understanding.
 - Why does it fail to happen.

When land is abundant control over labor

- Critical issue is access to labor, not land.
- Little incentive to invest in soil fertility (restored naturally through long tree fallow)

"When population densities rise, fallow periods ...shortened until the land is continually cultivated. Then plows, manure, artificial fertilizers, and other investments and labor intensive methods ...required to maintain soil fertility ... [m]arginal lands ...brought under cultivation requiring higher investments... Only now, ownership security becomes an important incentive

Boserup, 1965, quoted in Binswanger, Deininger Feder (1995)

Transformation of land tenure systems in response to rising population pressure (Boserup)

Before the emergence of private property in land...certain families are recognized as having cultivation rights within a given area...

Members 'general cultivation right to cultivate a plot inalienable ...but after lapse of normal period of allow if family does not re-cultivate a given plot, it may lose its right to this particular plot ... As long as forest-fallow cultivators has abundant land ...shift to new plot or have it allocated by the chief of the tribe...

Otsuka, Keijiro, and Frank M. Place. 2001

"Issues and Theoretical Framework", *Land Tenure and Natural Resource Management: A Comparative Study of Agrarian Communities in Asia and Africa*. IFPRI & Johns Hopkins University Press.

Synthesis evolutionary model of farming systems & induced technical change

In a book with chapters on Ghana, Malawi, Uganda, Nepal, Sumatra, Vietnam and Japan. Property rights institutions or land tenure systems:

- communal, state, common-property, individual
- As population grows and markets penetrate demand for individual property rights grows, communal and state ownership may face serious difficulties.
- Not clear that making private property is always preferable (e.g. negative externalities like soil erosion may intensify, inequity may rise, costly defense)

Model elements (pset 1)

Endowments, technology and choice of techniques

- territory-wide endowment of land \bar{T} and labor \bar{L}
- $F(T, L)$ assume CRS or linear homogenous at first
 - isoquant and choice of technique
 - iso-cost lines
 - cost-minimization

Technology vs. choice of technique

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

Simplify to two groups of identical farmers

Land T : includes 'fallowed lands'. Fallow land is not unused.

If population is scarce and land abundant little incentive to claim individual property rights. Forest area use is unrestricted except exclusion of outsiders.

Usufruct rights of individual members are well establish for cultivated fields but less so for fallow. Community chief may determine its allocation

Diagrammatic analysis

(on Chalkboard)

- Homogenous production functions, properties.
- Cobb-Douglas properties
- Isoquant and isocost lines
- A as total factor productivity and land quality parameter
- Planner and competitive market first order necessary conditions for efficient allocation
 - Appropriate choice of technique
 - Equilibrium (shadow) wage-rental
 - Edgeworth Box

(On Chalkboard)

- Effect of rising population density
 - Change to Edgeworth Box
 - Change in equilibrium efficient choice and shadow w/r
 - Shorter fallowing \rightarrow declining land productivity

Without technological/institutional change commercialization accelerates process placing pressure on most elastic factors (land, resources)

(on chalkboard)

Sustainable responses:

- improve land quality by investing in irrigation or terracing
- investing in commercial trees (cocoa, coffee, rubber, etc). To maintain soil fertility under continuous cultivation new farming systems with composting and other organic and inorganic fertilizer.
- Viewed as *new* more labor intensive production technology
- Depict new technology as more profitable

Land tenure system adaptation for sustainability

- restricted transfer rights and not totally secure usufruct rights under traditional land tenure may lower expected returns to investment.
 - Fear may not reap full benefits of investment or inability to bequeath to desired heirs or sell land freely if need arises.
- Establishment of clearer common property for degraded secondary forests

Why institutions may fail to adapt

Will we see demand driven process toward greater individualization or continued resource degradation?

Factors that may inhibit

- high cost of investments, or poor returns
- difficulties in organizing collective actions
- high transaction costs
- legal restrictions (e.g. nationalization of forests, granting leasehold/freehold to large holders, suppression of tenancy contracts)

Coase, Property rights and the 'Coase Theorem'

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

Coase, Ronald H. 1937. "The Nature of the Firm." *Economica* 4 (16):386–405.

(Also see jupyter notebook on Coase)

Coase (1960): A rancher and wheat farmer

On adjacent fields. No fence.

The Wheat Farmer

The wheat farm chooses inputs for a maximized profit of $\Pi_W = 8$.

- to things simple assume this all or nothing choice.

The Rancher

Chooses herd size x to maximize profits:

$$\Pi_C(x) = P \cdot F(x) - c \cdot x$$

P is cattle price and c is the cost of feeding each animal.

FOC for optimal herd size x^* : $P \cdot F'(x^*) = c$

If $F(x) = \sqrt{x}$, FOC are:

$$\frac{P}{2\sqrt{x^*}} = c \rightarrow x^* = \frac{P^2}{4c^2}$$

Example: If $P_c = 4$ and $c = 1$

the rancher's privately optimal herd size: $x^* = 4$

The external cost

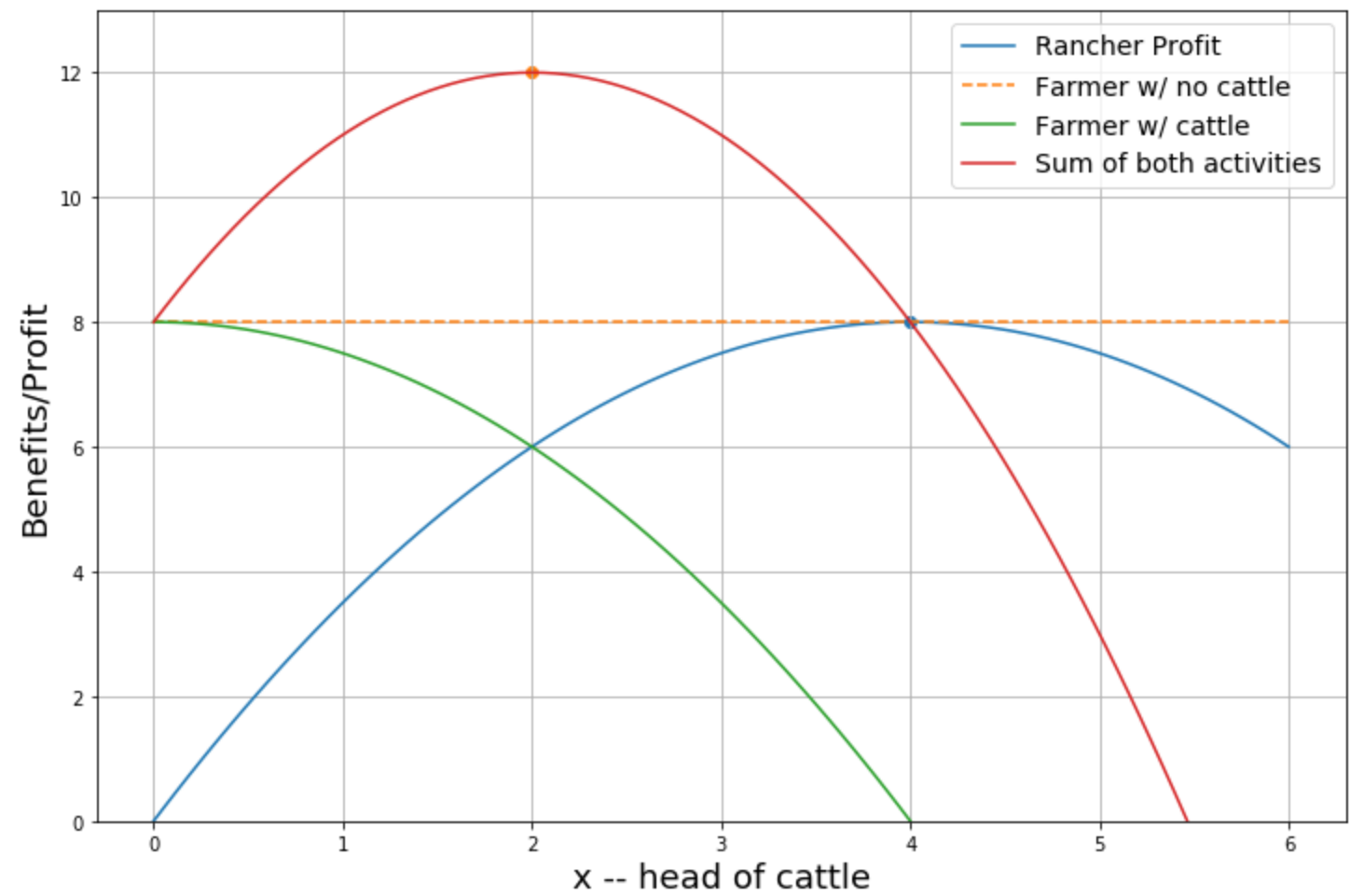
No effective barrier between fields so cattle can stray into wheat farmer's fields, damaging crops and profits.

Specifically, herd of size x reduces net wheat profits to:

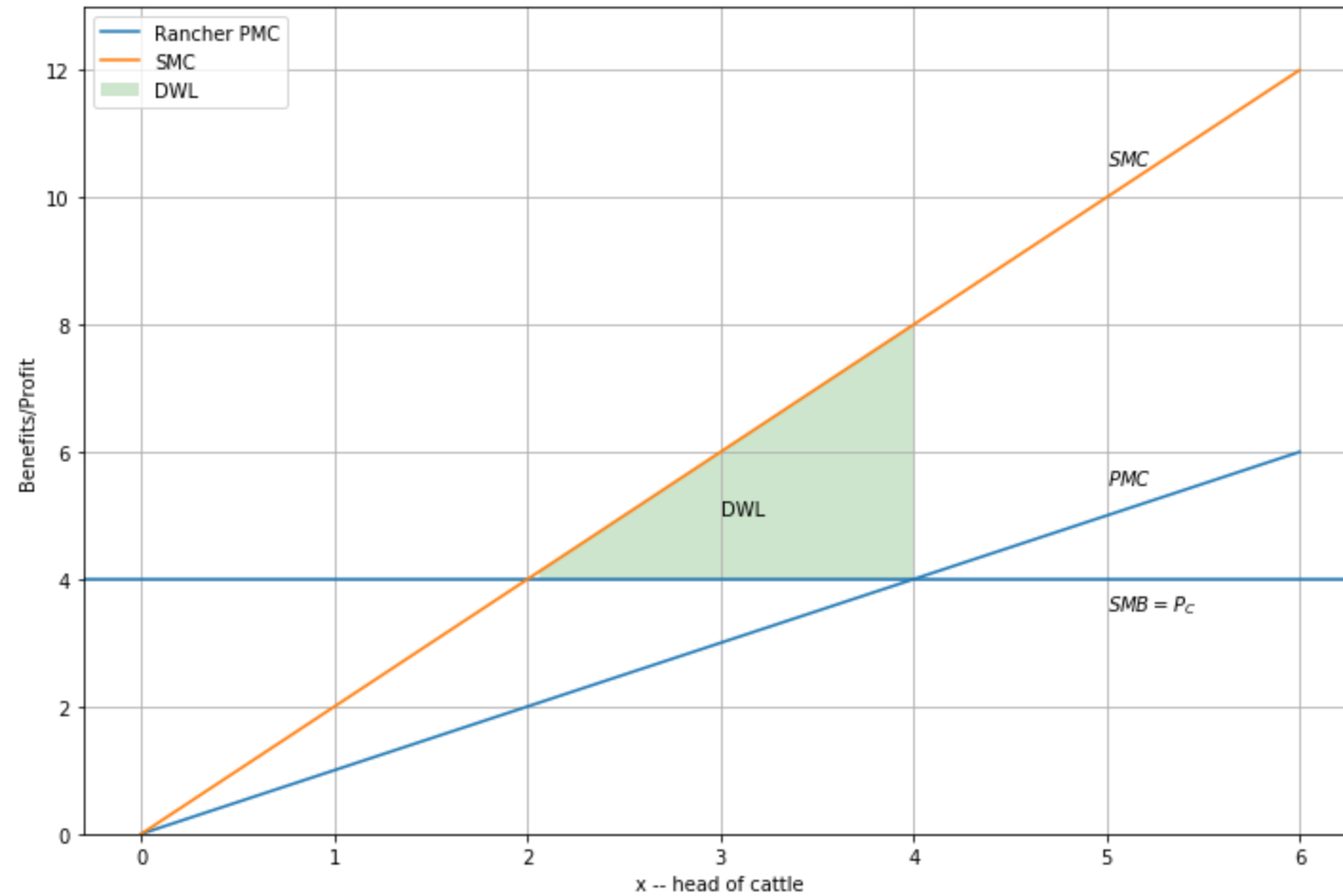
$$\Pi_W(x) = \Pi_W - d \cdot x^2$$

Suppose $d = 1$.

At ranchers private optimum $x^* = 4$ wheat profits are zero.



As private social marginal benefits and costs to see DWL:



Assigning Property Rights

Who is causing harm to who?

The cattle damages crops but if we prohibit all cattle then rancher is harmed.

Assignment of liability equivalent to assigning property rights

Think: right to graze cattle (e.g. tradable permits to graze 1 head cattle)

Case1: Property Rights to the Farmer

Farmer has right to enjoin cattle herding (prohibit via an injunction).

Rancher now earns \$0. Farmer \$8.

This is not Pareto efficient.

If rancher herded just 2 would earn \$6. Could offer \$2 compensation to the wheat farmer and capture $\$6 - \$2 = \$4$.

...or they could bargain to divide the gains to trade of \$4 in other ways.

Case 2: Property Rights to the rancher

Rancher has right to graze with impunity.

Farmer earns \$0 if rancher herds at private optimal of 4 cattle.

This is not Pareto efficient.

Farmer pay \$2 to have rancher reduce herd by 2 leaving rancher no worse off but raising farmer earnings from \$0 to \$4 ($= 6 - 2$).

...or they could bargain to divide the gains to trade of \$4 in other ways.

The 'Coase Theorem'

With zero transactions costs :

- **The initial assignment of property rights does not matter:** The parties bargain to an efficient outcome either way.
- However legal rights are valuable, so *the initial allocation will affect the distribution of benefits and incomes between parties*
- The farmer might 'buy out the rancher" (or vice-versa) to create a larger single firm that internalizes the costs.

Creating Property Rights

The emergence of property rights: Even there were no initial assignment of property rights the parties would create them by negotiating to establish an efficient outcome.

Creating tradable legal-entitlements to complete markets. Restore efficiency.

When transactions costs are positive

- With zero transactions costs property rights gravitate to who values them most.
- With positive transactions costs this may not happen. Hence the initial allocation of property rights can affect the efficiency of the outcome.
- Simple example: suppose rights to herd cattle are issued but cannot be traded due to high transactions costs. If allocate all rights to rancher then social output is below allocation where allocation is 2 and 2.

Coase and the development of a land market

Two scenarios:

1. Open frontier: where land is still abundant
2. Congestion or Land Scarcity.

A stylized system of "customary tenure"

An open field and no land market.

Under what we will call 'customary law' land is allocated to person with more status in village. They can clear as much land as can 'productively use'.

The other villager obtains access to remaining land or as much land as they can profitably use.

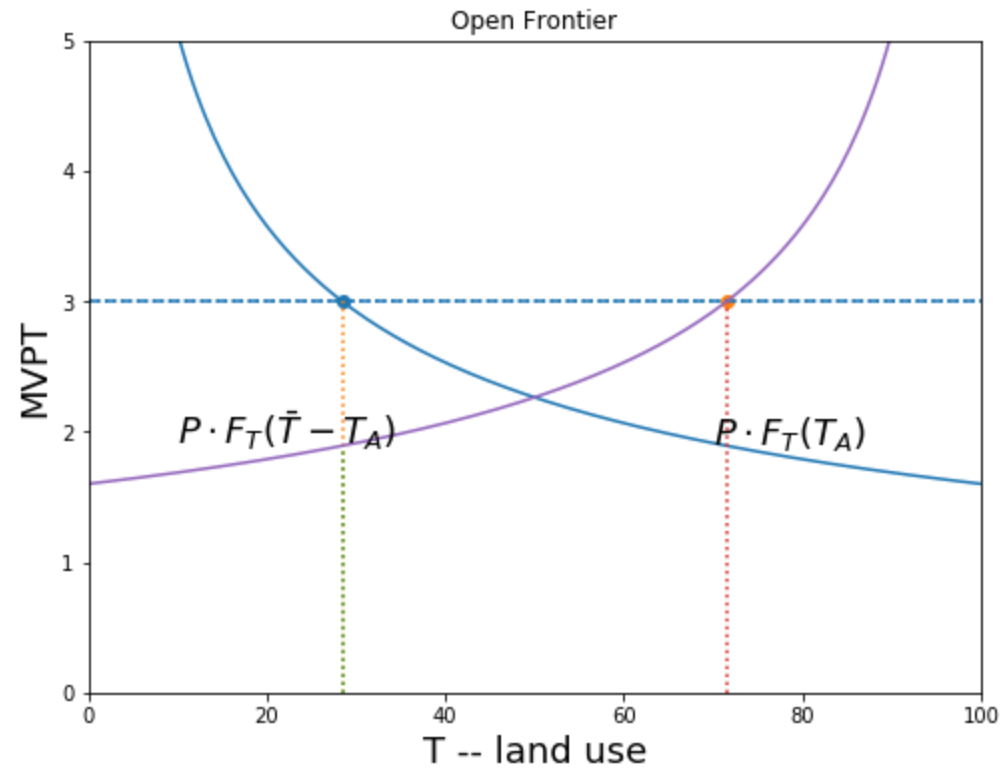
Land abundance or non-congestion

\bar{T} units of land and $N=2$ households.

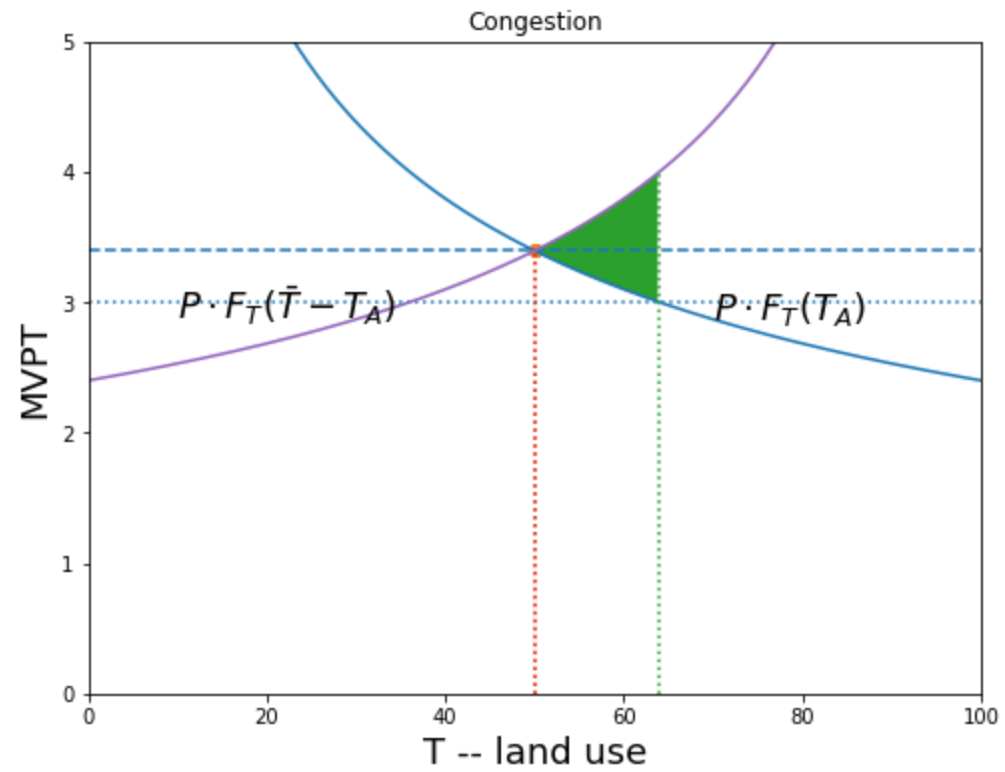
Land clearing cost c . Frontier land not yet exhausted.

Each farmer will maximize profits at $P \cdot F_T(T) = c$

No land rent (above cost of clearing land)



Congestion/land scarcity



- Why is the initial allocation inefficient?
- How do we calculate deadweight loss?
- What kind of bargains can farmer B offer to farmer A (or vice-versa)?
- How would a land market work?
- What 'transactions costs' might stand in the way of such a solution?

The 'Coase Theorem'

Costless bargaining between the parties will lead to an efficient outcome regardless of which party is awarded the rights?

Here farmer B can offer to pay farmer A to rent out the land farmer A has claimed.
Emergence of a land market.

Initial assignment of land rights does not matter... those who value rights more highly will be willing to compensate those who value them less to transfer the rights to highest value use.

Coase Theorem: True, False or Tautology?

Tautology?: "if there are no costs to fixing things, then things will be fixed."

Like the First Welfare Theorem (complete competitive markets will lead to efficient allocations, regardless of initial allocation of property rights).

The Coase Theorem 'works' by assuming new legal entitlements can be created and made tradable.

Key issue to which we return: If land is secure and tradable and 'small family farm' is most efficient operational size (issue we examine later) then a large landholder would have rental tenants rather than farm themselves.

With transactions costs, initial property assignments matter

Transactions costs in the land rental market:

- asymmetric information about plot characteristics
- fear that tenant will 'squat' and not pay rent/return land
- under some forms of customary farmer A may fear that rental to B will be viewed as evidence that A does not need as much land. A earns more by farming inefficiently than by giving up claim

Under insecure property rights as above then initial 'property rights' assignment matters (more output if A and B gets original assignment)

Land tenure and enclosure in Europe

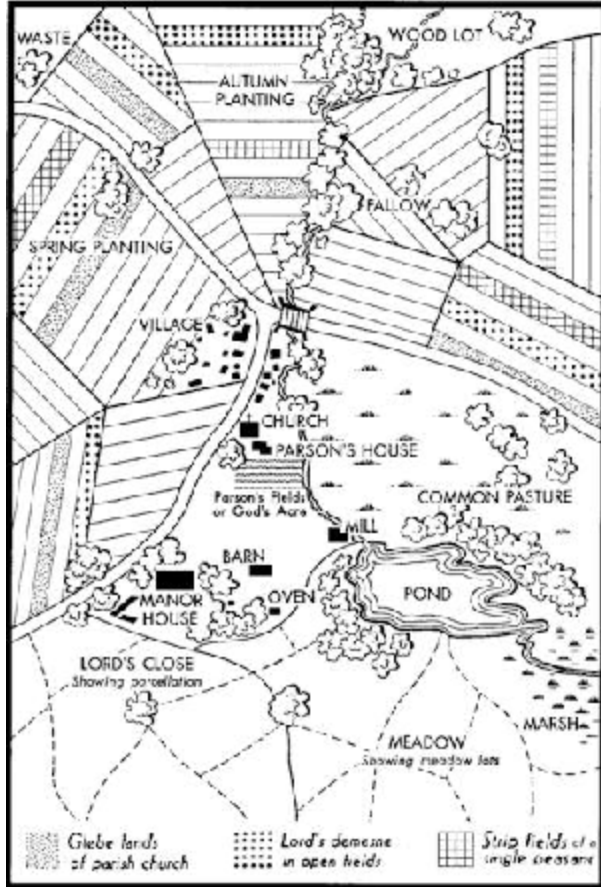
Manorial Estates, open field system and customary tenure

- Open-field system prevalent throughout Europe during middle age. Up to 20th century in many parts of Western Europe, Turkey, Iran.



The open field system

- Manor or village had 2-3 large fields divided into long narrow strips (or selions) cultivated by tenants or serfs.
- Lord levied rents and demanded labor service for own demesne land.
- Peasants customary use rights to cropland and common land.
- elaborate laws and controls, partly set by Lord and partly by tenants regulated planting, harvest, and pasturing. Inheritable usufruct rights, rights to commons, strip rotation, grazing rights
- Variations around similar forms around the world: e.g. Russia, Turkey, Western Europe.



- Legal process of consolidating communal fields, meadows, pastures and other commons lands into individually owned and managed plots.
 - In England from 12th century to end of 19th. In most of rest of Europe mostly in 19th century and into 20th century.
 - Landlords appropriated public lands for own purposes
 - In England alone more than 800 Parliamentary acts to consolidate properties.
-

Triumphant interpretations

- Led to agricultural Revolution and Industrial Revolution
 - Land markets led to more efficient use, crop yields increased
 - Rising gentry 'improving capitalists'.
- Civil War... Constraints on the King, Rise of Democracy

Natural Experiment: dissolution of monasteries

Heldring, Robinson, Vollmer. 2015. "Monks, Gents and Industrialists: The Long-Run Impact of the Dissolution of the English Monasteries." Working Paper 21450. National Bureau of Economic Research. ([link](#))

- Long-run impacts of Dissolution of the English monasteries in 1535
- Tawney (1941) thesis that led to 'rise of gentry' tied to commercialization of agriculture and location of industrial Revolution.

- Monasteries controlled large portion of lands in late medieval period.
 - No effective land market.
 - Feudal privileges, customary tenure
- in 1530s Henry VIII expropriated and then sold off enormous estates

Table 1: Distribution of Landownership in England in 1436 and 1688: Percentages of cultivated land owned

	1436	1688
Aristocracy and greater gentry	15-20	15-20
Middling and lesser gentry	25	45-50
Yeomen, family farmers and other small owners	20	25-33
Church & Crown	25-35	5-10

Notes: Adapted from Clay (1986, p. 143)

Natural Experiment: How did plausibly exogenous geographic variation in institutions (land markets) affect long run outcomes:

- Digitized the 1535 Valor Ecclesiasticus (locations and values)
- Outcomes: areas with more land converted from monasteries
 - had more non-noble farm gentry (1680)
 - Agricultural revolution
 - Wheat yields 1836
 - Agricultural patents
 - land enclosures 1750-1840
 - Industrial revolution (more Mills in 1838)

 monasteries

$$y_p = \gamma_f + \alpha_M \cdot M_p + \alpha \cdot X_p + \epsilon_p$$

- y_p is parish level outcome
- γ_f county or 'hundred' fixed effects
- X_p controls (physical area, soil, 1524 tax levy, distance to nearest town, etc)

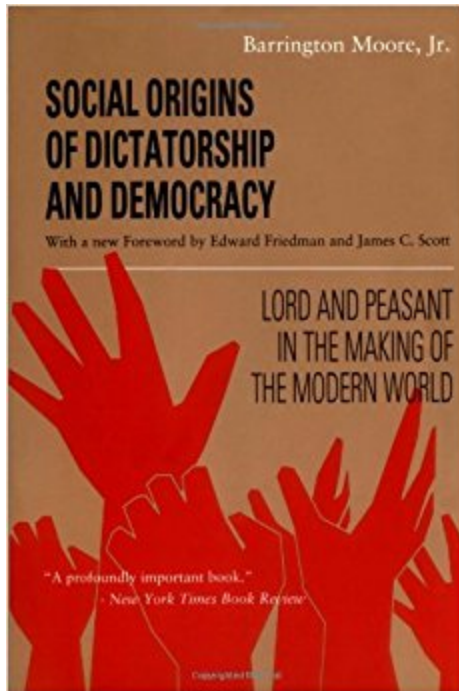
Enclosure and dispossession

Stop to consider how the so-called owners of the land got hold of it. They simply seized it by force, afterwards hiring lawyers to provide them with title-deeds. In the case of the enclosure of the common lands, which was going on from about 1600 to 1850, the land-grabbers did not even have the excuse of being foreign conquerors; they were quite frankly taking the heritage of their own countrymen, upon no sort of pretext except that they had the power to do so.[35]

George Orwell in 1944:

That the violence and coercion which produced these results took place over a long space of time, that it took place mainly within a framework of law and order and helped ultimately to establish democracy on a firmer footing, must not blind us to the fact that it was massive violence exercised by the upper classes against the lower.

Barrington Moore



Long run impact of Colonial Land Tenure Systems in India

Banerjee, Abhijit, and Lakshmi Iyer. 2005. "History, Institutions, and Economic Performance: The Legacy of Colonial Land Tenure Systems in India." *American Economic Review* 95 (4):1190.

Historical Accidents placed colonial India under two different land tenure and revenue collection systems:

1. Landlord based revenue system (*Zamindari*). Permanent-settlement, large landlord revenue collectors.
2. Individual Cultivator based (*Raiyatwari*) . Tax paid directly or via village body.

Evidence that English often mistook local (non-landlord) chieftains for landlords in many areas, and in effect creating larger landlords!

John Stuart Mill worked for East India company, ideas favored cultivator system on incentive grounds.

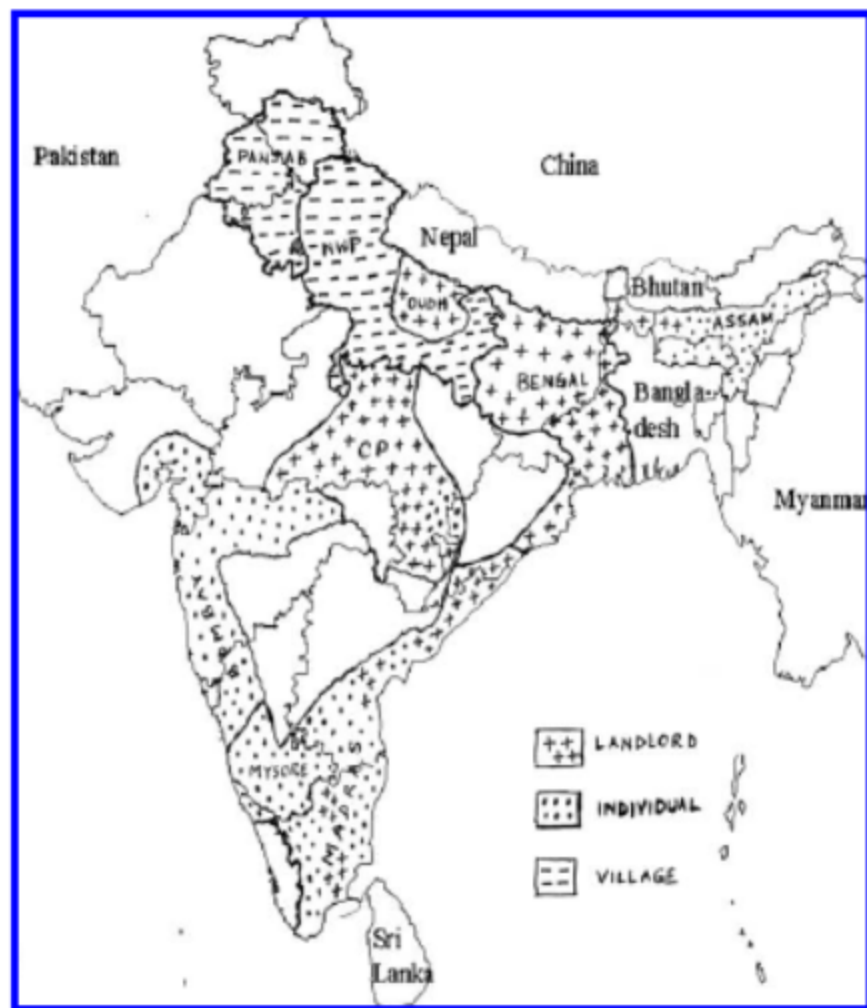


FIGURE 1. MAP OF INDIA

Methods and Findings

- Compare modern day measures in areas historically under different regimes on either side of boundaries. Instrument for conquest date. Balanced.
- **20th century outcomes. In cultivator regions:**
 - Higher yields (~16%) and investments, higher adoption of HYV seeds

Authors attribute differences to political economy (landlord dominated areas spend less on development, more conflict) and insecurity of tenant property rights in landlord areas.

Summing up thus far

- Benchmark models of efficient allocation and induced innovation
 - Effects of rising population pressure on optimal choice of technique and mix of production technologies
 - farming tenure adaptations needed to support such adaptations.
 - potential development and operation of land rental market
- Transactions Cost and Coasian theories of institutional change
 - when insecurity and transactions costs prevail 'wrong' initial assignment of property rights can have lasting impacts
- Some historical evidence that conflict, appropriation shape ownership in concentration sometimes associated with worse long term outcomes

Resource Allocation and Production Organization

- Extend simple land allocation model to land, labor and managerial ability or skill
- Technology, factor market imperfections and the efficient farm scale
- General equilibrium resource allocation benchmarks

Farm Household Models

- We built simple model of land market (no real labor market). - Now we study land and labor markets together for several applications:
- Endogenous labor supply
- Work own farm plot and/or hire or sell labor from the market. Market for land leases.
- Misallocation from shutting down one or more markets. Role of asset distribution with non-traded factors.
- Land rent and land taxes
- Equilibrium farm size distributions and (mis) allocation

See [Farm Household jupyter notebook](#) on Farm Households

What determines the size distribution of farms?

And patterns of Land and Labor market activity?

- Nature of Technology (returns to scale)
- Factor and product market imperfections
 - Transactions costs non-tradability in market of labor, land and farming skill or managerial ability
 - Access to credit, insurance, marketing assistance
 - Factor market power distortions

(continues)

- Size-biased policy distortions
 - Credit/subsidies that favor large (small) or well-connected
 - Discriminatory land policies, land ceilings, etc

Technology

Returns to scale

$F(T, L)$ is homogenous of degree k if $F(\tau T, \tau L) = \tau^k F(T, L)$

$k = 1$: constant returns (or linear homogenous)

(e.g. double both inputs gives double the output. $F(2 \cdot T, 2 \cdot L) = 2^1 F(T, L)$)

Returns to scale

$k < 1$: decreasing returns (rising marginal cost)

$k > 1$: constant returns (falling marginal cost)

Cobb-Douglas $A \cdot T^\alpha L^\beta$ is homogenous of degree $\alpha + \beta$

Homogenous and homothetic functions

- Higher output isoquants are 'blown up' versions of lower output ones
- Follow a $\frac{T}{L}$ from the origin and tangencies at intersection with every isoquant will have the same slope

With CRS, efficient scale of farm cannot be determined

- With $F(T, L)$ and $k = 1$ can only establish efficient factor proportion ratio $\frac{T}{L}$

$$\max_{T, L} p \cdot F(T, L) - r \cdot T - w \cdot L$$

$$p \cdot F_L(T^*, L^*) = w$$

$$p \cdot F_T(T^*, L^*) = r$$

$$\rightarrow \frac{F_L}{F_T} = \frac{w}{r}$$

Marginal Cost curve slopes

Competition means $P = MC(q)$

At an optimum $\frac{w}{F_L} = p = \frac{r}{F_T} = MC$

$MC(q) = AC(q)$ is constant when $k = 1$. Firm size indeterminate.

$MC(q)$ is rising when $k < 1$ so efficient scale q^* and hence factor input levels T^*, L^* can be determined from $P = MC(q^*)$ when $k < 1$

Efficient allocation with CRS with n-1 markets

Suppose there are N farmers each with access to a CRS Cobb-Douglas production technology $F(T, L) = T^\alpha L^{1-\alpha}$.

$$\frac{F_L}{F_T} = \frac{w}{r}$$

$$\frac{1-\alpha}{\alpha} \cdot \frac{T}{L} = \frac{w}{r}$$

All farms face same w/r and have same α so will employ same T/L ****

Equilibrium and Efficiency with CRS

- Farm size indeterminate.
- Can close down one market (e.g. land) and still reach efficient allocation

Land ownership endowments \bar{T}_i for each farmer i . No land market to trade.

Competitive labor market enough to equalize $F_L(\bar{T}_i, L_i^*) = \frac{w}{p}$ across all farms i

Efficient allocation at $L_i^* = \frac{\bar{T}_i}{\bar{T}} \cdot \bar{L}$

(useful b/c this extends to more complex models below where $F(\bar{S}_i, T_i, L_i)$ and \bar{S}_i non-traded)

Land and Labor Market Equilibrium

Suppose we have initial allocation of land property endowments \bar{T}_i across N farmers, but no land market.

There is however a labor market. Can we achieve efficient resource allocation despite 'failure' on land market?

With CRS one market to fail without efficiency cost

$N = 2$ example. Total endowment $\bar{T} = 100$. $\bar{T}_1 = 20$, $\bar{T}_2 = 80$

Labor market equilibrium: $L_1 + L_2 = \bar{L}$

Efficiency can be achieved using labor market to allocate more labor to farms with more land, to reach $\frac{T_1}{L_1} = \frac{T_2}{L_2} = \frac{\bar{T}}{\bar{L}}$

Tradable factor moves to the non-tradable: $L_i = \frac{T_i}{\bar{T}} \cdot \bar{L}$

The role of labor markets when land market is closed

Suppose economy has land $\bar{T} = 100$, and labor $\bar{L} = 100$. Each household has $\bar{L}_A = \bar{L}_B = 50$ If land is non-traded but property rights initially assigned as: $\bar{T}_A = 80$ and $\bar{T}_B = 20$

Efficient labor allocation on each farm would be:

$$L_A = \frac{\bar{T}_A}{\bar{T}} \cdot \bar{L} = \frac{80}{100} \cdot 100 = 80$$

Household *A* hires $L_A - \bar{L}_A = 80 - 50 = 30$ units of labor and household *B* sells that amount.

Value of labor endowment would be same even if land endowments had been different -- same equilibrium wage.

Farming skill and its distribution (adapts Lucas 1978)

Adapts Lucas (1978) "On the size distribution of firms".

- Span of control production function. Farm i :

$$\hat{F}(T_i, L_i, S_i) = S_i^{1-\gamma} [T_i^\alpha L_i^{1-\alpha}]^\gamma$$

$$\hat{F}(T_i, L_i, S_i) = S_i^{1-\gamma} [T_i^\alpha L_i^{1-\alpha}]^\gamma$$

- linear homogenous in S, T, L (i.e. CRS)
- S_i is **non-traded** farming skill or managerial ability
- T_i, L_i are traded land and labor

The Efficient Size Distribution of Farms

$\hat{F}(T_i, L_i, S_i)$ is linear homogenous in the 3 arguments. We can only determine optimum $\frac{T}{L}, \frac{T}{S}, \frac{L}{S}$

S_i is non-traded so other factors move to it to form farms. Analogous to how we found efficient labor allocations when T_i non-traded in simpler $F(T, L)$ case, now:

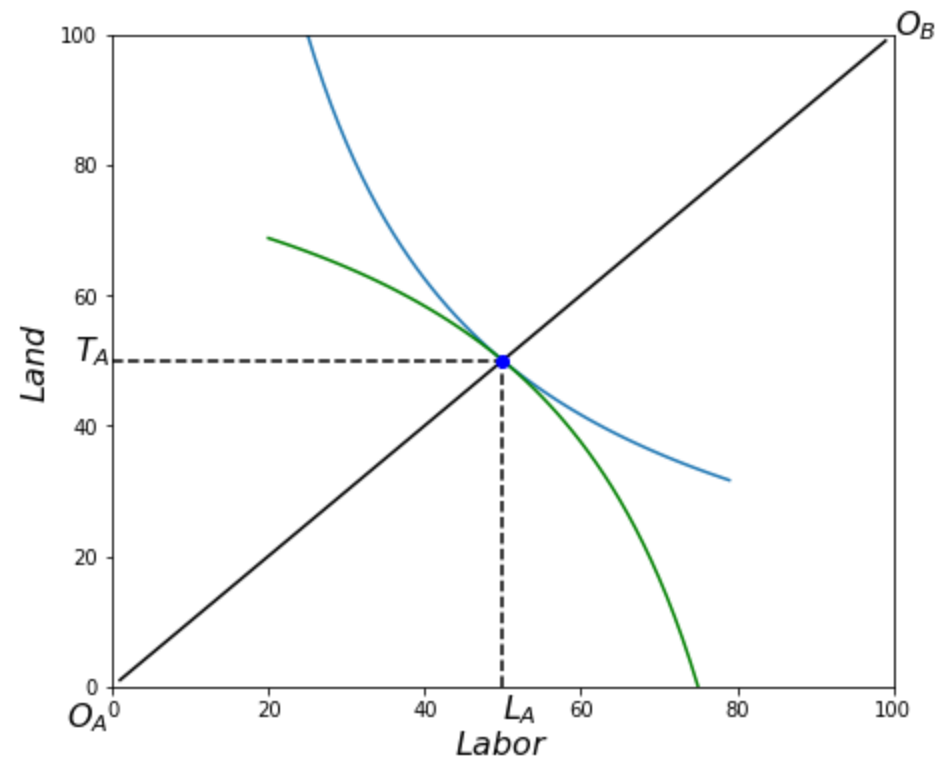
$$T_i^* = \frac{S_i}{\sum S_j} \bar{T}$$

$$L_i^* = \frac{S_i}{\sum S_j} \bar{L}$$

Identically skilled farmers

- $N = 2$ farm households (HH). Total land and labor $\bar{T} = \bar{L} = 100$
- HH have same skills $\bar{S}_A = \bar{S}_B = 50$, so $\bar{S} = 100$. Efficient use:
 - $T_A = \frac{\bar{S}_A}{\bar{S}} \cdot \bar{T} = 50$ and $L_A = \frac{\bar{S}_A}{\bar{S}} \cdot \bar{L} = 50$
 - $T_B = \frac{\bar{S}_B}{\bar{S}} \cdot \bar{T} = 50$ and $L_B = \frac{\bar{S}_B}{\bar{S}} \cdot \bar{L} = 50$
- if HH A's endowment is $\bar{T}_A = 40$ and $\bar{L}_A = 60$ it on NET HIRES IN:
 - $T_A - \bar{T}_A = 50 - 40 = 10$ units of land (hires *in* land)
 - $L_A - \bar{L}_A = 50 - 60 = -10$ units of labor (hires *out* labor)

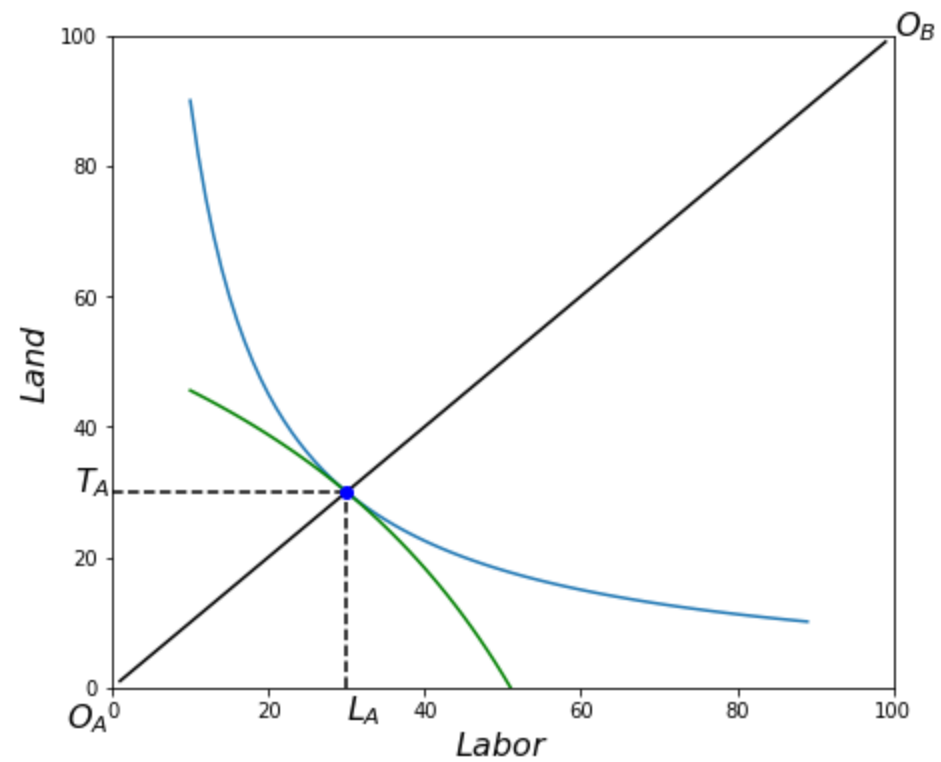
Equal distribution of farm skill:



Household A has less farm skill than B

- HH have skills $\bar{S}_A = 30$, $\bar{S}_B = 70$, so $\bar{S} = 100$. Efficient use:
 - $T_A = \frac{\bar{S}_A}{\bar{S}} \cdot \bar{T} = 30$ and $L_A = \frac{\bar{S}_A}{\bar{S}} \cdot \bar{L} = 30$
 - $T_B = \frac{\bar{S}_B}{\bar{S}} \cdot \bar{T} = 70$ and $L_B = \frac{\bar{S}_B}{\bar{S}} \cdot \bar{L} = 70$
- if HH A's endowment is $\bar{T}_A = 40$ and $\bar{L}_A = 60$ it on NET HIRES IN:
 - $T_A - \bar{T}_A = 30 - 40 = -10$ units of land (hires *out* land)
 - $L_A - \bar{L}_A = 30 - 60 = -30$ units of labor (hires *out* labor)
 - Lowering A's relative skill, increased it's net factor supplies

HH A has less farm skill compared to B:



Resource allocation and property rights assignment

- With complete markets (enough 0 transaction costs markets) efficient allocation does not matter on how initial property rights over \bar{S} , \bar{T} and \bar{L} are distributed across households.
- Markets reallocate factors to most productive uses leading to same output and competitive factor market prices w and r regardless.
- Initial assignment does affect income distribution. Household i 's income: $w \cdot \bar{L}_i + r \cdot \bar{T}_i + \Pi(\bar{S}_i)$
 - where $\Pi(\bar{S}_i)$ are 'farm profits' (return to non-traded skill)
 - Total economy output the same under any property rights assignment but HH with larger endowments earn more.

Any farm skill distribution

There are $N = 5$ farmers. Endowments \bar{T} and \bar{L}

If farmer 1 has skill $\bar{S}_1 = 2$ and farmers $i=2..5$ skill $\bar{S}_i = 1$

Then $\sum_{i=1}^5 \bar{S}_i = 6$ and efficient operation now has:

farmer 1 operate farm of size $T_1 = \frac{1}{3}\bar{T}$ and $L_1 = \frac{1}{3}\bar{L}$

other farmers operate farms of size $T_i = \frac{1}{6}\bar{T}$ and $L_i = \frac{1}{6}\bar{L}$

Note: efficient farm size independent of land ownership

1	2	4
	3	5

Farmer 1 operates $\frac{1}{3}$ of the land. Remaining farmers operate $\frac{1}{6}$ each.

Suppose thick line represent land ownership by farmer 1 (owns $\frac{2}{3}$ of all land). As shown farmers 2 and 3 become rent-tenants.

Cobb-Douglas forms

$$\hat{F}(T_i, L_i, S_i) = S_i^{1-\gamma} F(T_i, L_i)^\gamma$$

Also note for CD, marginal products relate to average products:

$$\hat{F}_L = \gamma(1 - \alpha) \frac{\hat{F}(T_i, L_i)}{L_i}$$

$$\hat{F}_T = \gamma(1 - \alpha) \frac{\hat{F}(T_i, L_i)}{T_i}$$

When $\gamma = 1$ linear homogenous (CRS) production function

$$F(T_i, L_i) = T_i^\alpha L_i^{1-\alpha}$$

Planner's problem

(e.g. village leaders acting as planner)

$$\max_{T_i, L_i} \sum_i S_i^{1-\gamma} [T_i^\alpha L_i^{1-\alpha}]^\gamma$$

subject to

$$\sum_i T_i = \bar{T} \qquad \sum_i L_i = \bar{L}$$

FOC:

Also equates marginal products of land and labor across farms.

Efficient allocation under planner or perfectly competitive market solution:

- equates marginal products of land and labor across farms
- For this homothetic production same $\frac{T_i^e}{L_i^e}$ across all farms
- Farms with larger S_i operate larger farms:

$$T_i^e = \frac{S_i}{\sum S_j} \bar{T} \quad L_i^e = \frac{S_i}{\sum S_i} \bar{L}$$

Cost minimization approach

Firms choose optimum input mix to maximize profits.

For any given output level q the firm minimizes costs:

$$TC(q) = \min_{T_i, L_i} rT_i + wL_i$$

$$\text{s.t. } F(\bar{S}_i, T_i, L_i) = \bar{q}$$

$$\text{FOC: } F_L(\bar{S}_i, T_i, L_i) = w \text{ and } \hat{F}_T(\bar{S}_i, T_i, L_i) = r$$

Efficiency requires that any two firms i and j have same marginal products and use same land-labor ratio (assuming here $p = 1$)

$$F_L(\bar{S}_i, T_i, L_i) = w = F_L(\bar{S}_j, T_j, L_j)$$

And similar for F_T . If we substitute in the efficient equilibrium

$$T_i^e = \frac{S_i}{\sum S_j} \bar{T} \quad L_i^e = \frac{S_i}{\sum S_i} \bar{L}$$

these marginal products can be written:

$$w = F_L = \gamma(1 - \alpha) \frac{F(\bar{S}, \bar{T}, \bar{L})}{\bar{L}}$$

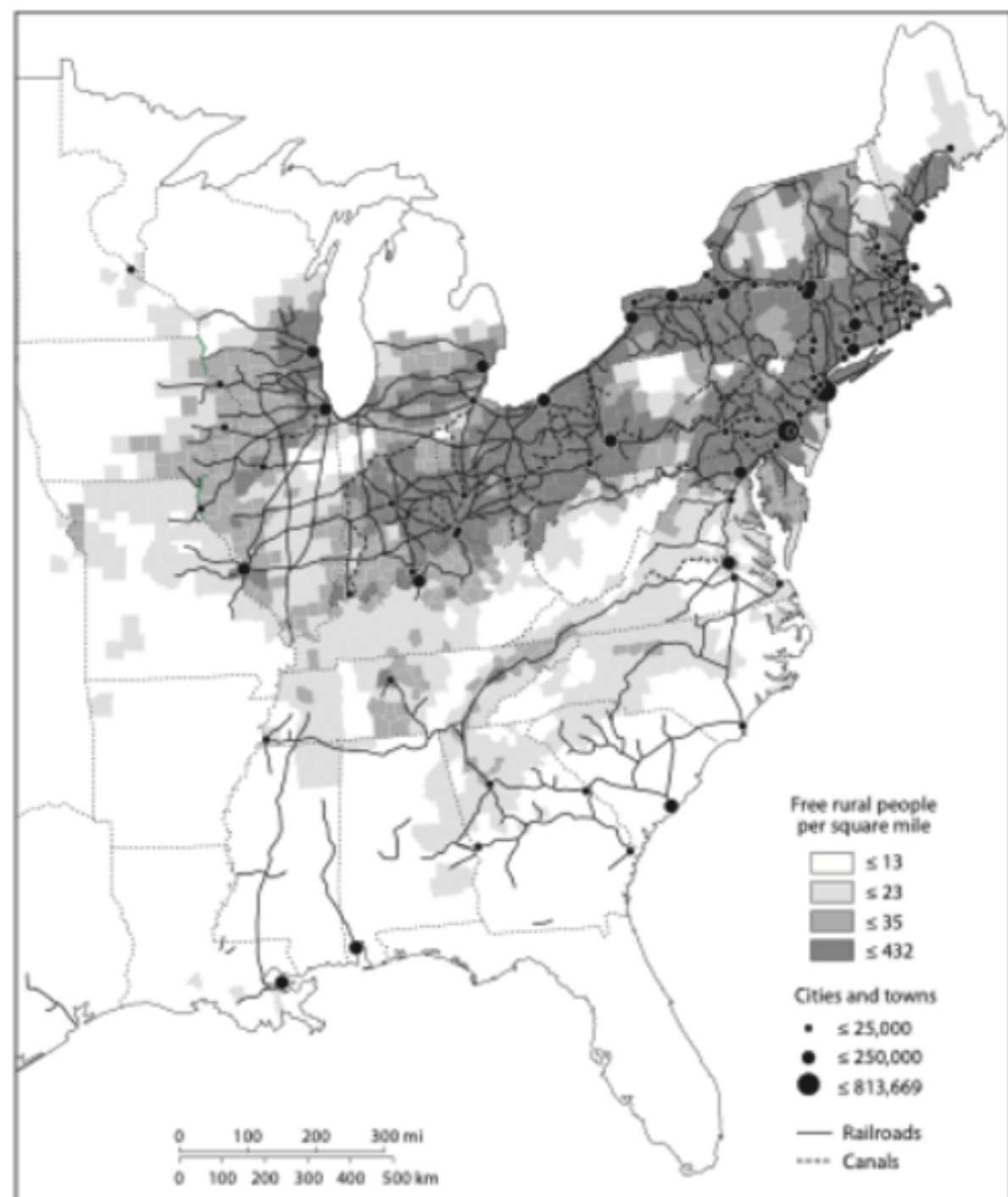
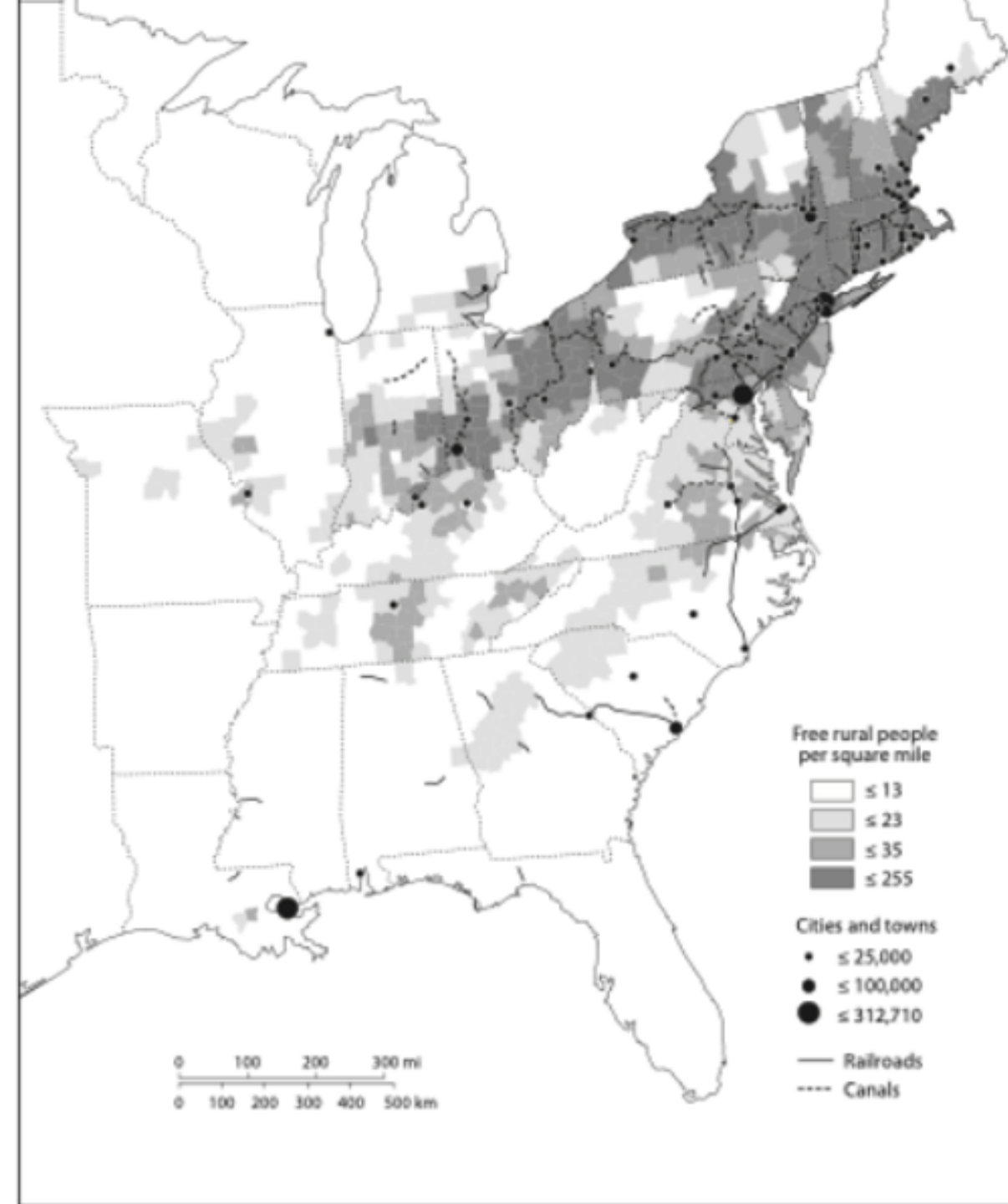
$$r = F_T = \gamma\alpha \frac{F(\bar{S}, \bar{T}, \bar{L})}{\bar{T}}$$

Equilibrium $\frac{w}{r}$ varies with economy-wide land-labor ratio: $\frac{w}{r} = \frac{1-\alpha}{\alpha} \frac{\bar{T}}{\bar{L}}$

USA experience

A thumbnail sketch of the plot might go something like this: Immediately after the Revolution, patrician agricultural improvers, animated by Enlightenment ideals, tried to modernize American farming from above. They succeeded in generating widespread interest in scientific farming but were cast aside when a sweeping deference-to-democracy politics took hold in the 1820s. Over the next couple of decades an enormous specialized farm press emerged, creating a distinct agricultural public composed of millions of middle-class farmers. After about 1840, a new generation of reformers mobilized this public to win state-level subsidies for agricultural societies that pledged to reform and improve farming practices through the introduction of science and technology, including biological innovation. During the 1850s, reformers (now backed by a huge network of agricultural societies, fairs and journals) scaled up their ambitions to the national level. They called for new kinds of federal farm agencies and funding for agricultural education and research. Southern politicians fought these initiatives tooth and nail, but when secession left Congress in the hands of the Republican Party, action was swift. Despite the

source: Ron (2021) [Origins of the US Agricultural State](#)



USA: squatter nation

- Claims clubs and frontier policy driven from below.
- Adverse possession and preemption laws. Later free or low price land via Homestead Acts.
- "a vast agricultural reform movement that arose between the American Revolution and the Civil War to demand novel federal policies that were fiercely opposed by slaveholders. (Ron, 2020)"

Soto, Hernando de. 2001. "Citadels of Dead Capital: What the Third World Must Learn from U.S. History." *Reason* May. [link](#)

Murtazashvili, Ilia. 2013. *The Political Economy of the American Frontier*. Cambridge University Press.

