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Unintended Consequences of Water Legislation

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Abstract

The population of Texas is expected to double by 2060. The Texas Lower Rio Grande Valley is one area in which alternative water sources and potable treatment methods are being sought to support a rapid population growth. An emerging and promising approach to expanding potable water supplies is brackish groundwater desalination. Due to recent technology developments in desalination membranes and increasing prices of surface water rights, the economics of desalination have become competitive with conventional treatment methods.

The seemingly comparable competitive economics relationship between conventional and desalination treatments was impacted by Floor Amendment 60 of Texas Senate Bill 3, which was an attempt to meet the increased demand for municipal water. This amendment established the price at which irrigation water in the Valley can convert to municipal water, as a result of urban/residential development of agricultural land, at 68 percent of the market price, effective January 1, 2008. Preliminary economic and financial investigations suggest this legislation could affect the adoption of water treatment technology. This paper identifies and analyzes the economic and financial implications, both intended and unintended, of Floor Amendment 60 on the Valley water market, and the associated adoption of alternative technologies for producing potable water.

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Introduction to the Problem

The population of Texas is expected to double between the years 2000 to 2060 (Texas Water Development Board 2006), substantially increasing the demand for potable water. These dynamics prompt stakeholders' concerns regarding the quantity and quality of future water supplies. The Lower Rio Grande Valley (Valley) of Texas, a four-county region bordering Mexico and the Gulf of Mexico, is an area in which alternative sources of water and potable treatment methods are being sought to support a rapid population growth (Rogers 2008).

The most current popular method for producing potable water in the Valley is the conventional treatment of Rio Grande surface water. The surface water used in the conventional treatment process originates from municipal water rights that are delivered by irrigation districts (IDs) and water improvement districts (WIDs).

One emerging approach to expanding the potable water supplies in the Valley is brackish groundwater[1] desalination (Norris 2006; Sturdivant et al. 2008). Critics of desalination have previously argued that this method is economically inefficient due to high costs of production (e.g., Michaels 2007). Recent technological developments in Reverse Osmosis[2] (RO) desalination membranes combined with an increasing price of local water rights have resulted, however, in desalination becoming more cost competitive with conventional treatment methods (Boyer et al. 2008).

The major municipal water suppliers (municipalities) within the Valley are Brownsville, Harlingen, and McAllen. IDs are constitutionally responsible for providing (i.e., delivering) water to municipalities. The municipalities are allocated water based on their pre-existing water rights and contracts with IDs (Stubbs et al. 2004). To account for the rapidly-growing municipal populations, irrigation water rights can be purchased and converted to municipal water rights.

Valley Water Issues

In early to mid-2005, Valley ID managers considered that the municipal delivery rates charged by some individual districts were too low. The rates were only covering operational costs, with the cost of capital replacement and rehabilitation largely ignored. Conversely, municipal managers believed they were paying too much for water delivery because the ID infrastructure was pre-existing. Some municipalities argued they were the largest customer of the ID and should therefore have some control over pricing policies/rates. The overall problem

[1] Brackish groundwater is underground "water containing more than 1,000 milligrams per liter (mg/L) of total dissolved solids (TDS) and less than 10,000 mg/L TDS" (Texas Water Development Board 2003).

[2] Reverse Osmosis "is the reversal of the natural osmotic process, accomplished by applying pressure in excess of the osmotic pressure to the more concentrated solution. This pressure forces the water through the membrane against the natural osmotic gradient, thereby increasingly concentrating the water on one side (i.e., the feed) of the membrane and increasing the volume of water with a lower concentration of dissolved solids on the opposite side (i.e., the filtrate or permeate). The required operating pressure varies depending on the TDS of the feed water (i.e., osmotic potential), as well as on membrane properties and temperature, and can range from less than 100 psi for some NF [Nanofiltration] applications to more than 1,000 psi for seawater desalting using RO" (Environmental Protection Agency 2005).

was a difference in the perspective of each party regarding the provision of water, without consensus agreement as to the underlying value of the associated water rights (Hinojosa 2007).

An eight-member Water Rights Task Force committee consisting of ID managers and representatives of the municipalities was created in 2005 to address select Valley water issues of concern to both IDs and municipalities. The task force met from June 2005 until coming to an agreement during December 2006, which was reviewed and approved by attorneys on each side (Hinojosa 2007).

Subsequently, additional meetings between the IDs and municipal representatives were held. The result was a written agreement contributing to the language subsequently incorporated into an amendment to Senate Bill 3 (SB 3) which appears in Section 49.507 (Texas Legislature Online 2007b). This amendment, Floor Amendment 60 (FA 6), established the price at which municipalities can purchase converted irrigation water rights associated with the urban/residential development of irrigated agricultural land at 68% of the current market value, effective January 1, 2008 (Texas Legislature Online, 2007b). The 68% value is thought to have originated based on actual historical firm yield of the Rio Grande as related to the amount of water actually adjudicated (Jarvis 2007).

Background of Legislation

Texas Senate Bill 3, the "Water Bill", was passed in 2007 during the 80th Legislative Session. The evolution and passage of FA 60 was a long process because two competing bills that addressed the Valley water issues were traveling through the Texas Legislature simultaneously.

The goal of the "Abolishment Bill" (House Bill 1271/Senate Bill 975) was to eliminate the Hidalgo County Water Improvement District #3 (WID). This would mean a complete surrender of all rights and powers held by the WID to the local municipalities. Due to specific and careful wording, this bill would only affect Hidalgo County WID #3 and the City of McAllen (McAllen). The argument behind this action was that this district was only serving 13 farmers. As a consequence, 80% of the district's water delivery services were being provided to McAllen, which accounted for 89% of the revenue earned by Hidalgo County WID #3. McAllen wanted to eliminate the necessity of paying a middleman to deliver their water, and therefore pushed for the legislative abolishment of this WID. Statewide attention was drawn to the abolishment bill wherein rights and authority are stripped from an existing ID or WID. As the 80th legislative session evolved, House Bill 1271 was left pending in committee on February 28, 2007, and failed to advance in the legislative process. The companion bill, Senate Bill 975, was passed in the Senate on April 19, 2007, but was not placed on the Calendar in the House (Texas Legislature Online 2007b).

Shortly after House Bill 1271 (the "Abolishment Bill") was filed in the House, a competing bill, the "Conversion Bill" (House Bill 1803/Senate Bill 847), was also filed. The intention of this bill was to implement the previously mentioned "compromise" that was struck by the Water Rights Task Force. The compromise was to establish a mechanism to ensure a water supply for subdivided properties within IDs while keeping IDs whole.[3] A municipality may petition an ID for the sale of the converted irrigation right associated with the subdivision or contract for the use of the water (Hinojosa 2007). As provided by specific wording in the bill, this legislation would only apply to Hidalgo, Cameron, and Willacy Counties in the Valley. Similar to House Bill 1271 (the "Abolishment Bill"), House Bill 1803 (the "Conversion Bill") failed to advance to the House floor. Senate Bill 847 was passed in the Senate on April 19, 2007, the same day that the competing Senate Bill 975 was passed. Senate Bill 847, however, also failed to advance on the House side (Texas Legislature Online 2007b).

Although both the "Abolishment" and "Conversion" bills stalled in the process, the concepts and agreements reflected by the bill language remained in debate. Language similar to House Bill 1803/Senate Bill 847 (the "Conversion Bill") resurfaced as a floor amendment to SB 3. In response, the previous "Abolishment Bill," Senate Bill 975, was attached as an amendment to FA 60. The outcome was passage of the Conference Committee Report for Senate Bill 3 as Floor Amendment 60, without the proposed abolishment component (Texas Legislature Online 2007b).

Potential Implications of Floor Amendment 60

As the Valley population continues to experience extraordinary growth rates, the concern of IDs in regards to a "taking" of water rights due to shifts in political strength are more acute. Discussions among the parties in 2005-2006 suggested the possibility of future increases in political power for municipalities, thereby decaying the position of IDs. As a consequence, the time (i.e., 2007 80th Texas Legislative Session) was right for compromises, leading to the Water Rights Task Force's agreement and related Senate Bill 847 and House Bill 1803.

Preliminary Investigations

Preliminary economic and financial investigations suggest that the implementation of this legislation could impact the competitiveness of desalination of brackish groundwater compared to conventional surface water treatment. The potential effect is a lowering of the costs of production for conventional treatment, resulting in a relatively more favored use of conventional treatment for producing potable water supplies to the detriment of brackish groundwater desalination. This effect suggests the introduction of a disincentive for the adoption of new technology. The institutionally driven lowering of the costs of conventional treatment methods relative to desalination methods is an example of how legislation can unintentionally impact local decisions and technology adoption.

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[3] The terms "keeping IDs whole" refers to the ability of IDs to operate at full capacity rather than allowing some water resources to sit idle. Doing so increases economic efficiency of the IDs.

Objectives

The objectives of this paper are to examine the potential impacts of legislative decisions on the Valley potable water market and to illustrate the economic and financial implications for various stakeholders. Insights are sought in regards to the consequential adoption of alternative potable water treatment methods and related welfare impacts on municipalities, consumers, and irrigation districts.

Methods

In an effort to analyze the potential implications of FA 60 of SB 3 on the Valley potable water market and its stakeholders, several interviews with experts were conducted. These interviews began in October 2007 and included legal and water experts and irrigation district managers. In addition, intensive on-line and library research was conducted to obtain additional information. Qualitative economic analyses of the Valley water market were conducted and evaluated to investigate and illustrate the perceived or possible effects of the legislation on municipalities' choice between alternative water treatment methods. Financial analyses, including capital budgeting and annuity equivalent analyses, were used to compare the financial implications on the life-cycle costs of producing potable water using conventional treatment facilities relative to using brackish groundwater desalination facilities. Conclusions were derived regarding the potential effect of such legislation on the adoption of emerging technologies for producing potable water. The economic gains and losses of consumers, municipalities, and IDs in the Valley water market were also examined.

Results

An evaluation of the effects of FA 60 on the costs of Valley potable water treatment options for municipalities, consequences of available water supply, and the overall impacts on stakeholders is provided in this section. Included are applications of game theory, financial analyses, isoquants and isocosts, supply and demand, and consumer and producer surplus.

The Compromise: Game Theory Economics

To completely understand the full consequences of the legislation, both intended and unintended, it is essential to consider the many ramifications of the amendment. FA 60 was the culminating result of what could be interpreted as "game theory" negotiations between the two parties.[4] Because of the increasing demand for water by the Valley municipalities that are experiencing unprecedented population growth, IDs were concerned that a legislative "taking" might be the course of action if they did not compromise with the municipalities. That is, the threat perceived by the IDs was that the water rights could be reallocated legislatively from the

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[4] Perloff (2004) was used as a reference for the economic theory and concepts that were applied to the research.

IDs to municipalities. The intent of the bill was to ensure a supply of water for the municipalities, while keeping a district whole. Municipalities were guaranteed a path for ensuring water supply with clear rules. The objective of the two parties to create a mechanism to keep the region's collective water rights in the Valley was also established.

The goal of both IDs and municipalities was to individually obtain the highest possible utility on the price (low for municipalities and high for IDs) of irrigation water converted to a municipal right. A compromise was reached between IDs and municipalities on a price to be paid for municipal water rights originating from the conversion of irrigation water associated with agricultural land development into urban/residential property on or after January 1, 2008. This objective of two agents, each attempting to competitively reach the highest utility for two goods, is graphically illustrated in figure 1 as an Edgeworth Box Diagram. Opportunities exist for both agents (IDs and municipalities) to reach higher levels of utility as they negotiate with each other and move toward the Contract Curve (CC).

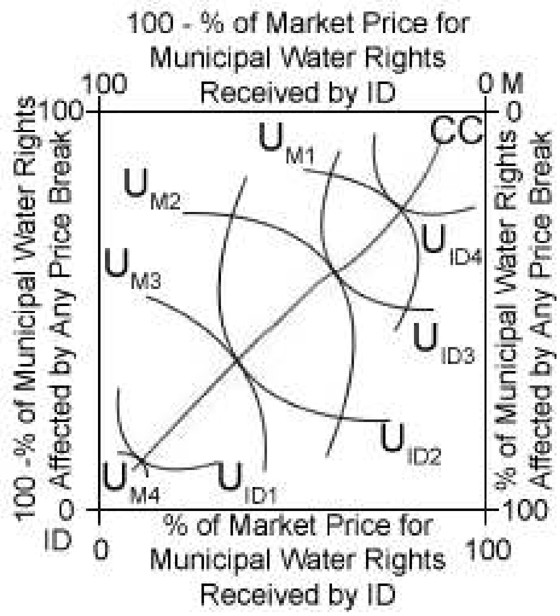

Figure 1. Edgeworth Box Diagram for Valley Irrigation Districts and Municipalities

The goal of Floor Amendment 60 of Texas Senate Bill 3 was to provide a policy that would benefit and demonstrate legislators' responsiveness to the constituents (IDs and municipalities) of the affected region. In the effort to achieve efficiency and consistency, however, some inadvertent consequences may have been created.

Financial Analyses

Texas AgriLife Research and Texas AgriLife Extension Service agricultural economists recently completed economic and financial analyses of the costs of producing potable water using the two prevalent technologies employed in the Valley: conventional surface water treatment (Rogers 2008) and brackish groundwater desalination (Sturdivant et al. 2008). The baseline assumptions embodied in these analyses are those existing prior to the 80th Texas Legislature and prior to the passage of SB 3. Full economic costs are calculated for each type of water treatment technology, accounting for initial construction costs, replacement of capital components over the total facility's useful life, annual operating/continuing costs, and the requisite investment in water rights.[5] Net present value (NPV) analyses and calculation of annuity equivalents are employed to determine the life-cycle costs of comparable quality potable water production for corresponding operational circumstances in Valley facilities using each of the technologies. The resulting modified life-cycle costs of production cited in Rogers (2008) and Sturdivant et al. (2008) are considered suitable for comparison purposes.

The McAllen Northwest 8.25 mgd conventional surface-water treatment facility has a modified life-cycle cost of producing potable water equal to $667.74/ac-ft ($2.05/1,000 gallons), in 2006 dollars (Rogers 2008). The modified life-cycle cost of producing potable water for the Southmost (Brownsville) 7.5 mgd brackish groundwater desalination plant is $615.01/ac-ft ($1.89/1,000 gallons), in 2006 dollars (Sturdivant et al. 2008). The inference of these results is that prior to January 1, 2008, brackish groundwater desalination economics in the Valley were competitive with conventional surface-water treatment economics, even to the extent of a slight advantage for the brackish groundwater desalination alternative. These studies do not propose that desalination will replace conventional water treatment, but rather that desalination is an economically viable option for increasing potable water supply.

Financial and Economic Implications Pre-Senate Bill 3

Drawing on economic concepts and theories, municipalities' choice of which potable water treatment technology to utilize in meeting increasing water demands in the Valley can be characterized using isoquant and isocost graphs. Considering Valley wide potable water needs, a convex isoquant representation (IQ_1) is appropriate to illustrate the decreasing substitution nature existing among all potable water production situations in the Valley (figure 2). Superimposing an isocost line [having a slope of -1.09 (i.e., $667.74/ac-ft for conventional surface water treatment /$615.01/ac-ft for brackish groundwater desalination)] on the isoquant in figure 2 suggests a combination of the two designated technological inputs that can be expected to be adopted to meet future expanded potable water demand; i.e., LC_{1D} level of desalination effort and LC_{1C} level of conventional water effort are used to meet the total quantity of IQ_1.

[5] Purchase/ownership of water rights is a requirement only for conventional surface-water treatment facilities. For brackish groundwater desalination facilities, the costs of developing the groundwater well field is a component of the initial construction costs.

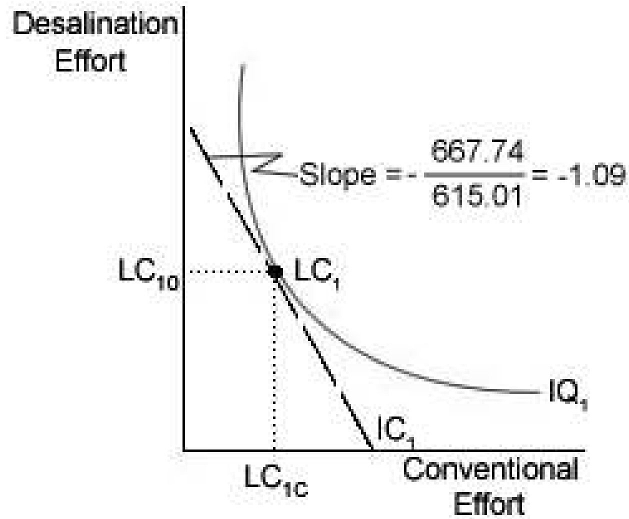

Figure 2. Isocost and isoquant of Valley potable water supply, pre-Senate Bill 3

Financial and Economic Implications Post-Senate Bill 3

The 68% factor in Section 49.507 of SB 3 reduces the costs of future expansion of potable water production from conventional technologies while leaving the costs of brackish groundwater desalination unaffected. That is, the purchase costs of municipal surface water rights converted as a result of development after January 1, 2008 are reduced by 32%. Incorporation of this institutionally induced cost reduction into the previously noted Rogers et al. (2008) analysis of the McAllen Northwest 8.25 mgd conventional surface-water treatment facility lowers the current $2,300/ac-ft cost of surface-water rights to $1,564/ac-ft (Rogers 2008). Using this adjusted, lower surface-water rights investment along with the other cost data identified for the modified analysis results in a revised, "modified" life-cycle cost of producing potable water of $609.33/ac-ft ($1.87/1,000 gallons), in 2006 dollars (Rogers 2008). The cited legislation has no apparent effect on the costs for producing potable water via brackish groundwater desalination (i.e., $615.01/ac-ft or $1.89/1,000 gallons) (Table 1).

Table 1. Financial Results on the Costs Per Acre-Foot of Water

	$/Ac-Ft	
Treatment Technology	Before Legislation	After Legislation
Conventional[a]	$ 667.74	$ 609.33
Desalination[b]	$ 615.01	$ 615.01

[a]Source: Rogers (2008).
[b]Source: Sturdivant et al. (2008).

The economic consequences of the institutional lowering of the cost of surface water rights can be illustrated by adjusting the -1.09 slope of the prior-identified isocost line in figure 2. This revised isocost line IC_2 with a slope of -.99 (i.e., \$609.33/ac-ft for conventional surface water treatment/\$615.01/ac-ft for brackish groundwater desalination) is illustrated in figure 3. The noticeable result is the movement of the least-cost combination of desalination and conventional treatment technologies from LC_1 to LC_2, lowering desalination effort from LC_{1D} to LC_{2D} and increasing conventional treated water effort from LC_{1C} to LC_{2C} for IQ_1.

Supply and Demand Economics

The summation of supply curves for all of the individual firms comprising an industry constitute the industry's supply curve. The supply curve for brackish groundwater desalination is illustrated as S_D in Panel A of figure 4. This is a combination of the potable water supplied by brackish groundwater desalination facilities in the Valley. The supply curve for conventional surface water treatment is illustrated in Panel B of figure 4 as S_{C1}. It represents the supply of

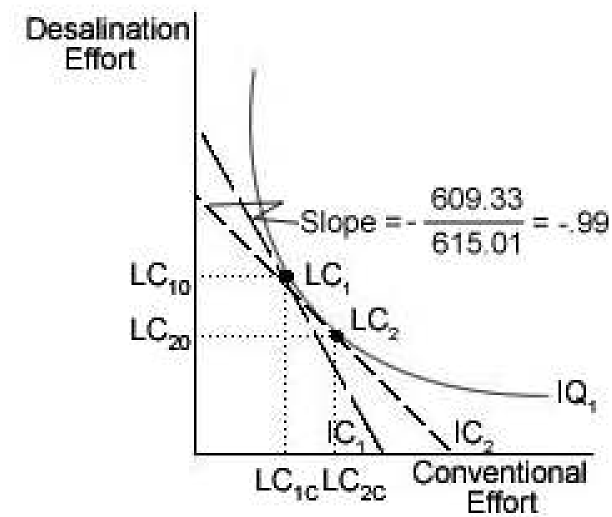

Figure 3. Isocost and isoquant of Valley potable water supply, post-Senate Bill 3

potable water from all conventional surface water treatment plants in the Valley. For each respective firm, its own cost relationships and the associated firm supply curve demonstrate the level of production that will occur at each price. The aggregate supply curve represents the respective quantities (Q) of output that will be produced in total by all firms in the industry. The aggregate supply curve for potable water created by brackish groundwater desalination and conventional surface water treatment is represented in Panel C of figure 4 as S_{A1}. This is a horizontal summation of the industry supply curves of the two treatment methods in the Valley.

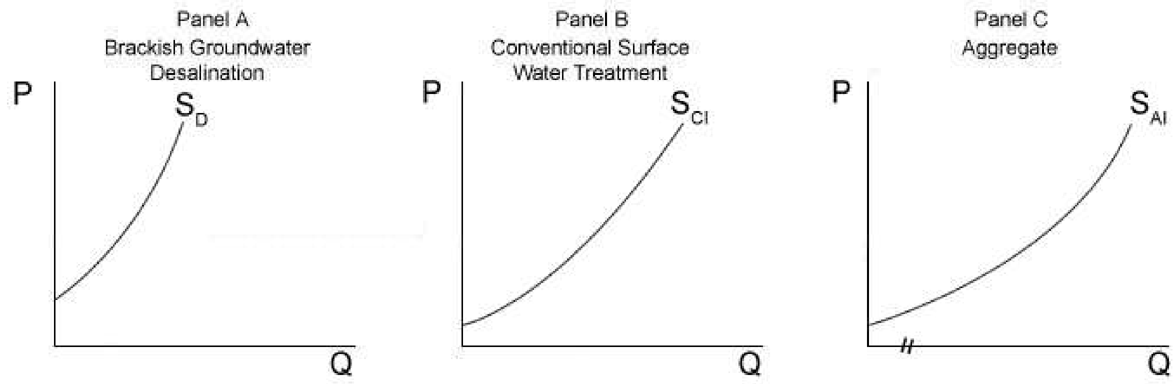

Figure 4. Pre-Senate Bill 3 industry and aggregate supply in Valley water market

An individual demand curve provides an explanation for a consumer's purchasing behavior for one good over a range of prices. Generally, the lower the price, the more that an individual will purchase. Or, alternatively, the higher the price, the less an individual will purchase. The summation of individuals' demand curves for a particular product constitutes the industry demand curve for that product. This phenomenon is similar to the development of the aggregate supply curve resulting from summing the individual firms' supply curves. Figure 5 is an extension of figure 4, with the addition of the industry demand curve for potable water. This is illustrated in Panel C of figure 5 as curve D_A. The demand curve in this graph represents the amount of potable water desired by all consumers in the Valley at alternative prices.

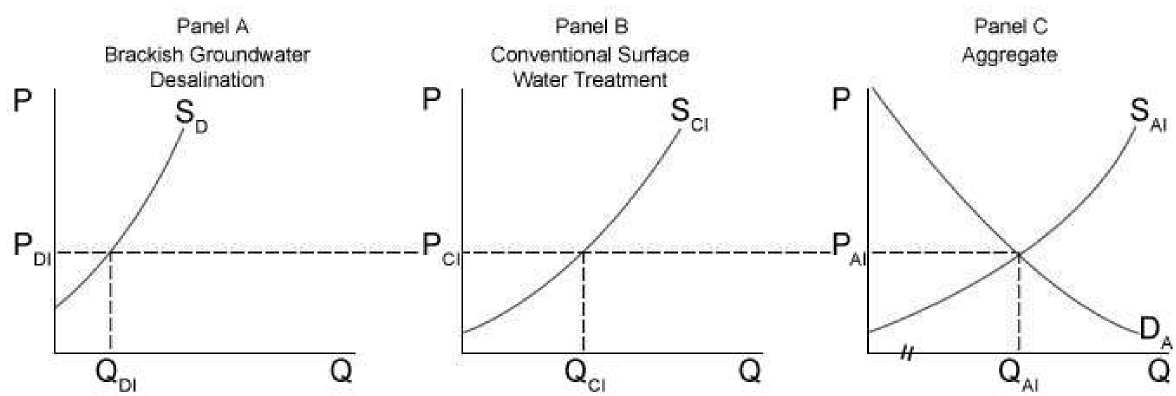

Figure 5. Pre-Senate Bill 3 industry demand and equilibrium in the Valley water market

The previous discussions of supply and demand relate to the full range of possibilities for prices and quantities of a specific product. At any given time, in a specific location, there is generally only one effective price and quantity, referred to as the market equilibrium. It is graphically illustrated as the intersection between an industry supply curve and an industry demand curve. This equilibrium point is illustrated in Panel C of figure 5, in which the potable water industry's demand curve and aggregate supply curve are superimposed on each other in the same two-dimensional space. The market-clearing price and quantity at this point are identified in the graph as P_{A1} and Q_{A1}. The equilibrium point $P_{A1}Q_{A1}$ identifies the market price at which the demand for potable water in the Valley by consumers is fulfilled by potable water suppliers, which includes brackish groundwater desalination facilities and conventional surface-water treatment facilities.

The equilibrium price that is determined by the aggregate supply curve and industry demand curve is the price received by all suppliers within that market. Specifically in the case of the Valley, P_{A1} is received by brackish groundwater desalination facilities and conventional surface-water treatment facilities. Panel A in figure 5 illustrates this price, labeled as P_{D1}. The same price, P_{C1}, is received in the conventional treatment market represented in Panel B of figure 5. In response to the price change, Q_{D1} will be supplied by desalination technologies and Q_{C1} will be supplied by conventional treatment to provide a total supply of Q_{A1}.

The previously identified market equilibrium at $P_{A1}Q_{A1}$ will change if an increase or decrease in aggregate supply occurs. Because the legislated 68% price of selected municipal water rights identified in FA 60 in Texas SB 3 allows for a reduced cost of production in the conventional treatment method, the supply of potable water produced by this method has the propensity to increase. Such a development is graphically illustrated as a rightward, or outward, shift in the existing conventional surface-water treatment supply curve, S_{C1}, in Panel B of figure 6. The new supply curve is then represented as S_{C2}. The aggregate supply curve for the potable water industry also increases, as it is a combination of all suppliers within that market. The supply of potable water available at all prices in the Valley effectively shifts to the right (S_{A2}), or more water is supplied at a given price as compared to the pre-legislation conditions. The resulting new equilibrium price and quantity are illustrated graphically by the intersection of the new aggregate supply curve (S_{A2}) and the industry demand curve (D_A) in Panel C of figure 6 as $P_{A2}Q_{A2}$. Notice that the equilibrium quantity increases and the equilibrium price decreases.

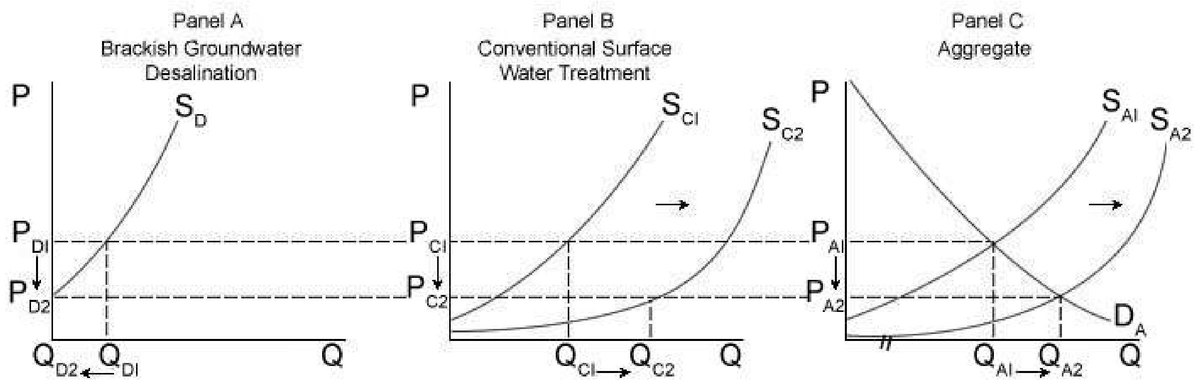

Figure 6. Post-Senate Bill 3 market equilibrium in the Valley water market

The new price for brackish groundwater desalination facilities decreases in Panel A of figure 6 to P_{D2}. The resulting change in quantity is a decrease to Q_{D2}. This represents the most extreme case in the potential decreased use of brackish groundwater desalination associated with FA 60 of Texas SB 3. Following the adjusted market equilibrium $P_{A2}Q_{A2}$, the price of potable water produced by conventional surface water treatment water also decreases in Panel B of figure 6 to P_{C2}. Due to a shift in the supply of potable water produced by this method, however, an increase in the quantity supplied results. This is shown graphically by an increase from Q_{C1} to Q_{C2} in Panel B. This visual representation of the unintended consequences of legislation illustrates the extreme potential impact on future supplies of potable water originating from brackish groundwater desalination. The direction of change (i.e., toward less future development of potable water via brackish groundwater desalination) is the point of relevance.

Stakeholder Impacts

Prior to January 1, 2008, the industry market equilibrium for potable water can be conceptually illustrated in panel C of figure 5, reproduced here as figure 7. For this equilibrium situation, consumer surplus is represented in the area $bP_{A1}E_1$. The corresponding producer surplus is represented by the area $P_{A1}aE_1$. The potential effects of SB 3 resulting in more potable water production and a new industry market equilibrium is illustrated in Panel C of figure 6 and reproduced here as figure 8.

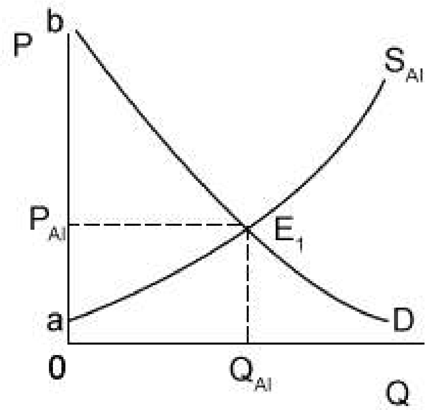

Figure 7. Pre-Senate Bill 3 consumer and producer surplus in Valley water market

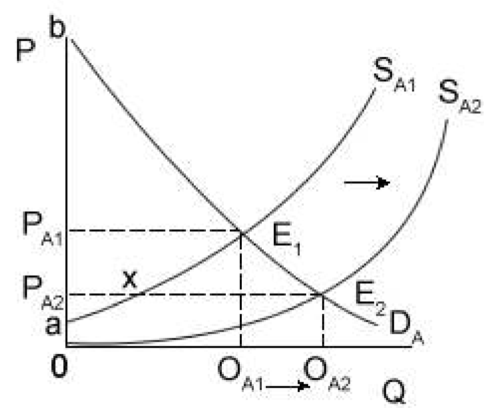

Figure 8. Post-Senate Bill 3 consumer and producer surplus in Valley water market

As a consequence of the shift in industry market equilibrium potentially precipitated by the legislation, the resulting consumer surplus changes from $bP_{A1}E_1$ to $bP_{A2}E_2$ and producer surplus changes from $P_{A1}aE_1$ to $P_{A2}0E_2$. The resulting increase in consumer surplus is illustrated as trapezoid $P_{A2}P_{A1}E_1E_2$. This is an advantage to consumers of potable water in the Valley. Part of the original area that represented producer surplus is lost (i.e., $P_{A1}P_{A2}xE_1$), but a new area is gained (i.e., axE_20). The area gained can be more, less, or the same as the area lost. The exact measurements of magnitude of effect on the consumers of potable water are unknown, and neither the magnitude nor the direction of effect on the producers of potable water are known.

Municipalities with lower costs of production for their potable water supplies are anticipated as receiving benefits.

Additional critical players in this water issue are IDs that supply water to conventional treatment facilities. In this perspective, the IDs are the producers (i.e., suppliers of the municipal water rights) and municipalities are the consumers (i.e., buyers of the municipal water rights). Figure 9 is a representation of FA 60 impacts. Pre-January 1, 2008, the equilibrium point for IDs supply (of municipal water rights converted as a result of development) to municipalities was at point *b*, with price at P_{ID1} and quantity at Q_{ID1}. This suggests a consumer surplus to municipalities of P_{ID1}ab and a producer surplus to IDs of P_{ID1}b0. If the IDs are expected to maintain Q_{ID1} supply of water at the new market price, P_{ID2}, the producer surplus becomes P_{ID2}c0 minus the area of cbf after the implementation of FA 60. Simultaneously, consumer surplus post-legislation increases by area $P_{ID1}P_{ID2}$fb to become P_{ID2}fba. With the lower cost to municipalities resulting in a converted water rights price of P_{ID2}, consumers (i.e., municipalities) can be expected to increase the water rights they purchase to Q_{ID2}. This means that consumer surplus would be P_{ID2}ae. Alternatively, IDs producer surplus becomes P_{ID2}c0 less cde. This suggests that IDs are selling water rights at less than the cost to supply beyond point *c*.

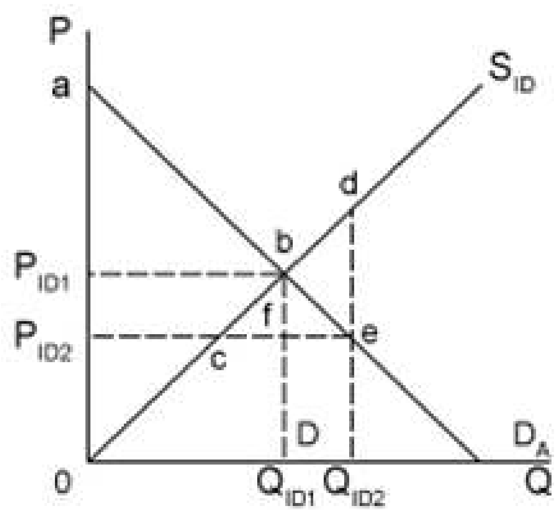

Figure 9. Legislative effects on consumer and producer surplus for Irrigation Districts

Although only a conceptual representation, the above discussion and associated graphs illustrate that IDs which are selling water rights converted as a result of development are negatively impacted by the legislation. This is not to say the legislation is undesirable. It evolved between IDs and municipalities, resolving an issue of concern with regard to municipal water rights prices. All discussions with experts occurring during the course of this research noted that the potential impact of the legislation on technology adoption was never considered. The research presented herein is an illustration of how legislation may cause unexpected consequences and impede the adoption of new technology if it is ignored in the process.

The consumer and producer surpluses illustrated in this section are a demonstration of the potential effects on stakeholders in the short-run. These surpluses could potentially change in the long-run with an increase in potable water demand. Producers could potentially gain more surplus due to an increase in equilibrium price, but theoretically, however, the only opportunity for simultaneous realization of maximum producer surplus and maximum consumer surplus is in an open competitive market void of any governmental interference.

Conclusions

Floor Amendment 60 to Texas Senate Bill 3 is an example of how legislation may have unintended consequences that can be illuminated and interpreted by financial and economic analyses. Financial analyses reveal that prior to the implementation of this legislation, the price per ac-ft of water each year for brackish groundwater desalination as compared to conventional surface water treatment was less costly. After implementation of the legislation, however, this change in price alters the least-cost combination between the use of brackish groundwater desalination and conventional surface water treatment, with an apparent advantage toward the conventional method. The decrease in cost of supplying potable water favors an increased share in the supply produced by conventional surface water treatment facilities and an increase in total supply. This increase in supply is then transferred to consumers, resulting in a reduced equilibrium price and expanded equilibrium quantity. The change in equilibrium results in an increase in consumer surplus for households, but a decrease in producer surplus from the IDs perspective. Therefore, Floor Amendment 60 has overall implications of benefiting consumers (i.e., municipalities and people), while adversely affecting some producers (i.e., IDs).

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