

# Economic Organization and the Lease-Ownership Decision in Water



Kyle Emerick & Dean Lueck

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# ABSTRACT



This paper analyzes the lease-own decision using data on water transactions in the western USA. Water is transferred through short-term and long-term leases as well as permanent ownership contracts. Water is a unique asset in that its supply is highly variable and its transfer and use affect third parties. We apply an ordered probit analysis to investigate the empirical determinants of contract type. We confirm that long-term and permanent contracts are more likely when investments in specific assets are required for conveyance. We also find that longer term arrangements are common when buyers with uncertain water supplies are purchasing from sellers with more certain rights. We do not find robust evidence supporting the hypothesis that short-term agreements are more likely when the costs of a transfer to third parties are potentially high. Limits and future work are described.

# Paper Outline



## **1 Introduction**

2 California Water Institutions

3 Economic Organization

4 Data and Estimates

5 Summary and Direction

# Los Angeles Aqueduct

## A picture



## Facts

- LA owns water (and land) from Owens Valley in the Sierra Mts and the delivery infrastructure.
- 223 mile aqueduct completed in 1913.

[http://www.ladwp.com/ladwp/cms/\\_ladwp004409.jsp](http://www.ladwp.com/ladwp/cms/_ladwp004409.jsp)

# Classic Question in Economic Organization



What determines the contract length or lease-own decision?

Issues for our application in western US water:

- Asset specificity
- 3<sup>rd</sup> Party Effects: water externalities & pecuniary–political economy effects.
- Uncertainty (about water stocks)
- Asset complexity

# Paper Summary



- We use data on California water transfers to test theory specific assets (and some related ideas).
- We confirm that long-term and permanent contracts are more likely when investments in specific assets are required for conveyance.
- We also find that longer term arrangements are common when buyers with uncertain water supplies are purchasing from sellers with more certain rights.
- We do not find robust evidence supporting the hypothesis that short-term agreements are more likely when the costs of a transfer to third parties are potentially high. Limits and future work are described.

# Water & Economic Organization



**Water is a complex asset: quantity, quality, delivery time & place, rate of delivery, ---**

Water is a variable stock (seniority is part of law) unlike real estate.

Third party effects from use and transfers – quality changes and stream volumes.

Water and government policy – lots of intervention via public investment, taxes, subsidies, regulations.

Big deviations in marginal values for agricultural and urban uses are driving the market in many parts of the US.

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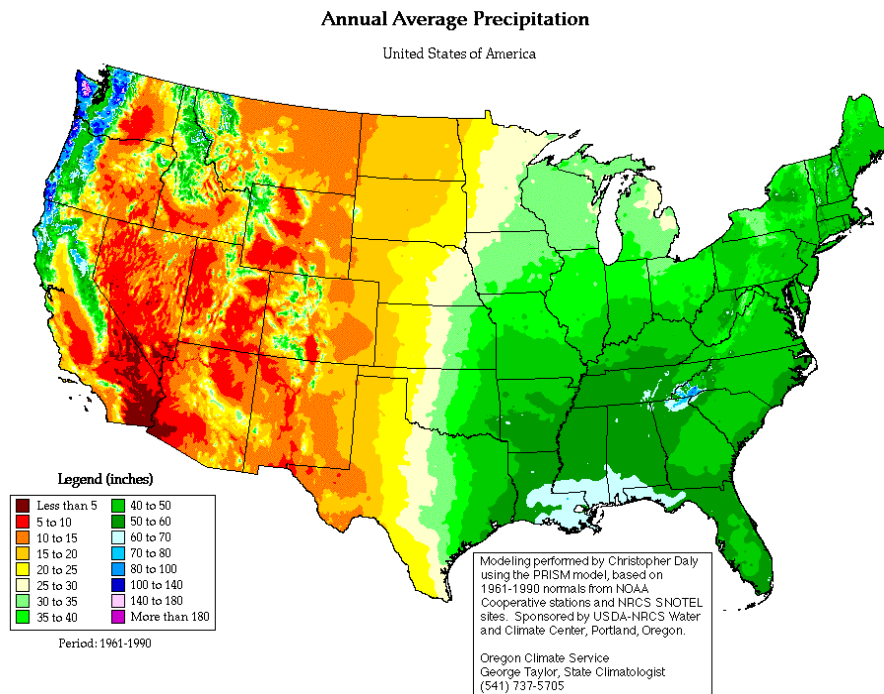
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# Water Law in Western USA – mostly private

## Distribution of Precipitation USA



## Water Law in USA

EAST 'riparian doctrine' ties water to riparian land (more typical of Europe)

WEST 'appropriative doctrine' severs water from riparian land and creates right similar to a property estate and is widely transferable (but with some important restrictions)

# More on California Water Organization

## Common law

- Appropriative rights – emerge early in mining communities.
- Irrigation districts (e.g., Imperial Irrigation District has old claim on lower Colorado – 1M acre-feet) often own delivery assets and govern water.

## State

- California State Water Project (SWP).
- Instream flow requirements & other environmental uses.

## Federal projects

- Central Valley Project (CVP)-- est. 1933, reservoirs, canals, aqueducts,

## Municipalities

- Commonly own water and are purchasing recently from agriculturalists.

# Some California Water Basics

California is the largest of the western states in terms of both agricultural and municipal water use.

On average, the state uses 34 million acre-feet of water/Year

[www.water.ca.gov](http://www.water.ca.gov).

An acre-foot of water is defined as the total amount required to flood an acre of land to a height of one foot. Typically considered to be enough water to satisfy the demand of an urban family for an entire year.

California has the largest agricultural economy of all states with 75-85% of water use in agriculture.

The fertile soils in the central part of the state are generally unproductive without sufficient irrigation.

The magnitude of agricultural water use is a common topic of debate given growing urban demands fueled by population growth.

**Widely diverging MVs between agricultural and urban (up to 10 x) use is causing reorganization. \$20/af in ag versus \$1,000/af in urban.**

# Details of Water Transfer Contracts

- Range from simple 2-page documents to complex contingent laden contracts.

Typical contract specifications [**very complicated compared to land or equipment**].

- Quantity & price: may even depend on water stocks.
- Duration: may have option to renew or lengthen.
- Conveyance procedures.
- Timing and location of diversion.

Other more complex deals include:

- conservation measures, land fallowing, arbitrage and termination clauses, resale w/ royalties, \* \* \*

# The Imperial Irrigation District (IID) Sale to San Diego County Water Authority (SDCWA)

- Largest single transfer in US history? Hundreds of pages of PDF files
- 200,000 + acre-feet from Lower Colorado Basin west over a divide to San Diego County.
- Negotiations began late 1980s completed in 2003.
- No-harm to 3<sup>rd</sup> party clause.
- contingencies in both prices & quantities, price adjustments over time, resale terms, & delivery schedules during each year of the agreement.

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# Economic Organization Questions



## Contract Choice

- Short versus long term
- Share versus fixed fees
- Allocation of control
- Flexible vs. rigid

## Ownership Choice

- **Lease versus own (farmland, trucking, coal . . . )**
- Form of ownership

Literature suggests organization is chosen to maximize PV net of transaction costs (e.g. Lafontaine & Slade 2007)

# Economic Forces & Water Organization



**Asset Specificity** (water delivery and conveyance – canals, aqueducts, pumping stations, dams).

**Third Party Effects** (downstream and in-stream impacts) & (political/pecuniary externalities).

**Uncertainty** (about the stock of water you have and what you are buying – linked to legal rights).

**Asset complexity** – many dimensions of water over which MH might occur.



# Predictions about Water Organization



PREDICTION 1: As **specific assets** for conveyance become more important long term agreements are more likely.

PREDICTION 2: When buyers have **uncertain water supplies** long term agreements are more likely. When sellers have **uncertain supplies** (e.g., junior rights) long term agreements are less likely.

PREDICTION 3: When the transfer has fewer **third party impacts** (real and pecuniary externalities) long term agreements are more likely.

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# Data – California Water Transactions



## **Ideal Data**

transaction level data with information on buyer and seller characteristics and characteristics of the water resource and surrounding area.

## **Our Data**

from a trade journal called the *Water Strategist* available at UCSB and from supplemental state and federal sources (e.g., California Dept of Water Resources, USGS, USDA, US Fish & Wildlife Service). Missing data on legal characteristics (e.g., seniority of right).

# Some Information about Our Data

## Transaction Data

- 416 water transfers in California from 1987-2008.
- 211 1-year, 65 long term, 65 ownership, 75 no time reported.
- Just **207 transfers** with information about buyers and sellers.

## Supplemental Data

- Precipitation for buyer and seller location.
- Water stock variability – 10 year CV – at both locations.
- Agricultural income shares.
- State parks water ownership.
- Endangered Fish Species.
- Precipitation.

# Empirical Strategy

Standard approach is to estimate lease length or discrete choice of own-lease (buy-make) decision.

Ordered probit estimates of lease length with three categories (1-year, long lease, ownership)

$$y_i^* = x' \beta + \mu$$

$$y_i = \begin{cases} 0 & \text{if } y_i^* < 0 \\ 1 & \text{if } 0 < y_i^* < \mu \\ 2 & \text{if } y_i^* > \mu \end{cases}$$

# Variables & Summary Stats

Variable Name	mean	stdv	min	max
<b>Asset specificity</b>				
Distance: buyer to seller (miles)	102	127	0	528
<b>Uncertainty</b>				
CV of water supply for buyer	0.79	0.42	0.03	1.96
CV of water supply for seller	0.73	0.53	0.04	2.55
<b>3<sup>rd</sup> Party Effects</b>				
# of endangered fish species in county	0.82	1.09	0	4
State Park water (linear ft / county area)	65.17	136.38	0	611.12
Agricultural Income Share in County	0.03	0.03	0	0.22
<b>Controls</b>				
Streamflow % of normal for buyer	101.92	109.40	2.25	648.42
Buyer precipitation in buyer county (inches)	12.44	7.37	1.80	41.09
Urban (municipal) buyer [0,1]	0.49	0.50	0	1

N = 200-300 depending on variable

# Mean Values by Contract Types

Variable Description	Short-Term Leases (1-yr)	Long-Term Leases	Permanent Sales
Buyer Precipitation (inches)	10.80	15.77	14.03
Buyer Long-Term Streamflow	93.11	114.70	119.68
Urban Buyer	0.29	0.72	0.65
<i>Distance from Buyer to Seller (miles)</i>	<i>0.85</i>	<i>1.02</i>	<i>1.77</i>
Buyer Water Uncertainty (CV)	0.71	1.02	0.84
Seller Water Uncertainty (CV)	0.73	0.76	0.72
Agricultural Income Ratio	0.03	0.03	0.02
State Park Water Area	75.17	56.27	22.93
Endangered and Threatened Species	0.71	1.00	1.22

# Ordered Probit Estimates

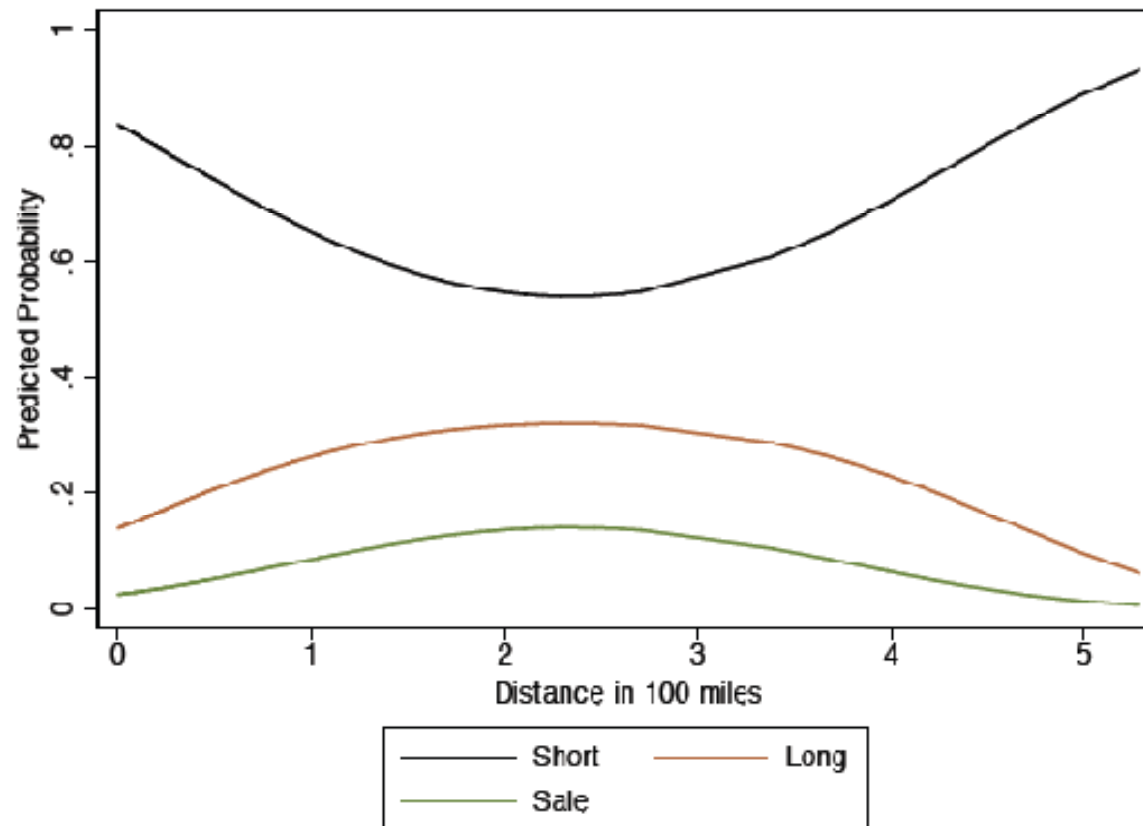
INDEPENDENT VARIABLES	Expected sign	(1)	(2)	(3)
<b>Asset specificity</b>				
Distance buyer and seller	+	0.75**	0.88**	0.67*
Distance squared	?	-0.16**	-0.23**	-0.17**
<b>Uncertainty</b>				
CV of water supply for buyer	+	1.17**	1.08*	1.12**
CV of water supply for seller	-	-0.72**	-1.64**	-0.73**
<b>3<sup>rd</sup> Party Effects</b>				
# of endangered fish species	-			0.19*
State water area	-			-0.001
Agricultural income share	-		-9.36*	
<b>Controls</b>				
Time trend	+	0.05**	0.01	0.04*
Buyer precipitation	+	0.06***	0.02	0.07***
Urban/municipal buyer [0,1]	+	0.70**	1.39***	0.64***
Observations		168	107	164



# Marginal Effects

Independent Variable	Transfer Type		
	Short Lease	Long Lease	Permanent
Controls			
Buyer Precipitation	-0.0224	0.013	0.0095
Buyer Long-Term Streamflow Percentage	0.0009	-0.0005	-0.0004
Urban Buyer	-0.2532	0.1424	0.1107
Time Trend	-0.0178	0.0103	0.0075
Asset Specificity			
Distance Buyer and Seller	-0.1596	0.0924	0.0672
Uncertainty			
Buyer Water Uncertainty	-0.4313	0.2497	0.1816
Seller Water Uncertainty	0.2645	-0.1531	-0.1114
Third Party Effects			
Agricultural Income Ratio	2.624	-1.8582	-0.7659
State Park Water Area	0.0004	-0.0003	-0.0002
Endangered and Threatened Species	-0.0705	0.0426	0.0279

# Predicted Probabilities - Distance



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# Summary & Conclusion



1. We examine the economic organization of water in the western US by studying the lease-ownership decision using data on California water transfers.
2. We find that asset specificity, water stock uncertainty, and the potential for 3<sup>rd</sup> party effects are key determinants of this choice.
3. Findings fit the literature on economic organization and add new data for a relatively complex transaction.

# Other Issues to Consider

1. General difficulty of measuring these transaction cost forces (e.g., DISTANCE, URBAN).
2. Political forces maybe important (the Owens Valley effect) – need to think more about measuring them.
3. Endogenous matching -- it is possible that buyers and sellers match along asset specificity and stock uncertainty dimensions.
4. Other specifications such as own-lease (similar findings) or continuous lease length, nested logit of lease/own in first stage.
5. We look at just a single contract dimension, but other contract terms might handle these issues separately or in combination.

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