

SHAUNA YOW TEXAS A&M UNIVERSITY SPONSOR: RIO GRANDE BASIN INITIATIVE

UNINTENDED CONSEQUENCES OF LEGISLATION ON THE ADOPTION OF WATER TREATMENT TECHNOLOGY

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Abstract

The population of Texas is expected to double by 2050. The Lower Rio Grande Valley is searching for alternative water sources and potable treatment methods to support a rapid population growth. An emerging promising approach is the desalination of brackish groundwater. Recent technology developments in desalination membranes combined with an increasing price of local water rights have resulted in the economics of desalination becoming more competitive with traditional treatment methods.

Attempting to facilitate meeting the increasing needs for municipal water, the 2007 Texas legislature passed Floor Amendment 60 of Senate Bill 3, establishing the price at which irrigation water converts to municipal water at 68 percent of the market price for municipal water converted prior to January 1, 2008. Preliminary economic and financial investigations suggest this legislation could affect the adoption of water treatment technology between brackish groundwater desalination and conventional surface water treatment methods.

This project seeks to identify and analyze the economic and social implications of the legislation on the Rio Grande Valley water market, any unintended consequences of legislation, and the resulting adoption of alternative technologies for producing potable water.

The Players: Irrigation Districts and Municipalities

- Irrigation Districts (ID) are constitutionally responsible for delivering water to municipalities
- Municipalities pay IDs for the cost to deliver water, not for the actual water
- Irrigation water rights can be purchased and converted to municipal water rights at a conversion rate of 2-to-1
- IDs believed the delivery rate being charged was too low because only operational costs were covered
- Municipalities believed they were paying too much for the water because they had a greater use and value than the irrigators for the water
- Water Rights Task Force was created in 2005 to address the Valley water issues
 - Eight-member committee of ID representatives, municipal representatives, and the Rio Grande Watermaster's Office
 - Resulting agreement between the task force members contributed to the language incorporated into an amendment to SB3, in Section 49.507
- Compromise represents game theory economics

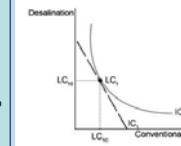
Economic & Financial Analysis

- Recent analyses indicate desalination technology is competitive and perhaps slightly less expensive than conventional surface water treatment at pre-2008 surface water rights prices
- 2007 legislation shifted the relationship to favor conventional surface water treatment on a cost basis
- A decrease in the cost of supplying potable water could result in an increase in the supply produced by conventional surface water treatment, with less supply produced by desalination
- Increased supply is available to consumers, which results in a reduced equilibrium price and expanded equilibrium quantity
- Change in equilibrium results in an increase in consumer surplus, but producer surplus could be less or more
- Financial results suggest effects of legislation on cost per acre-foot for a 7.5-8 million gallon per day facility to be:

Treatment Technology	Before	After
Conventional (\$/ac ft)	\$649.67	\$591.27
Desalination (\$/ac ft)	\$615.01	\$615.01

Isocost and Isoquant Pre-Legislation

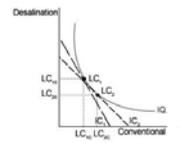
- Input Substitution: Economic choice between two inputs to produce a given quantity of one product
- Isoquant: Equal quantity of output of a good with varying combinations of two inputs
- Isocost: Equal level of cost for all combinations of the two inputs



- IC₁ is the isocost of desalination and conventional treatment pre-legislation
- IQ₁ is the isoquant of desalination and conventional treatment pre-legislation
- IC₂ represents the least-cost combination of potable water created by the two methods pre-legislation

Isocost and Isoquant Post-Legislation

- The slope of IC₁ changes after implementation of FA 60 of SB3 due to a decrease in the input price of conventional



- IC₂ is the isocost of desalination and conventional treatment post-legislation
- IQ₂ is the isoquant of desalination and conventional treatment post-legislation
- IC₂ represents the new least-cost combination of potable water created by the two methods
- Post SB 3, more conventional is favored in the combination due to the less expensive cost of source water for municipalities that was established in Floor Amendment 60

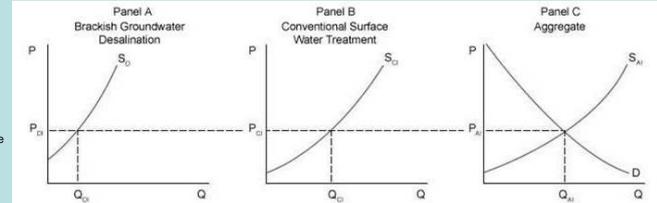
Background of Legislation

- Texas Senate Bill 3, the "Water Bill", was passed in 2007, during the 80th legislative session
- Floor Amendment 60 was passed:
 - Established the price at which municipalities can purchase converted irrigation water rights at 68% of the current market value of municipal water converted before January 1, 2008
 - Evolution of the Amendment was a long process because two competing bills addressing this issue were traveling through the legislature simultaneously:
 - "Abolishment Bill": HB 1271/SB 975
 - ID would completely surrender all rights and powers to municipality
 - Died in Calendar Committee
 - "Compromise Bill": HB 1803/SB 847
 - Implement compromise that was struck by Water Rights Task Force
 - Died in Calendar Committee, but was later passed as a floor amendment

Pre-Legislation Industry Supply, Aggregate Supply, and Industry Demand Curves

Panel A is groundwater desalination supply

SD = supply from desalination
PD1 = price of desalination before legislation
QD1 = quantity from desalination before legislation



Panel B is conventional surface water supply

SC1 = supply curve of conventional before legislation
PC1 = price of conventional before legislation
QC1 = conventional quantity before legislation

Panel C is aggregate of desalination and conventional, with industry demand

D = industry demand curve for potable water
SA1 = aggregate supply function before legislation
PA1 = equilibrium price before legislation
QA1 = aggregate quantity before legislation

Introduction

- An amendment to Texas Senate Bill 3 established the price at which irrigation water in the Lower Rio Grande Valley converts to municipal water at 68 percent of the market price of municipal water existing/converted before January 1, 2008
- The 68 percent rate was identified by a Task Force comprised of irrigation districts and municipal stakeholders through a process reflecting economic game theory
- This legislation could create unintended consequences for the choice of adoption between desalination and traditional treatment methods by artificially lowering the costs of conventional methods relative to desalination

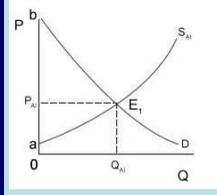
Objectives

- Analyze and identify potential implications of legislative decisions.
- Illustrate possible impacts in the Texas Lower Rio Grande Valley water market
- Identify consequential adoption of alternative potable water production methods
- Identify the most economically efficient method of providing potable water

Methodology

- Interviews with experts, economic and financial analyses, and on-line and library research
- Qualitative economic analyses of the Valley water market using graphics and theory
- Capital budgeting and annuity equivalent analyses to compare financial implications of conventional water treatment facilities relative to brackish groundwater desalination facilities
- Quantitative economic analyses utilizing financial analysis to determine impacts on Valley water market

Consumer & Producer Surplus Before Floor Amendment 60



The consumers in this instance are Valley citizens who consume potable water. The producers are brackish groundwater desalination and conventional surface water treatment facilities which supply the potable water.

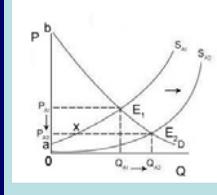
- Consumer surplus pre-legislation is represented by area $bP_{A1}E_1$
- Producer surplus pre-legislation is represented by area $aP_{A1}E_1$

Effects of FA 60 on Firms:

- Equilibrium price decreases, and desalination quantity declines to zero
- This is the most extreme possible case
- With lower price, quantity of conventional water increases

- Consumer Surplus: Difference between the value that a consumer places on each unit of a good and the actual amount paid for the specific quantity of that good
- Producer Surplus: Difference between the price received by a producer for a specific quantity of a good and the actual cost per unit to produce that quantity of the good

Consumer & Producer Surplus After Floor Amendment 60



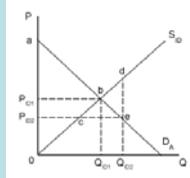
Consumer surplus post-legislation is represented by area $bP_{A2}E_2$

- Producer surplus post-legislation is represented by area $aP_{A2}E_2$

- Stakeholder Impact:
- Consumers are at an advantage due to gain in additional surplus
 - Producers (i.e., municipal treatment facilities) may lose or gain surplus depending on nature of the supply shift
 - The total surplus area is greater for these two groups

Irrigation District Surplus Before and After Legislation

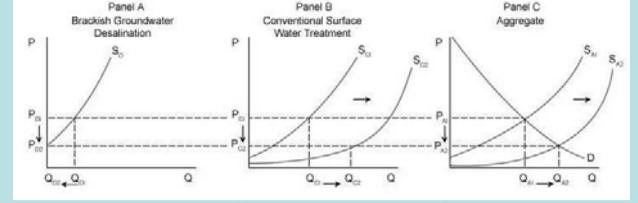
Consumers in this instance are municipalities, while producers are irrigation districts



Stakeholder Impact:

- Municipalities experience a gain in consumer surplus
- IDs experience a decrease in producer surplus due to having to provide a greater supply at a reduced price

Post-Legislation Industry Supply, Aggregate Supply, and Industry Demand Curves



PD2 = price of desalination after legislation
QD2 = zero quantity from desalination after legislation

SC2 = supply curve of conventional after legislation
PC2 = price of conventional after legislation
QC2 = conventional quantity after legislation

SA2 = aggregate supply function after legislation
PA2 = aggregate price after legislation
QA2 = aggregate quantity after legislation

Affects of FA 60 on Aggregate:

- Market equilibrium changes
- Market price decreases
- Market quantity increases
- Consumers benefit

Conclusions

- Legislation was in response to requests from Valley constituents and appears to satisfy their request, but also has some unintended consequences for the Valley water market
- Floor Amendment 60 to Texas Senate Bill 3 has potentially affected municipalities' future choices in potable water supply sources between conventional surface water treatment and brackish groundwater desalination
- An incentive for the continued use of conventional surface water treatment is created, while a disincentive for the adoption and expansion of brackish groundwater desalination is created
- Economic and social efficiency is weakened by discouraging adoption of new technology that can potentially provide water for future generations
- It is not within the scope of this study to conclude that this legislation is a social good or detriment due to the complexity of the issue

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Counties Affected by Floor Amendment 60

Valley Irrigation Districts

Desalination Facility in Brownsville, TX

Conventional Treatment Facility in McAllen, TX