Developing a Price Index for Western Water Rights

Matt Payne
AWRA Annual Water Resources Conference
November 9, 2011
Albuquerque, NM
Authors

• WestWater Research – Clay Landry and Matt Payne
  ▫ Water Resource Economics
    • Water asset valuation
    • Economic planning and feasibility analysis
    • EIS/EA economic support
  ▫ Transaction Advisory
    • Water rights acquisition
    • Marketing water assets
    • Investment services

• Mark Griffin Smith
  ▫ Professor of Economics
  ▫ Colorado College, Colorado Springs
  ▫ Research Interests: Environmental and resource economics, particularly water resources and climate change
Background

- Fixed/limited water supplies in the arid West
- New storage development becoming less feasible
- Large water volumes allocated to historic agricultural uses
- Growing urban and environmental demands
- Prior Appropriation: Defined and transferable water use rights
- An economically efficient solution: Market-based reallocation of water rights to higher value uses
- Challenges/Hurdles – water markets are not perfect
Motivation and Analysis Objectives

• Enhance understanding of market prices for water rights
• Assess water market efficiency
• Methodological contributions
  ▫ New method for examining time trends in water right prices
  ▫ New application of the dummy variable method for developing hedonic price indices to natural resources
  ▫ Compare multi-period pooled regression to the adjacent-period approach
## Data

<table>
<thead>
<tr>
<th>State</th>
<th>Market Region</th>
<th>N (Perpetual)</th>
<th>N (Temporary/Single Use)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colorado</td>
<td>Northern Colorado Water Conservancy District</td>
<td>381</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>South Platte Basin (Native surface water)</td>
<td>380</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Arkansas Basin</td>
<td>144</td>
<td>0</td>
</tr>
<tr>
<td>New Mexico</td>
<td>Middle Rio Grande</td>
<td>170</td>
<td>0</td>
</tr>
<tr>
<td>Washington</td>
<td>Yakima Basin</td>
<td>23</td>
<td>45</td>
</tr>
<tr>
<td>California</td>
<td>Central Valley</td>
<td>36</td>
<td>399</td>
</tr>
<tr>
<td></td>
<td>Mojave Basin</td>
<td>122</td>
<td>0</td>
</tr>
<tr>
<td>Texas</td>
<td>Lower Rio Grande Valley</td>
<td>57</td>
<td>82</td>
</tr>
<tr>
<td>Nevada</td>
<td>Truckee River Basin</td>
<td>1,073</td>
<td>0</td>
</tr>
<tr>
<td>Utah</td>
<td>Salt Lake City</td>
<td>379</td>
<td>0</td>
</tr>
<tr>
<td>Arizona</td>
<td>Active Management Areas</td>
<td>72</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td>Colorado River Corridor</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td><strong>Total, 2002-2010</strong></td>
<td></td>
<td><strong>2,841</strong></td>
<td><strong>616</strong></td>
</tr>
</tbody>
</table>
Middle Rio Grande Basin, NM

- **Unit Price ($/AF CU)**
  - **Standard Deviation**
  - **Average Water Right Price**

Graph showing the trend of Unit Price ($/AF CU) from 2000 to 2009, with a peak in 2006. The graph also shows the total volume traded (AF CU) with a significant spike in 2006.
Middle Rio Grande Basin, NM

Average Price ($/AF CU)

<table>
<thead>
<tr>
<th>Upstream - Isleta Dam</th>
<th>Downstream - Isleta Dam</th>
</tr>
</thead>
<tbody>
<tr>
<td>$16,321</td>
<td>$13,454</td>
</tr>
<tr>
<td>39 Transactions</td>
<td>131 Transactions</td>
</tr>
</tbody>
</table>
South Platte Basin, CO: C-BT Units

The graph shows the average price ($/AF) and volume (AF) of C-BT units from 2002 to 2009. The average price has generally decreased over the years, while the volume shows variability with peaks in 2002 and 2009.
Water Rights Price Index: Method


- OLS, log-linear specification
- “Dummy Variable Method” for estimating hedonic price indices: coefficients on transaction year dummy variables are the index numbers
- Sales weighted
- Multi-period pooled regression
  - Single model estimated using pooled data from 2002-2010
- Adjacent-period approach
  - Separate equations estimated for each two-year period
  - Preferred approach – allows implicit market values (coefficients) for volume, location, transaction term, and new uses to fluctuate over the 2002-2010 period.
Results: Adjacent-Period Approach
Price Variation Across States

- Attributable to differences in transaction costs, and supply and demand conditions
- Where physically possible, there is potential for gains from transboundary water right trade
  - For example, the Colorado River
  - Regulatory and political barriers
Implicit Capitalization Rate for Western Water Rights

- Defined as the discount rate that equates water right sale prices to annual lease rates
- Can also be thought of as \( \frac{\text{annual lease rate}}{\text{sale price}} \)
Price Variation Across New Uses

- In efficient markets, arbitrage causes price variation across different buyers (all else equal) to disappear rapidly (Libecap 2005)
- In western water markets, prices continue to vary widely by buyer type (ag, urban, environmental)
- Indicates that water markets are inefficient
Conclusions

• Scarce western water supplies are being reallocated to higher-value uses through a large number of market transactions
• In their current state, water markets are inefficient
• Policy changes can improve efficiency
  ▫ Poorly defined property rights
  ▫ Regulatory uncertainty
  ▫ Transaction costs
  ▫ Geographic and volumetric limitations on transfers
  ▫ No-injury
  ▫ Incomplete information
Thank You

WestWater Research, LLC
2375 E. Camelback Road, Suite 5122
Phoenix, AZ 85016

Ph. (602)387-5033
Email: payne@waterexchange.com

www.waterexchange.com
www.waterrightstrading.us