

The Economic Institutions of Land and Agriculture



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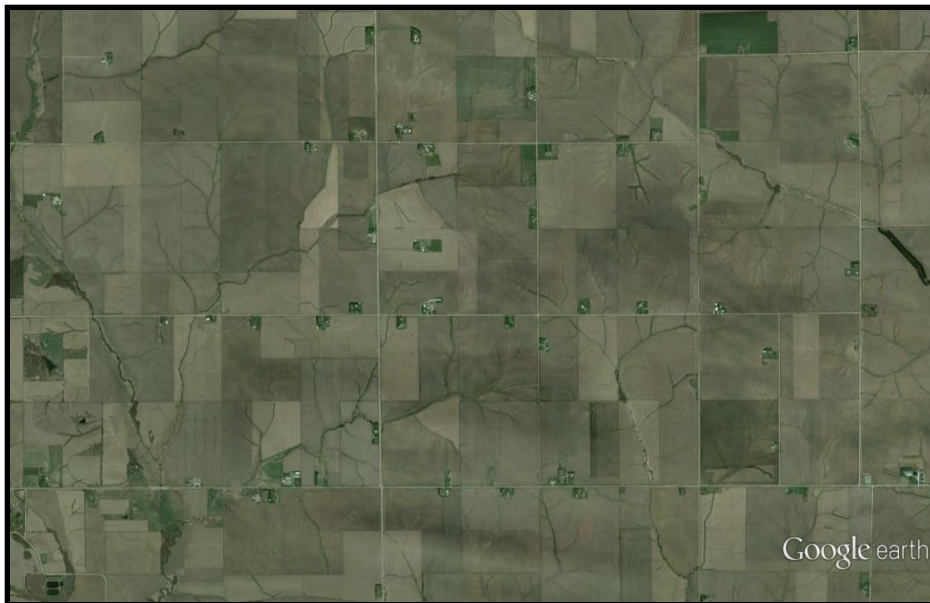
Workshop in Institutional Analysis NS

Humboldt-Universität zu Berlin

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What's Behind the Pictures?

Demarcated Landscape



Family Farm



OUTLINE

1. Economics of Institutions
2. Basics of Land and Agriculture
3. Land ownership and land demarcation
4. Farm organization and contracting
5. Large scale assets: water, wildlife, oil-gas, wildfire
6. Path dependence

Economics of Institutions

Institutions

- legal, political, contractual, customary constraints

Zero transaction costs

- Institutions do not matter or do not exist

Positive transaction costs (the real world)

- Institutions matter: property rights and contract are costly to define and enforce
- Institutions are costly to change

Basic Agricultural Institutions & Facts

- Agriculture output = $f(\text{land, labor, capital})$ but requires incentives to maximize the value of this output.
- Since the origin of agriculture private land has dominated.
- The demarcation of land has varied over time and space.
- Labor and capital – often jointly owned by a farmer – land owner.
- Contracts in agriculture must create incentives for optimal input use.

Sir Wm. Blackstone on Land and Agriculture

And the art of agriculture, by a regular connexion and consequence, introduced and established the idea of a more permanent property in the soil, than had hitherto been received and adopted. It was clear that the earth would not produce her fruits in sufficient quantities, without the assistance of tillage: but who would be at the pains of tilling it, if another might watch an opportunity to seize upon and enjoy the product of his industry, art, and labor?”

Commentaries on the Laws of England. [Book II, Chapter 1765]

Land Demarcation

1. Ancient human institution: foundation for land and markets.
2. Just two types generally: MB (e.g., Rome - Boston) & RS (e.g., Torino- LA)
3. We have a natural experiments in the US to study the consequences.
4. We have also studied the determinants of demarcation systems.

Land Demarcation as an Institution

Examine the causes & consequences of land demarcation systems using transaction cost and network economics. (Joint work with Gary Libecap)

1. Natural Experiment in Ohio (JPE 2011)
2. Demarcation in the British Empire (JLE 2012)
3. Natural Experiment in 19th Century California
4. Demarcation in the Roman Empire
5. Urban Demarcation – O’Grady’s NYC Grid, later project on US Cities.

Two Land Demarcation Systems

Mexico-US Border Near Yuma, AZ.



Barcelona



Demarcation and property rights to land

Two dominant systems:

- Metes and Bounds (MB)—individualized, uncoordinated, flexible. [ancient & simple, no surveying]
- Rectangular *i.e.*, Roman System (RS)—centralized, coordinated, rigid. [requires surveying]

Centralized system requires control over land allocation and social planning.

- Rome, British Empire, U.S. and Canadian frontiers.
- Urban settings. Paris. Land Development—Manhattan.

Some Big Issues Arise When Studying Land Demarcation

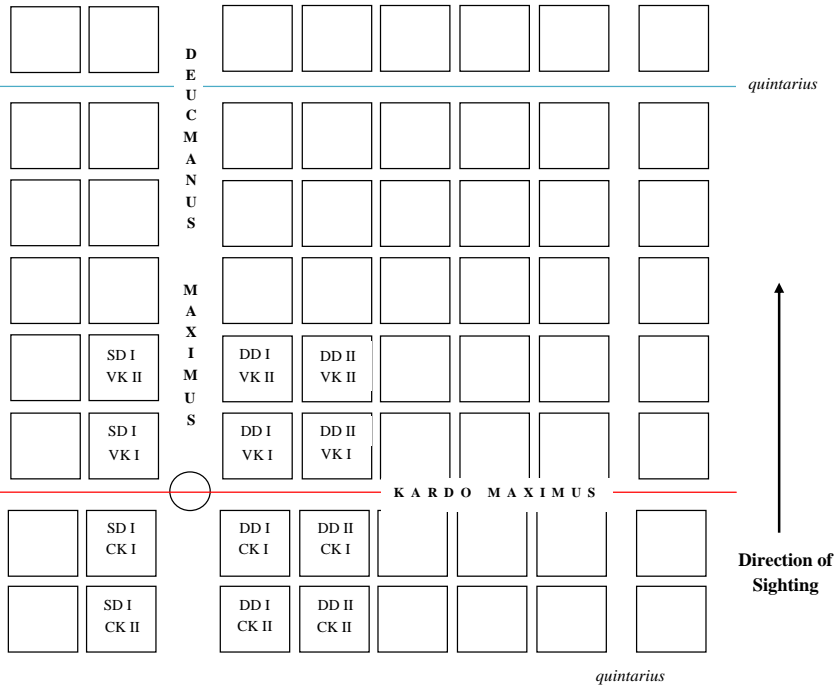
- The Role of the State (breadth & depth)
- Centralization vs. decentralization
- Size and scope of network effects (standardization vs. flexibility)
- Path dependency of institutions and the importance of a good start.
- Economic growth and institutions (ag to urban)

Rectangular demarcation systems around the world

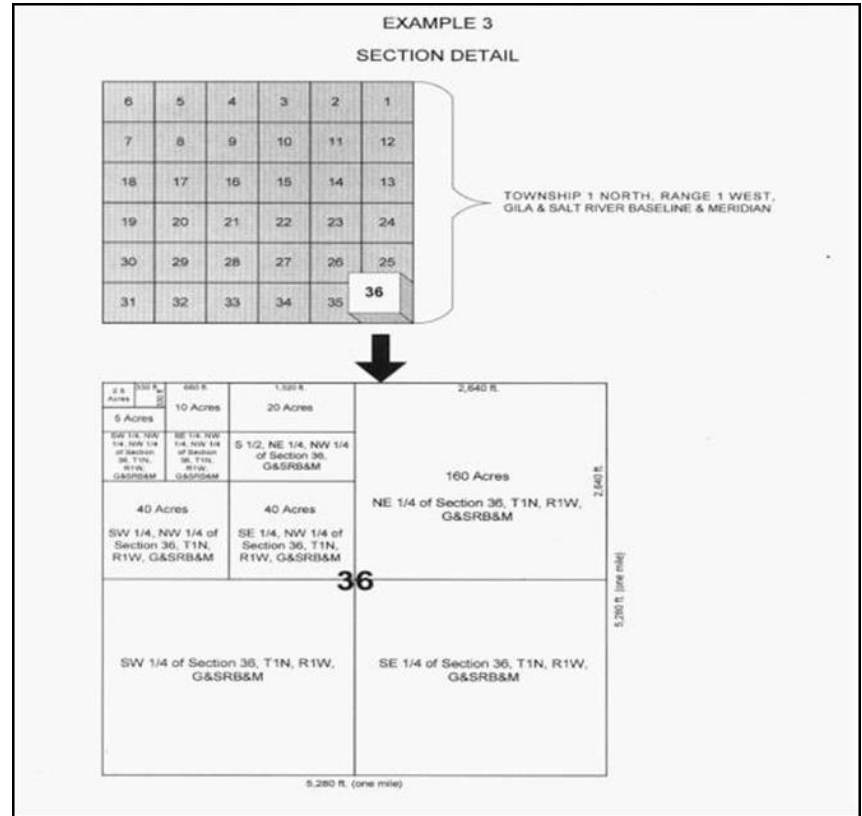
Greece	479 BC- c.146 BCE	Rectangle	unknown
Rome	170 BC – c. 500 CE	Square	varied
Indus Valley Civilization	3300-1700 BCE	Squares/ rectangles	North – South
Netherlands	11th century CE	Square	Not uniform
Mexico	1523-1656 CE	Rectangle	Unknown
Canada	1800s	Square	North – South
US	1785	Square	North-South

Two Rectangular Systems

Roman Centuria = 100 heredia



US System of Townships



RS: Benefits & Costs

BENEFITS OF THE NETWORK

1. Coordinates by convention parcel shapes and alignment.
2. Creates public good information that expands the land market – simple addresses.
3. Borders standardized, aligned, and fixed.
4. Common system of description and survey
5. Squares are efficient shapes for a wide variety of landuses.
6. Enforcement cost savings over time -- must claim all land (good & bad), no floating of surveys, no gaps & gores.

COSTS OF THE NETWORK

1. Upfront design of system – including costs of determining points of origin (e.g., principle meridians).
2. Upfront surveying costs.
3. Delay of land use & entry control costs.
4. Imposition of rectilinear borders in rugged terrain.
5. Administrative costs of system.

Adoption of the RS

A rectangular system is more likely to be adopted when

- Agents/ Sovereign can control large tracts of land.
- When the time horizon is longer.
- When implementation can be rapid.
- Network benefits among parties are high.

Less likely with rugged topography since that lowers value and increases costs.

Implications for RS abandonment are similar.

Evidence: British Empire, Ancient Rome, New York City, Dutch Polders

Economic Effects of the RS

1. Higher (per acre) land values under RS than under MB in flat land and this effect will be decreasing in terrain ruggedness. [Libecap & Lueck 2011, Libecap, Lopes & Lueck 2014, O'Grady 2014]
2. Fewer legal disputes (and litigation) over boundaries and titles under RS than under MB. [Libecap & Lueck 2011]
3. More land transactions under RS than under MB. [Libecap & Lueck 2011]

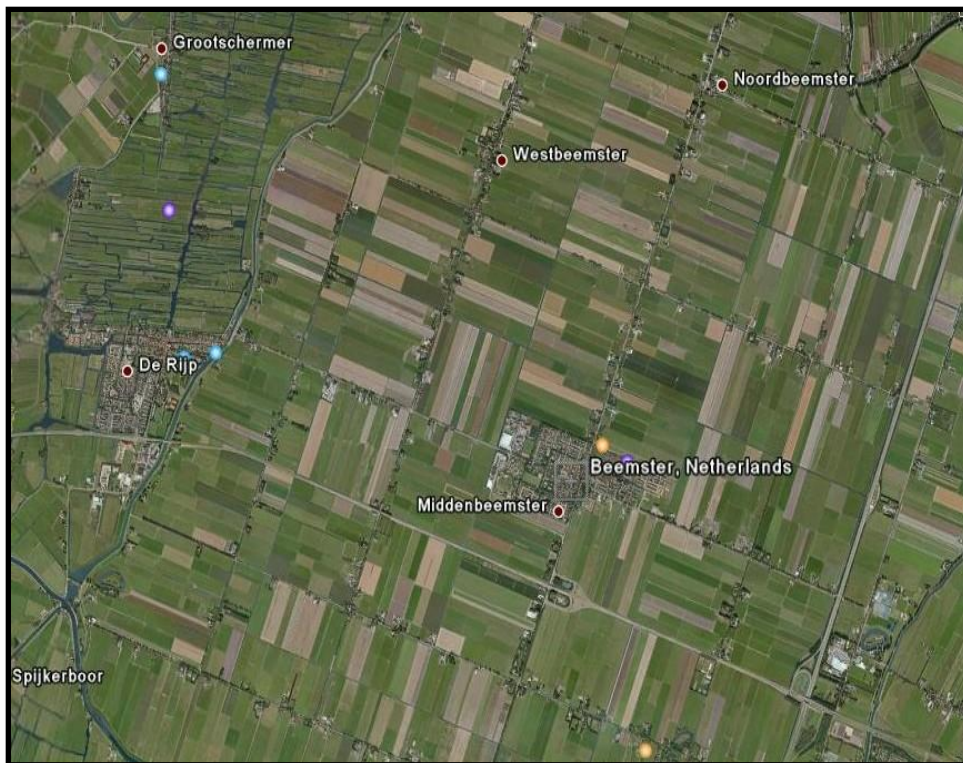
Path Dependence & Demarcation

1. Libecap & Lueck (2011) find RS value differences persist BUT no changes in demarcation.
2. Roman centuriation persists after 2,000 years.
3. Carthage as the classic example

Q: Why doesn't RS takeover the world?

- Investments are hard to move: houses & buildings, fences, ditches & road.
- The network gains require a large area to consolidate (like oil reservoirs) and then you need to destroy the above investments.

Polders- Beemster, Netherlands (52°N, 4°E)



- Valuable land was drained and demarcated in a grid.
- Old MB system is seen on right side.

The Nature of the Farm and the Economics of Farm Organization

Natural Forces Shape Incentives

- Uncertainty
- Seasonality

Assets are complex (many attributes)

Incentive theories vs. risk-avoidance theories.

The Nature of the Farm (Allen & Lueck 2003)

US Farms: 1920 - 1997

	1920	1997
FARMS	6,454,000	1,911,859
FARM SIZE (ACRES)	149	487
% OF US POPULATION	30.1	1.9*
# HORSES & MULES	25,199,000	None
# TRACTORS	246,000	3,936,014
# GRAIN COMBINES	4,000	460,606 (> 1 million in 1960)
# TRUCKS	139,000	3,497,735
CORN YIELD (bu/acre)	30.9	156.9
WHEAT YIELD (BU/ACRE)	13.8	75.2
% FAMILY	NA	86.0
% FULL OR PART OWNER	60.1	90.0

- Farm size has increased.
- Mechanization has increased.
- Crop yields have increased.
- Despite changes in technology farm organization has not changed much.

Source: Allen and Lueck (2003)

US Farm Organization: 1992-1997

Type of Organization	Acres		% Acres		Farms		% Farms	
	1992	1997	1992	1997	1992	1997	1992	1997
Individual/Family	604,279,515	585,464,911	63.9	62.8	1,653,491	1,643,424	85.9	86.0
Partnership	152,819,349	149,321,484	16.1	16	186,806	169,462	9.7	8.9
Family Corporations	110,836,974	119,559,203	11.6	12.8	64,528	76,103	3.4	4.0
Non-Family Corporations	11,930,944	11,904,053	1.2	1.3	8,039	7,899	0.4	0.4
Corporations		131,463,256		14.1		84,002		4.4
Other *	65,664,724	65,545,604	6.9	7.0	12,436	14,971	0.6	0.8
TOTAL	945,531,506	931,795,255	100	100	1,925,300	1,911,859	100	100

Family farms are often organized as simple corporations.

Source: Allen and Lueck (2003)

Vertical Coordination in US Farming

FARM PRODUCT	PERCENT VERTICAL COORDINATION (contract or integration)
Citrus fruits	100.0
Sugar beets	100.0
Sugarcane	100.0
Vegetables for processing	98.1
Potatoes	95.0
Seed crops	90.0
Other fruits and tree nuts	60.0
Vegetables for fresh market	53.0
Cotton	18.0
Oil-bearing crops	10.5
Food grains	8.5
Feed grains	7.5
Dry beans and peas	3.0
Hay	0.5

- Very little coordination in typical crops

Source: Allen and Lueck (2003)

Agricultural Contracts

- Land contracts: cash rent & share contracts
- Labor contracts: owner-operator & fixed wage
- Equipment contracts: hourly & hired with operator

Evidence from North American Agriculture

Land Contracts

- Share-cash choice is not explained by risk avoided (measured by crop yield uncertainty)
- Enforcement costs and land use incentives determine contract structure

Farm Organization

- Family farms economize on moral hazard losses when production requires timely action.

Source: Allen and Lueck (2003)

Risk versus Transaction Cost Incentives

Class Principle-Agent Model

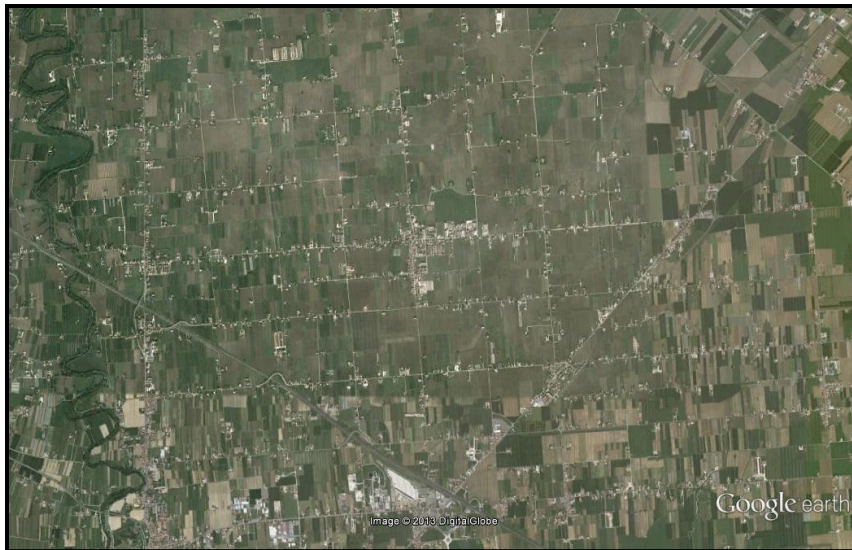
- Risk averse parties organize contracts to optimally share risk.

Transaction Costs Framework

- Risk neutral parties structure contracts and organizations to create optimal 2nd – Best incentives.
- Multiple dimensions of incentives.

Path Dependence in Institutions

Cesena, Italy (demarcated in 3rd century BCE)



Carthage, Tunisia (demarcated 2nd century BCE)



Large Scale Assets & Agriculture

- Oil gas
 - Groundwater
 - River basins
 - Viewsheds
 - Wildlife habitat
 - Firesheds
- Require a scale of ownership often larger than for agriculture.
- Management and use of these resources may lead to contracting or regulation or both.

Summary and Future Work

Summary

1. There is a transaction cost logic to the institutions of land and agriculture.
2. Path dependency is important in these institutions.

Extensions

- Land demarcation – urban rural, new areas (e.g., Africa, S America)
- Property rights to large scale resources – groundwater, oil & gas, firesheds, - - -
- Contract structure – joint determination of contract terms

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