Agricultural and Resource Economics
ARE UPDATE

Giannini Foundation of Agricultural Economics, University of California Vol. 22, No. 6 Jul/Aug 2019

ALSO IN THIS ISSUE

California Farmers Change Production Practices As the Farm Labor Supply Declines
Zachariah Rutledge and J. Edward Taylor 5

Livestock Guardian Dogs: Do the Benefits Outweigh the Costs for Sheep Producers?
Ellen M. Bruno and Tina L. Saitone 9

Energy Prices, the Financial Crisis, and Their Implications for Land Policies in California

Junjie Wu, Steven Sexton, Joel Ferguson, and David Zilberman

The more than doubling of fuel prices between 2001 and 2006, combined with lax lending practices, triggered the collapse of the housing market that ultimately led to the Great Recession of 2008. In California, commuter communities with relatively lower income and located greater distances from the coastal urban centers suffered the largest declines in housing value and highest rates of foreclosure. Our analysis suggests that relaxing land use regulation to improve housing opportunities in urban centers will increase the resilience of the housing market, while policies that raise energy costs will increase its vulnerability (at least in the short run).

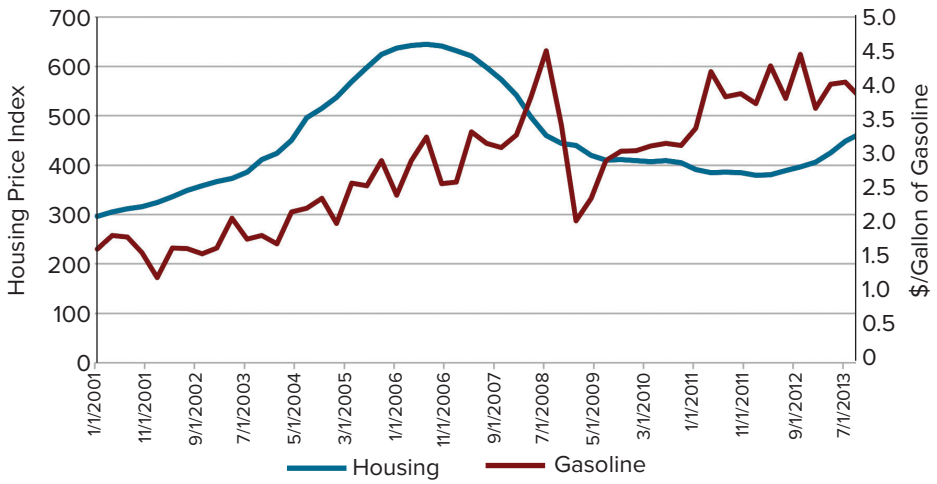
The Great Recession of 2008 devastated the lives of many communities and individuals in California and elsewhere. The recession was preceded by a major collapse in the housing market, especially in California, which triggered the bankruptcy of major banks. There is a broad agreement that the 2007 housing crisis triggered the 2008 economic recession. The Financial Crisis Inquiry Commission concluded that "It was the collapse of the housing bubble . . . that was the spark that ignited a string of events, which led to a full-blown crisis in the fall of 2008."

According to Steven Levy, director of the Center for Continuing Study of the California Economy, "[California was the] epicenter of the housing bubble, and … the epicenter of the fallout." California's rate of bankruptcy was almost twice the national rate. A broad set of policies was introduced to tighten regulation of financial markets and lending practices to ensure against future collapses in the housing market.

In this paper, we argue that a more than doubling in gasoline prices between 2001 and 2006 precipitated a housing market collapse across the U.S. that induced mortgage defaults and triggered the Great Recession. As most Californians intuitively understand, distance to city centers like San Francisco and Los Angeles greatly determines home value because greater distances imply longer and costlier commutes. This principle of urban economics dictates that as commute duration or transportation costs rise, home values will fall with distance from city centers. A spike in gasoline prices could cause home values to tumble in suburban and exurban bedroom communities occupied mostly by commuters, who tend to have relatively lower income than homeowners in cities.

Our analysis suggests that continuous urban sprawl makes California's housing market vulnerable to future energy price shocks that may be triggered by market forces or government policies. We will proceed with a conceptual exposition of our perspective, followed by an analysis of the impact of energy price shocks on the housing market in California, and conclude with a policy discussion.

Figure 1. Gasoline and Housing Prices in California 2001–2014



Sources: U.S. Federal Housing Finance Agency and US Energy Information Administration

The Link Between Energy and Housing Prices

We can demonstrate the effect of gasoline prices on home values with a simple model of homeownership and location decisions. Suppose a household has the choice of renting in the city or owning a house in the suburbs. A household prefers to rent in the city if the benefit of the housing services in the city minus the rent is greater than the benefit of the housing services in the suburbs minus commute costs and other costs of homeownership, including net mortgage costs, opportunity cost of the down payment, maintenance, insurance, taxation, and depreciation or appreciation. A household that has decided to own a house will select the location that maximizes the benefit from housing services minus the costs of ownership and commuting.

We assume that households vary in their income and bid on houses at different locations. The price at each location is the willingness to pay of the household that values living at that location the most. Given other factors, the value of living away from the urban center is declining in transportation costs. Therefore, house prices decline with distance, and, thus, relatively low-income households are likely to rent in the city or purchase homes in commuter communities farther away from the cities.

Moreover, a reduction in transportation costs may lead to an increase in the value of houses, especially those farther away, and to the expansion of the urban boundary. Housing may compete with agricultural and industrial land uses, and a reduction in transportation costs makes housing relatively more valuable compared to other uses.

An increase in the cost of commuting is likely to reduce the price of houses away from the city because buyers are willing to pay less for such houses as the net benefits from living at those locations decline. A large gasoline price shock that causes such home values to decline substantially may lead homeowners to go "underwater." That is, the value of their houses may be less than their remaining mortgage debt. The likelihood of being underwater amid a gasoline price shock increases in distance from the urban center, all else held constant.

Homeowners farther from the city face a choice of staying in their homes or defaulting and moving away. Those who realize that the costs in terms of transportation and mortgage are greater than the benefit of holding their house will declare bankruptcy. The vulnerability of a homeowner to energy price shocks is greater the larger the amount of the mortgage debt that they owe. At a given location, a household is more likely to be underwater if they paid a low down-payment, the term of their mortgage is longer, they are new homeowners, or the depreciation in the value of the house is greater relative to other homeowners.

The extent of the vulnerability to high energy shocks depends on the distribution of the population across space. The size of the population that is vulnerable to energy price shocks is likely to increase with the number of households located farther from cities. The distribution of a population is affected by zoning policies.

Zoning regulations that limit the expansion of housing near employment centers are likely to lead to the development of large commuter communities farther from urban centers. The pairing of market forces that lead to a spike in energy prices with land-use policies that cause low-income individuals to reside farther away from employment centers may lead to drastic disruption of real estate and financial markets.

The Case of California

Before the housing market collapse in 2008, California realtors described a "drive 'til you can buy" phenomenon in which families drove away from city centers until they found communities with homes they could afford. In the greater Los Angeles and San Francisco metropolitan areas, some commuters travel 50–100 miles or more to and from work each day. Many of the bedroom communities in California were built relatively recently or experienced rapid growth before the housing bust. Lax lending practices that required low down payments from homeowners but large loan payments increased the likelihood of bankruptcy.

Between 2002 and 2008, nominal gasoline prices rose from $1.38 per gallon to $4.15. To a commuter traveling 3,000

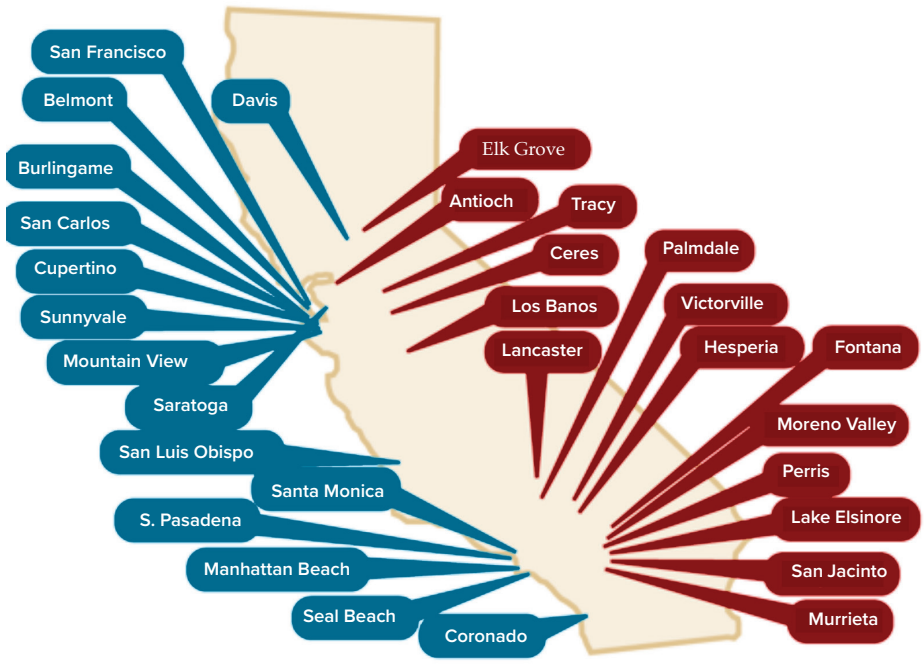
miles per month in a 20 miles-per-gallon vehicle, transport costs increased $415 per month. To a commuter traveling 4,500 miles per month in a less efficient 15 miles-per-gallon vehicle, transport costs increased by $831 per month. These dramatic increases in commuter costs, especially when considered to be permanent, would significantly depreciate the value of the house and drive the homeowner underwater. Such a combination of deteriorating cash flow and asset situations are sufficient to cause a low-income family to consider defaulting on a loan.

Studies show that seven of the vulnerable communities in California were among the 20 metropolitan areas nationwide with the highest rates of foreclosure activity in 2010, including Modesto (3rd), Riverside-San Bernardino-Ontario (6th), Stockton (7th), and Merced (8th). Seven of the other eight cities with greatest shares of homes underwater were California communities like Merced, Vallejo, and Riverside, whose workforces commute to relatively distant major cities.

In Figure 2, we define two groups of California cities according to foreclosure rate during the financial crisis. The 15 cities with the lowest rate of foreclosure form the resilient group and the 15 cities with the highest rate of foreclosure form the vulnerable group. As Figure 2 suggests, the vulnerable group is located mostly inland, and the resilient group is mostly located along the coast and proximal to San Francisco or Los Angeles.

Complementary to Figure 2, we show in Table 1 characteristics of the cities with the highest and lowest rates of foreclosure in 2008. The average distance to the urban core of the resilient group is 28.8 miles, whereas the vulnerable group averages 67 miles. Average family income is $44,690 in the vulnerable group and $120,344 in the resilient group. The average amount spent on gasoline in the vulnerable cities jumped from about $1,723 in 2000 to about $4,600 in 2008.

Figure 2. Resilient (Blue) and Vulnerable (Red) Cities in California



Source: RealityTrac and CoreLogic

The average housing price drop was 57% in the vulnerable group and 6% in the resilient group, and foreclosure rates were 15.78% in the vulnerable group and 0.74% in the resilient group. The foreclosure rates reached a peak between 2008 and 2010, but were still very high in 2011. In that year, Stockton had the second-highest foreclosure rates, Modesto was third, and seven out of the 20 metropolitan areas with the highest foreclosure rates in the U.S. were in California.

Regional and urban planning strategies that restrict growth exacerbate vulnerability to energy price shocks in California. These strategies result in strict zoning policies that impede housing construction in major urban centers with growing employment opportunities. These policies push lower-income families to far-flung bedroom communities. For example, San Francisco limited the height of housing buildings and approved only a fraction of the required housing requests, leading to a growing gap between demand and supply for housing in the Bay Area. As Silicon Valley has grown, these policies have contributed to urban sprawl, resulting in the expansion of communities in the Central Valley. Likewise, housing expanded rapidly in the Inland Empire of Southern California, yielding lengthy commutes into Los Angeles.

Conclusion and Implications

These data and our model of housing location decisions suggest energy price shocks triggered the housing crisis of 2007 that caused the Great Recession. While others have investigated the energy price shock on the economy through its impacts on employment and consumption costs, we identify a new channel through which energy price shocks affect the financial market and the macroeconomy. We find that lax lending practices yielded a cohort of low-income homeowners located far from cities who were vulnerable to energy price shocks. While price volatility is not generally considered an important determinant of economic growth because of opportunities to smooth such volatility, highly leveraged households may not be able to withstand such volatility—particularly those who do not perceive the shocks

Table 1. California City Characteristics by 2010 Foreclosure Rate

Rank	City	Distance To Nearest City (miles)	Mean Commute (minutes)	Annual Foreclosure Rate (%)	Nearest City	Mean Income ($)	Gas Cost Increase 2000-2008
	a. Highest Rates of Foreclosure						
1	Victorville	84.8	33.72	20.40	LA	42,485	3,051
2	Murrieta	65.4	35.99	18.96	SD	72,422	2,910
3	Los Banos	79.7	39.20	18.48	SJ	43,370	2,827
4	San Jacinto	85.2	31.62	17.40	LA	35,600	2,989
5	Palmdale	62.6	42.48	17.28	LA	47,699	3,065
6	Elk Grove	16.7	30.75	16.92	Sac	59,878	2,759
7	Lake Elsinore	70.6	39.78	16.68	LA	42,111	3,124
8	Tracy	63.0	40.43	16.56	SF	49,207	2,823
9	Perris	72.2	36.74	16.44	LA	36,056	2,973
10	Lancaster	69.5	33.57	14.40	LA	42,657	2,886
11	Fontana	49.8	37.80	13.80	LA	38,347	2,504
12	Moreno Valley	64.4	33.91	13.68	LA	38,358	2,718
13	Antioch	45.3	42.06	12.48	SF	45,953	3,156
14	Ceres	94.6	26.99	12.12	SJ	37,184	2,538
15	Hesperia	79.5	37.30	11.16	LA	39,018	3,249
	Average	**66.9**	**36.16**	**15.78**		**44,690**	**2,905**
	b. Lowest Rates of Foreclosure						
1	Davis	15.3	20.75	0.48	Sac	63,478	2,211
2	Cupertino	48.0	25.81	0.48	SF	126,859	2,244
3	Seal Beach	29.6	30.63	0.60	LA	70,675	2,218
4	Mtn. View	12.9	20.91	0.60	SJ	95,252	1,879
5	Santa Monica	15.8	25.00	0.60	LA	101,401	1,501
6	Burlingame	15.8	27.06	0.72	SF	218,989	2,146
7	Manhattan Beach	21.1	29.20	0.72	LA	204,052	1,772
8	Coronado	6.4	17.39	0.72	SD	99,032	2,831
9	S. Luis Obispo	185.0	15.60	0.84	SJ	61,319	2,130
10	San Carlos	24.4	26.69	0.84	SF	131,613	2,252
11	Saratoga	13.4	26.40	0.84	SJ	260,549	2,812
12	So. Pasadena	8.6	27.44	0.84	LA	91,396	1,782
13	San Francisco	1.0	26.16	0.96	SF	87,099	1,583
14	Sunnyvale	11.8	23.86	0.96	SJ	89,544	1,811
15	Belmont	23.3	28.37	0.96	SF	103,908	2,320
	Average	**28.8**	**24.75**	**0.74**		**120,344**	**2,099**

Source: Wu, J., S. Sexton, and D. Zilberman, 2019. "Energy Price Shocks, Household Location Patterns, and Housing Crises: Theory and Implications." *Energy Economics* 80(May): 691-706.

to be temporary. In 2008, few anticipated the fracking boom that would usher in a period of relatively cheap energy. Instead, headlines debated when oil production would peak.

There is a growing number of policy initiatives aiming to relax zoning restrictions and otherwise promote housing construction. These policies will expand housing supply and presumably moderate growth of home prices, but they will not diminish the vulnerability of inland communities to increases in commute costs. Policies intended to further reduce carbon emissions in California, like gasoline or carbon taxes and renewable fuel standards, could be regressive in the sense that their cost could be borne disproportionately by suburban homeowners through their impacts on transport costs and housing prices.

The 2018 French Yellow Vest Movement ignited by fuel carbon tax hikes underscores how significantly climate policy and energy costs can affect the livelihood of low-income households. One great challenge of climate change policy is reducing greenhouse gas emissions associated with commuting without hurting vulnerable populations. We challenge researchers, policymakers, and urban planners to change guidelines, zoning regulations, and incentives for urban developers so that more people can live near their workplaces in urban centers to avoid the burden and social costs of heavy commuting.

Suggested Citation:
Wu, Junjie, Steven Sexton, Joel Ferguson, and David Zilberman, "Energy Prices, the Financial Crisis, and their Implications for Land Policies in California." *ARE Update* 22(6) (2019): 1–4. University of California Giannini Foundation of Agricultural Economics.

Authors' Bios

Junjie Wu holds the Emery N. Castle Chair in Resource and Rural Economics at Oregon State University and Steven Sexton is an assistant professor in the Sanford School of Public Policy at Duke University. Joel Ferguson is a Ph.D. student and David Zilberman holds the Robinson Chair, both in the ARE department at UC Berkeley. They can be reached by email at junjie.wu@oregonstate.edu, steven.sexton@duke.edu, joel_ferg@berkeley.edu and zilber11@berkeley.edu, respectively.

For additional information, the authors recommend:

Wu, J., S. Sexton, and D. Zilberman, 2019. "Energy Price Shocks, Household Location Patterns, and Housing Crises: Theory and Implications." *Energy Economics* 80(May): 691-706.