Unlocking water markets: an experimental approach

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Introduction

Water markets - the lease and sale of water rights between willing buyers and willing sellers - have long interested economists. They have the potential to increase the efficiency of water use by moving water from lower-valued to higher-valued uses and increasing the incentive for irrigation efficiency. Despite the enthusiasm of economists, water markets have largely generally failed to develop in the western U.S., and indeed in most of the world (Young 1986, Brewer et al. 2008, Donohew 2009).

There are a number of possible explanations, including legal uncertainty surrounding water rights and fear of discovery, high transaction costs, potential third-party effects, and opposition from irrigation districts. We explore one potential reason that we feel has received less attention in the economics and policy literature: farmers as sellers may have preferences for different elements of a water market transaction that are not captured in the relative comparison of their profits from farming and their profits from agreeing to a deal.

Objectives

What elements of the institutional context of a water market trade (specifically a 1-year lease) are most important to senior water rights holders? **Do irrigators (as sellers) prefer**….

- to lease to other irrigators over environmental or municipal buyers?
- to lease their water rights for only part of the growing season (split season leases)?
- to lease through a non-profit water bank or a state-run bank?

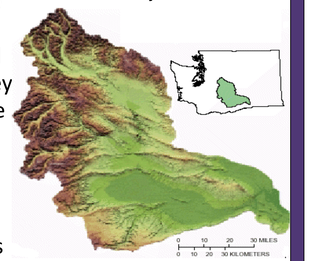
If so, what compensating differentials (premia) might the irrigators demand for different leasing scenarios?

Finally, do experiments using student participants, the typical participants in existing water market experiments, give comparable results? We focus only on the irrigator results in this poster.

Methods

We recruited 49 irrigators with senior water rights in the upper Yakima River Basin in Washington state to participate in a series of experimental auctions. These auctions asked participants to imagine that they owned and operated a 100-acre timothy hay farm with a given level of net revenue (i.e. an induced value design). Participants then reacted to series of offers for 1-year leases from hypothetical buyers where several attributes of the lease varied across tasks (**Figure 2**). We randomly chose one of the ~ 20 choices and paid participants in cash based on the earnings of their hypothetical farm in that round . We replicated the experiment with 38 UW undergraduates, though with lower cash payments.

Figure 1. Study location: Yakima River Basin, WA



Source: USGS

Figure 2. Sample experimental choice

Task 9 (Set2_block1_task3) PARTICIPANT ID_____

POTENTIAL BUYER	DEPT OF ECOLOGY	IRRIGATION DISTRICT	DEVELOPER	
LEASE TYPE	FULL SEASON	SPLIT SEASON	SPLIT SEASON	
INSTITUTION	NON-PROFIT WATER BANK	NON-PROFIT WATER BANK	NON-PROFIT WATER BANK	
PRICE	$270 PER AF	$300 PER AF	$250 PER AF	
	I WOULD AGREE TO LEASE MY WATER RIGHT TO THIS BUYER ☐	I WOULD AGREE TO LEASE MY WATER RIGHT TO THIS BUYER ☐	I WOULD AGREE TO LEASE MY WATER RIGHT TO THIS BUYER ☐	I WOULD NOT ACCEPT ANY OFFERS; I WOULD CONTINUE FARMING ☐

Which of the attributes was **most** important to you in your decision? (mark only one)	Which of the attributes was **least** important to you in your decision? (mark only one)
☐ **The type of buyer**	☐ **The type of buyer**
☐ **The lease type**	☐ **The lease type**
☐ **The type of water bank**	☐ **The type of water bank**
☐ **Price**	☐ **Price**

If this round were randomly-selected, you would earn: $_____

Results

We analyze the data using a random parameters logit (RPL) approach. We specify the following model, where V_0 is the indirect utility of rejecting a lease offer and continuing to farm and V_j is the indirect utility of accepting the lease:

$$V_j = \beta_j + \beta_{ss} SPLIT_j + \beta_p PAY_j + \beta_{p2} PAY_j^2 + \beta_{rp} RisAvers \cdot PAY_j + \beta_{np} NonProfitBank_j$$

$$V_0 = \gamma_0 + \gamma_{RISK} RiskAvers + \gamma_{2ND} SecondYr + \gamma_{R2} RiskAvers \cdot SecondYr + \gamma_{AGE} AGE + \gamma_{MALE} MALE + \gamma_{EDUC} EDUC + \gamma_{FARM} FARMNOW + \gamma_{MKTEXP} WM + \gamma_{AR} AGE \cdot RiskAvers$$

We find that non-monetary attributes are important to participants. Sellers prefer to lease to another irrigation district rather than the Dept of Ecology, or (especially) a developer. They prefer split-season leases. They are less likely to accept a lease if they are currently farming, and more likely to accept if they are younger, have water market experience, or have higher levels of education.

Table 1. Choice modeling results

	Multinomial logit		Random parameters logit	
Coefficient	Estimate	Est./s.e.	Estimate	Est./s.e.
Lease characteristics				
Irr. District	0.32**	2.02	0.62*	1.93
Developer	-0.77***	-3.91	-1.39***	-4.18
Split season (β)	1.13***	7.02	2.19***	4.43
Split season (σ)	--	--	3.76***	3.57
Offer price (β)	0.12***	3.67	0.21***	3.06
Offer price (σ)	--	--	0.018	1.44
Offer price^2	-4.1E^{-4}***	-2.62	-6.0E^{-4}**	-2.04
Nonprofit bank (β)	0.064	0.47	0.22	0.03
Nonprofit bank (σ)	--	--	0.033	0.03
Opt-out (ASC)	1.75	0.65	3.16	0.461
Respondent characteristics				
Risk aversion (β)	1.33***	2.99	1.81	1.43
Risk aversion (σ)	--	--	0.64***	2.70
2nd year of hay	2.16**	2.24	4.79*	1.72
Risk * 2nd year	-0.34*	-1.70	-0.56	-0.99
Risk * offer price	0.0037	1.52	0.0064	1.41
Age	0.16***	4.33	0.32***	2.80
Male	-0.28	-1.15	-0.95	-1.41
Educ	-0.57***	-6.39	-1.31***	-3.87
Farm	0.46	1.56	1.49*	1.88
Water Mkt Exper.	-0.86***	-2.92	-1.96**	-2.30
Age*Risk	-0.023***	-3.36	-0.039*	-1.94
Log likelihood	-525.28		-524.47	

Notes: n=49 irrigators, 756 total choice observations. Includes data from both single buyer and multiple buyer rounds. * denotes significance at the 10% level, ** at 5%, and *** at 1% levels of significance. Excluded categories: Dept. Ecology as buyer.

Figure 3. Predicted participation by percent of opportunity cost

% split season opp. cost	102	127	152	178	203	228	254
% full season opp. cost	92	115	138	161	183	206	229

Table 2. Average premia required to make offer j_1 as attractive as offer j_0

j_0 \ j_1	Ecology, Full	Irr. District, Split	Irr. District, Full	Developer, Split	Developer, Full
Ecology, Split	$17.47 (26.9%)	-$4.48 (-6.9%)	$12.19 (18.8%)	$10.69 (16.4%)	$30.42 (46.8%)
Ecology, Full	0	-$19.04 (29.3%)	-$4.48 (-6.9%)	-$5.77 (-8.9%)	$10.69 (16.4%)
Irr. District, Split		0	$17.47 (26.9%)	$15.88 (24.4%)	$36.98 (56.9%)
Irr. District, Full			0	-$1.34 (-2.1%)	$15.88 (24.4%)
Developer, Split				0	$17.47 (26.9%)

Conclusions

Using a sample of potential water market participants, we find that several non-price attributes of a water market contract matter, and that the irrigators demand a different premium, depending on the water contract offered. Agriculture-to-agriculture water transfers occurring in the later part of the growing season appear to have the highest potential for success. These results could be embedded in an hydroeconomic model of possible water market activity for the Basin.

Bibliography

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