Visualizing Basis in the Water Futures Market: An Example from the Westside 5

The Westside 5 is a group of five agricultural water districts located in the southwestern portion of California’s San Joaquin Valley. The districts are home to a large number of permanent crop growers and rely heavily on water allocated by the State Water Project (SWP) to meet irrigation demands. Water demand in the region is inflexible as a result of the prevalence of permanent crops that do not allow for seasonal fallowing. SWP allocations are highly variable, and the Westside 5 often enter into spot market transfers¹ to acquire supplemental water supplies to offset low SWP allocations and meet the districts’ agricultural water demands. Inflexible water demands and variable water supplies result in high willingness to pay among Westside 5 buyers, and spot market transfers of water to the Westside 5 are often priced at a premium above the statewide average.

Relative scarcity influences price in all markets, including the water market. Market prices for water transfers are highly correlated with annual hydrologic conditions. The past three years of market activity illustrate how the water transfer market is impacted by changes in hydrology. For example, 2019 was a relatively wet year followed by drier conditions in 2020 and critically dry conditions so far in 2021. Figure 1 illustrates the NQH2O Index value and the concurrent Westside 5 water transfer activity across three different water year types.

¹“spot market” refers to single year surface water market transactions.

Figure 1: NQH2O Index Values and Westside 5 Spot Market Transfers January 2019 – May 2021
As shown in Figure 1, transfers of water to the Westside 5 were priced at or very near the NQH2O Index during a wet year, deviated slightly more from the Index in the subsequent dry year, and have traded at a premium to the Index in the first part of a critically dry year. This provides an indication that the Westside 5 basis is minimal in wet years (average = +20 in 2019), while basis is slightly higher in dry years (average = +60 in 2020), and substantially higher in critically dry years (average = +315 in 2021).

How can the Westside 5 use this information regarding basis? Let’s look at an example. Assume hydrologic projections are indicating a critically dry year, and a grower located within the Westside 5 anticipates needing to acquire 10,000 AF of spot market transfers in June. Based on the above analysis, the grower knows that the local water market basis in the Westside 5 is about +$315/AF. With that knowledge, the grower buys 1,800 water futures contracts (representing 10 AF each) for $400/AF in January with a June settlement date. In June, the NQH2O Index is at $800/AF and the grower makes $400/AF on the futures contracts. The grower still purchases 10,000 AF in the spot market for the regional price of $1,115/AF, but has effectuated a net purchase price of approximately $400/AF with their futures hedge. By accounting for basis, the Westside 5 grower was able to hedge against future price exposure and offset higher market prices through a net gain in the futures contracts.

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\text{Futures cost} = 7,200,000 \text{ based on } 18,000 \text{ AF} \times 400/\text{AF} \\
\text{Net futures return} = 7,200,000 \text{ based on } 18,000 \text{ AF} \times 800/\text{AF} - 7,200,000 \\
\text{Water acquisition cost} = 11,150,000 \text{ based on } 10,000 \text{ AF} \times 1,115/\text{AF} \\
\text{Net purchase price for water} = \approx 400/\text{AF} \text{ based on } (11,150,000 - 7,200,000) / 10,000 \text{ AF}
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This example does not account for margin or transaction costs.