Drinking Water Contamination and Home Prices: *Evidence from California*

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Abstract

Water systems in the U.S. are required to provide notifications to consumers when they detect elevated levels of contaminants in drinking water. This paper provides the first examination of the effects of nitrate contamination notifications on home prices in California, an issue that has impacted more than 1.4 million residents in affected water systems across the state. Using a robust difference-in-differences and event-study framework with ZIP-code level housing data from 2000 to 2024, I find that nitrate contamination notifications are associated with statistically significant declines in home prices of approximately 5.8 percent in the years following a notification. These estimates imply economic costs amounting to $212.5 million for an average-sized water system.

Keywords: Water quality; home prices; public notification rule; nitrate contamination
JEL Codes: R31, Q51, Q53, K32

1 Introduction

U.S. water systems must issue public notifications (PN) alerting consumers when elevated contaminant levels are detected (EPA, 2010). This PN requirement is the key mechanism by which consumers learn about unsafe drinking water and thus is crucial in preventing disease outbreaks and limiting chronic exposure to harmful substances. Despite the importance of this system, research on how consumers respond to these notifications remains limited (Currie et al., 2013). A handful of studies have found that consumers engage in averting behavior such as purchasing bottled water to avoid adverse health impacts (Graff Zivin and Neidell, 2013; Pape and Seo, 2015; Allaire et al., 2019). To my knowledge, this study provides the first statewide examination of how home prices in California respond to PNs about nitrate contamination. California is an ideal setting for this study given the link between nitrates and agriculture, because the state is the largest in the U.S. in terms of both population and agricultural output (Economic Research Service, 2025).

Prior studies on home prices and water contamination (Case et al., 2006; Guignet et al., 2016; Marcus and Mueller, 2024) have typically examined single counties or communities using traditional estimation strategies. I extend this literature by analyzing nitrate impacts across California using modern causal inference methods that address recent methodological concerns about two-way fixed effects estimators. Understanding the response of housing markets to information about water quality sheds light on the effectiveness of "right-to-know" laws and contributes to the broader literature on environmental amenities and home prices.[1]

2 Background

Despite California recognizing safe water as a human right (California State Legislature, 2012), nitrate contamination remains prevalent. Nitrates are categorized as a Tier 1 contaminant, for which community water systems (CWS) are required to issue a PN within 24 hours of their detection (EPA, 2010). Elevated nitrate levels in drinking water pose acute health risks, particularly to infants through "blue baby syndrome," which can be fatal (EPA, 2025).

[1] In Online Appendix Section A1, I summarize the theoretical relationship between nitrate PNs and home prices using a hedonic pricing framework following Rosen (1974).

Nitrate contamination primarily originates from fertilizers and animal waste, which are prevalent in California's Central Valley agricultural hub. A 2012 investigation concluded such contamination is widespread and "will likely worsen for several decades" (Groundwater Nitrate Project, 2012). Sustained public attention, and the relevance of nitrates to California's agricultural economy, suggest that PNs regarding nitrates may be especially salient for homebuyers. In Online Appendix Section A2, I provide additional discussion of public attention towards nitrate contamination in California.

3 Data and Methods

I collect data on home prices from the Zillow Home Value Index (ZHVI) at the ZIP-code level from 2000 to 2024. The ZHVI is designed to reflect "typical value for homes in the 35th to 65th percentile range" (Zillow Research, 2025). In Figure 1, I plot average home prices over time.

I obtain data on CWS from the California State Water Resources Control Board (SWRCB). These records include CWS service boundaries and total service populations. I conduct a spatial merge of ZHVI data with CWS boundaries using Census Bureau ZIP Code Tabulation Areas, calculating weighted average home values at the CWS level based on the intersection area and population for each overlapping ZCTA and CWS.[2]

Finally, I use the EPA's Safe Drinking Water Information System (SDWIS) to collect records of PNs issued by CWS. My analysis sample includes the universe of CWS that issued a Tier 1 PN at some point during the same period, for contaminants posing serious health risks such as nitrates, *E. coli*, etc. I construct a CWS-by-year level working data set comprised of all such CWS with non-missing home values across the entire sample period. There are 51 CWS that experience nitrate PNs with a total service population of approximately 1.4 million consumers.[3] These affected systems contribute 91 CWS-year observations in which a nitrate PN is issued. In Figure 1, I plot the annual count of CWS-year observations with a nitrate PN over the sample period. In Figure 2, I show the distribution of CWS-year PNs across counties in California.

[2]I describe this process in greater detail in Online Appendix Section A4 and demonstrate the robustness of the results presented below to alternative approaches.

[3]To avoid double-counting CWS with multiple violations, I count each CWS service population once at the current level reported by the SWRCB.

For a given CWS w in year t, I denote the log typical ZHVI home value in that CWS as $log(Y_{wt})$. The baseline "static" difference-in-differences (DiD) specification considered below is given by:

$$\log Y_{wt} = \alpha_0 + \alpha_1 PN_{wt} + \phi_w + \gamma_t + u_{wt} \quad (1)$$

Where ϕ_w represents CWS fixed effects and γ_t represents year fixed effects. I also estimate an event-study variation of this specification.

I use Borusyak et al. (2024)'s robust imputation approach for estimation. This approach addresses bias from heterogeneous treatment effects and provides valid inference under staggered adoption, which are important advantages over traditional OLS for the estimation of Equation (1). As with other robust methods in this setting, estimation is most straightforward given a binary, absorbing treatment; thus, PN_{wt} is set equal to 1 when a CWS issues its *first* PN for nitrate contamination and stays 1 thereafter. To define a credible comparison group of CWS, I restrict the sample to CWS in counties that experienced nitrate contamination at some point during the sample period.[4]

4 Results

In Figure 3, I present results estimating DiD and event-study variations of Equation (1). The pre-treatment period shows no evidence of differential trends in home prices between treated and control CWS, supporting a causal interpretation of the post-treatment estimates. In the 5 years post-PN, point estimates are uniformly negative with statistically significant estimated declines between 3% and 5% in years 1-3. I also report the static DiD estimate corresponding to α_1 in Equation (1), finding that average home prices declined by approximately 5.8% post-PN. These declines are consistent with a hedonic pricing framework where home price declines may reflect changes in perceived environmental quality (Rosen, 1974).

These estimates suggest substantial economic costs of nitrate contamination. The average

[4]CWS located in counties never experiencing a nitrate PN may systematically differ in terms of geography, economic output, etc., potentially making them a poor comparison group for CWS in affected counties. Removing this restriction does not materially affect the reported estimates.

population of CWS with a nitrate PN is 27,697. This corresponds to roughly 9,232 households per affected CWS, assuming an average of 3 residents per household. Using the static DiD estimate above, this implies that the average home in affected systems (valued at $396,755) loses approximately $23,012 in value. These figures translate to an average CWS-level total cost of $212.5 million. In the Online Appendix, I demonstrate the robustness of these findings across a range of specifications and alternative estimators.

5 Conclusion

I find that nitrate PNs are associated with home price declines of approximately 5.8%, with economic costs of $212.5 million for the average-sized affected CWS. These findings highlight the importance of addressing nitrate contamination and ensuring effective communication about water quality to the public. They also demonstrate that consumers respond to information about environmental hazards when that information is salient and concerns acute health risks.

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Declaration of Interest

The author reports there are no competing interests to declare.

Declaration of Funding

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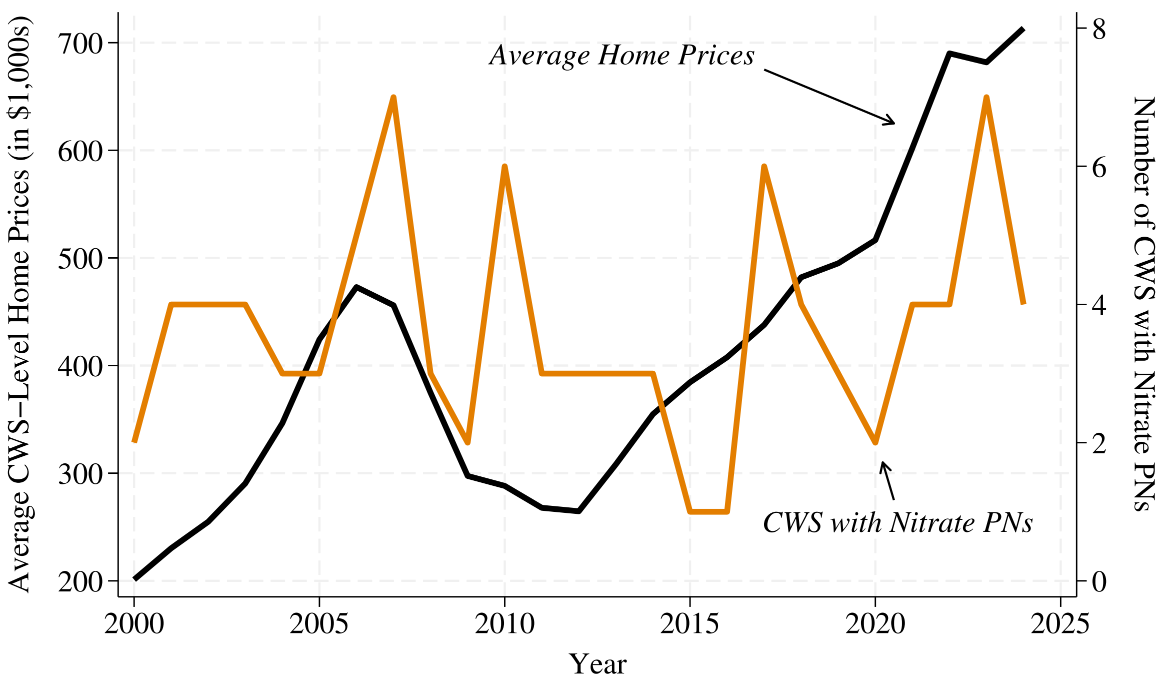
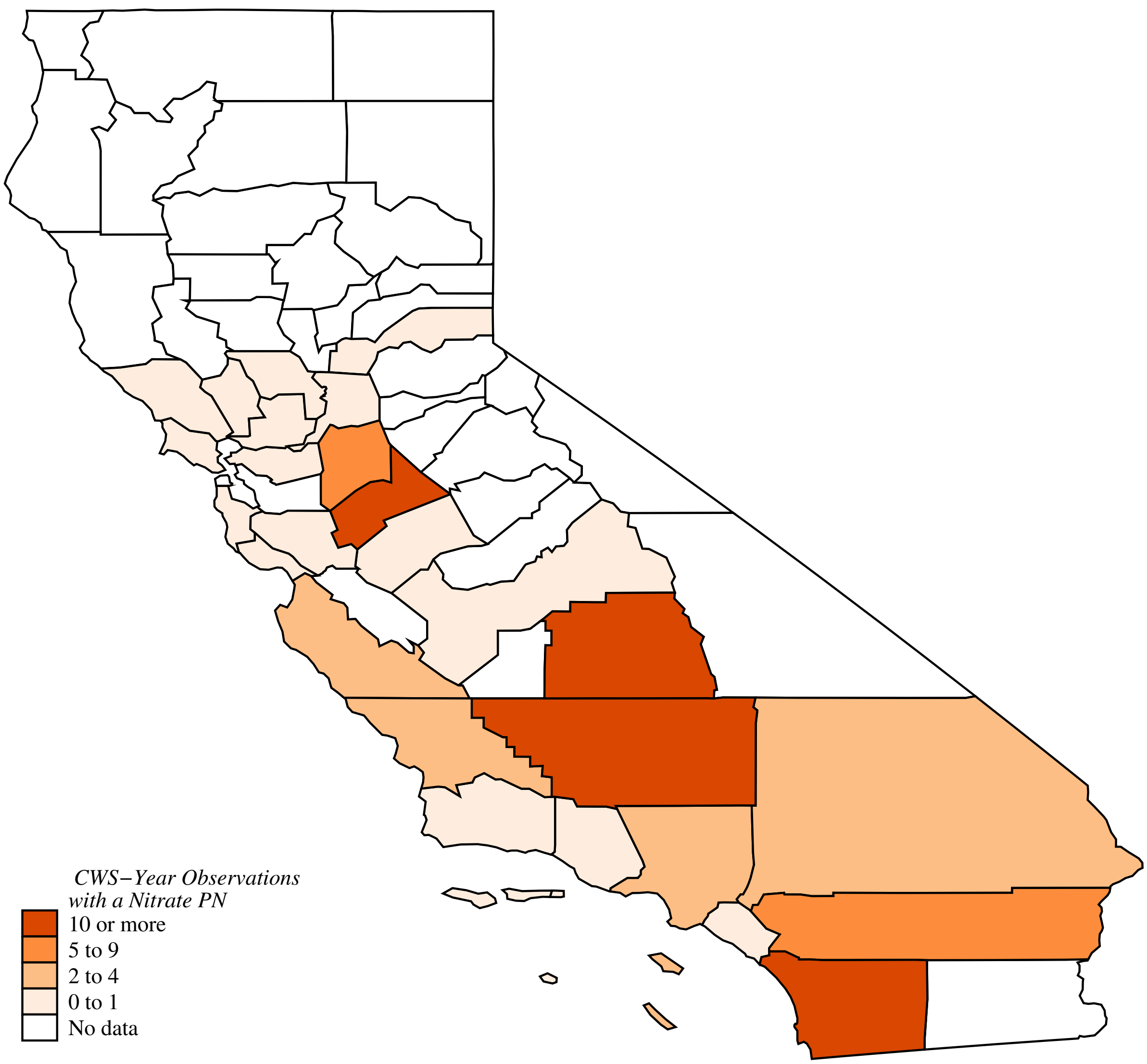
Figure 1: *Home Prices and Nitrate Public Notifications in California*



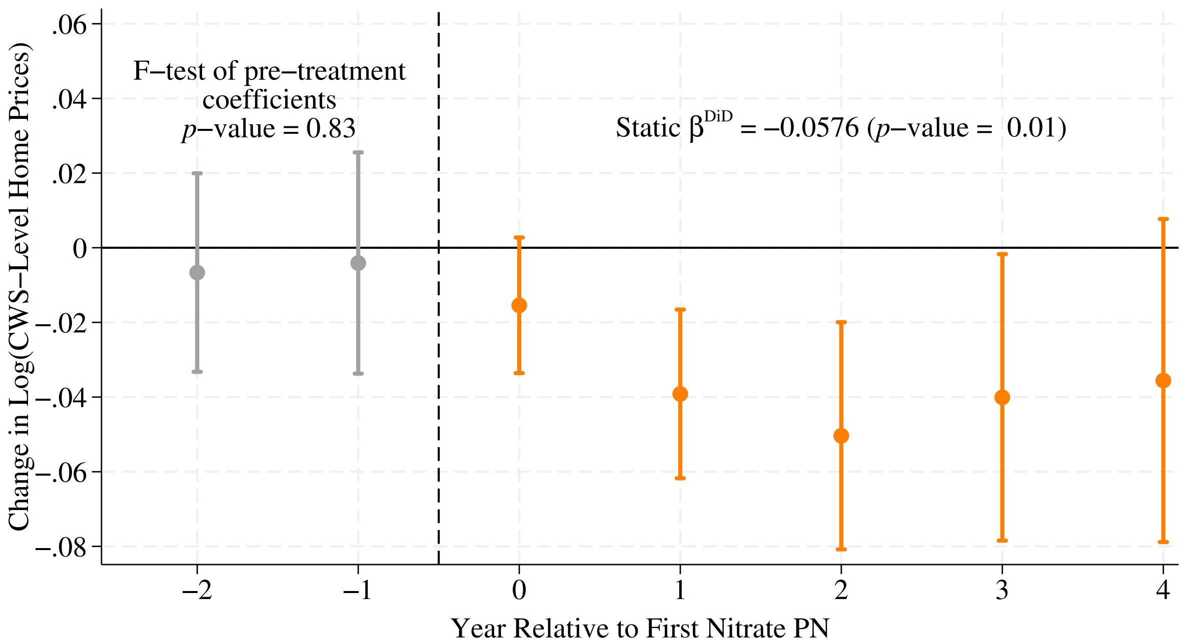
Notes: Average annual home prices are plotted in black. The number of CWS issuing a nitrate PN in each year is plotted in orange.

Figure 2: *Nitrate Public Notifications across California*



Notes: This figure reports the number of CWS-year observations with a nitrate PN included in analysis sample (2000-2024). Counts are aggregated to the county level.

Figure 3: *Event Study Estimates*



Notes: Data is aggregated to the CWS-year level (2000-2024). Standard errors are clustered at the CWS level with 95% confidence intervals around each point estimate. Results are reported in table format in Online Appendix Table A1.