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The Capitalized Impact of Groundwater Levels on House Prices in Rural Residential Areas in Fresno and Madera Counties, California

A Project White Paper

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Research Team

Andres Jauregui

Andres Jauregui graduated with a bachelor's degree in International Economics from the International University of the Americas in San Jose, Costa Rica in 1999. He obtained an M.Sc. in Economics and Ph.D. in Applied Economics from Auburn University, in Auburn, Alabama, in 2006. His dissertation essays were in the areas of real estate, environmental, and urban economics.

Jauregui is currently an Associate Professor of Real Estate in the Department of Finance and Business Law in the Craig School of Business at Fresno State. Besides his teaching and research responsibilities, Jauregui is also Director of the Gazarian Real Estate Center, which promotes the advancement of real estate education and research in the Central Valley. He has also been on the Board of Directors of the Community Housing Council and the Kings River Conservancy, and currently serves on the Board of Directors of the U.S. Green Building Council Central California Chapter.

Jauregui conducts high-quality research in the areas of real estate economics and finance. He has published papers in the Journal of Real Estate Finance and Economics, Housing Policy Debate, Journal of Regional Science, Journal of Housing Research, and Journal of Real Estate Research. I have a profound interest in conducting research on the linkages between real estate and environmental issues, particularly related to water.

Laura Ramos

Laura Ramos is the Associate Director of Research and Education of the California Water Institute at California State University, Fresno, managing multiple programs and overseeing marketing and operations. Her primary duty is to elevate the water IQ of the community by engaging stakeholders throughout the San Joaquin Valley — including Fresno State faculty, staff, students, and researchers — in the pursuit of sustainable water resource management solutions for California's agriculture, urban, environment, and disadvantaged community interests.

She has been part of the Fresno State water initiatives since 2001 and some of her most recent projects include a feasibility study to consolidate small water systems, stakeholder engagements for water infrastructure needs in the Valley, and presenting and developing educational material to engage communities, including a campus-wide water book club.

Jacquelin Curry

Jacquelin Curry is an assistant professor at California State University, Fresno. She earned a bachelor's of science degree in business administration with an option in real estate and land economics from Fresno State. She also earned a Juris Doctor from San Joaquin College of Law in Clovis, California.

Dr. Curry's intellectual contributions and professional activities focus in the areas of finance, real estate valuation, real estate law and ethics, and effectiveness of business communication instruction. She currently teaches real estate appraisal, real estate law, business law, and business communication. Her professional activities focus in real estate and include practicing as a Realtor; she also has a California Real Estate Brokers license. She supports programs that focus in helping under represented populations attain and retain homeownership through education and support.

Dr. Curry has worked in the real estate industry since 2004 in various positions from project and customer service roles at a new homebuilder firm to acquisition manager of an investment firm. She is a board member of the Gazarian Real Estate Center at Fresno State, as well as an academic advisor on certain projects within the MBA program at the Craig School of business and the construction management department in the Lyles College of Engineering.

Problem Statement

Most studies in the United States focus on the impact of groundwater quality on house prices (McLaughlin, 2011), particularly properties with private wells. Though we acknowledge the importance of water quality, our research sets to explore how different water sources and water availability impact residential house prices in non-urban areas. Local organizations advocating for the importance of safe drinking water are voicing concerns over home buyers purchasing in areas where water provision is limited. Not taking proper measures prior to acquiring a property dependent on private wells, for example, may eventually result in considerable loss of property value.

Technical Background

Academic and policy circles have abundantly examined the importance of accessing water for drinking, agricultural production, recreation, and energy production, among others, especially in areas that have experienced substantial drought periods. Federal, state, and local governments, especially in California, provide guidelines and regulations to sustainably manage water resources and help mitigate the impact of water shortages in urban and rural areas.

This research project has two main objectives. First, we intend to provide estimates of the impact of different water supply and sewer systems on residential house prices in non-urban areas in Fresno and Madera Counties, in California. This topic has been extensively explored in developing countries (den Berg and Nauges, 2012; North and Griffin, 1993; Yousuf and Koundouri, 2005), yet surprisingly, little attention has been given in developed countries.

Secondly, we intend to provide estimates of how underground water shortages may impact house prices in non-urban areas. Water availability, especially groundwater, is crucial for the survival of rural communities. As far as we are concerned, no study has specifically considered the capitalization effects of proximity to areas where water shortages are predictably recognized. We intend to fill this gap and provide measurable impacts on house price capitalization effects.

Scientific Approach

The hedonic price model (Rosen, 1974) is a well-known and extensively used economic theoretical framework that is used to gauge the value of non-market characteristics on house prices. In equilibrium, house prices collapse information from the property and its surroundings, including features such as proximity to schools, parks, and multiple sources of water. Further, the real estate literature argues that house prices are contemporaneously correlated to the time it takes to sell the property, so we are also interested in the impact of proximity to stormwater retention basins on days on the market (DOM). Our final empirical specification takes the following form:

$$P_i = DOM_i\theta_1 + H_i\alpha_1 + E_i\alpha_2 + \epsilon_1$$
$$DOM_i = P_i\gamma_1 + H_i\beta_1 + E_i\beta_2 + \epsilon_2$$

where P_i is a vector of housing prices, H_i is an n x k_1 matrix of housing characteristics, E_i is an n x k_2 matrix of environmental characteristics, DOM_i is a vector of days on the market, $\alpha_{k=1,2}$, $\beta_{k=1,2}$, 0_1, and y_1 are parameters to be estimated, and ϵ_i is assumed to be a vector of i.i.d. errors. The housing characteristic variables include house size, house age, number of bathrooms and bedrooms, and whether the house includes a chimney, a pool and/or solar panels. The housing characteristics related to water usage include dummy variables for properties with a *private well, community well, shared well, public water access, public sewer, or septic tank*.

The environmental characteristics are related to groundwater availability in Fresno and Madera County. The Geospatial Information Systems at the Fresno State Library provided GIS maps of groundwater rechargeable areas and 30-meter resolution Digital Elevation Model raster maps for ground water to water surface areas (in feet).

For the groundwater rechargeable areas, we include dummy variables for properties located within three categories of groundwater rechargeable areas: 1) excessively drained soils, 2) somewhat excessively drained soils, and 3) well-drained soils. Properties located in *excessively drained soils* get the water to the ground faster than poorer rechargeable soils. We should see a premium for *Category 1* groundwater rechargeable areas and decreased capitalization effects for the other categories.

For the ground water to water surface (in feet) area maps, we create dummy variables for properties located within 9 category ranges of ground surface to water surface in feet. The categories range from less than 30 feet to greater than 500 feet of ground surface to water surface. These maps indicate how deep wells need to go to reach groundwater. Deeper wells are costlier as they require more expensive and complicated water pumping system, plus would likely require more energy to run. We should expect a negative capitalization effect for properties located in areas with deeper ground surface to water surface.

Anticipated Outcomes

Our findings indicate that non-urban properties with private well or community wells command price premiums, as well as properties connected to public water.

- Having to dig deeper to reach to groundwater is costly. It would require a more expensive and complicated water pumping system, plus more likely would require more energy to run, therefore they should be reflected in higher capitalization rates on house prices.
- Properties located in Excessively Drained Soils get the water to the ground faster than poorer rechargeable soils. We should see a premium for Category 1 groundwater rechargeable areas and decreased capitalization effects for the other categories (as it related to groundwater recharge areas).
- As distance from a decreasing trend (feet/year) testing station increases, property values should increase. As distance from an increasing trend (feet/year) testing station increases, property values should decrease.

Target Audience

Results can be used by future homeowners in non-urban areas to consider appropriate evaluation of water supply

before committing to acquiring a rural residential property.

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