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The Economic Impact of the PSPS and Kincade Fire on Sonoma County

Introduction

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This is a testament to Sonoma County's many assets, including its highly educated workforce, desirability as a tourist destination, and proximity to arguably the hottest economy of the past decade, that of the Bay Area. But as fear and frustration mounted this autumn in Sonoma County, the question of just how costly recent economic disruptions have been has come to the fore.

In the pages that follow, this topic is examined in detail. The short-term impact on output and property of the events of October and November is considered using the widely cited Moody's Analytics methodology for quantifying economic shocks. Other recent events are examined as well, both to contextualize the Kincade Fire and PSPS, as well as to provide insight into the long-term ramifications for Sonoma County. The analysis is supported wherever possible by data that were gathered on the ground, including a survey of businesses that was conducted by the Sonoma County EDB. We also considered news accounts and information from state and local authorities that was disseminated during and after both the PSPS and fire.

The Economic Impact of the PSPS and Kincade Fire on Sonoma County

BY ADAM KAMINS, LAURA RATZ AND COLIN SEITZ

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and information from state and local authorities that was disseminated during and after both the PSPS and fire.

Background
Recent Performance

Sonoma County is on firm footing, but job growth is softening amid significant labor market tightness. Annual job growth, at just above 1%, is solid but unspectacular and is slightly behind the California and regional averages. The performance among

Table 1: Survey Results From Public Safety Power Shutoff
# of businesses

		Reported loss of revenue			
Industry	None	Less than 25%	26% to 50%	51% to 75%	76% to 100%
Accommodation/food services	15	12	10	4	29
Administrative and support and waste management and remediation services	2	1	1	0	3
Agriculture	19	13	4	4	8
Arts, entertainment, recreation, and educational services	17	16	8	3	9
Construction	11	10	3	3	3
Government	8	5	0	0	0
Healthcare and social assistance	5	10	5	2	12
Information, finance, real estate, technical, or professional services	61	43	21	4	28
Manufacturing	7	7	3	2	5
Other	19	3	2	0	4
Other services (except public administration)	0	1	3	0	5
Retail or wholesale trade	17	13	13	7	30
Transportation/warehousing	1	2	2	0	0
Utilities	2	1	0	0	0

Sources: Sonoma County EDB, Moody's Analytics

Chart 1: Sonoma Tracks California Peers

Payroll employment, % change yr ago, 3-mo MA
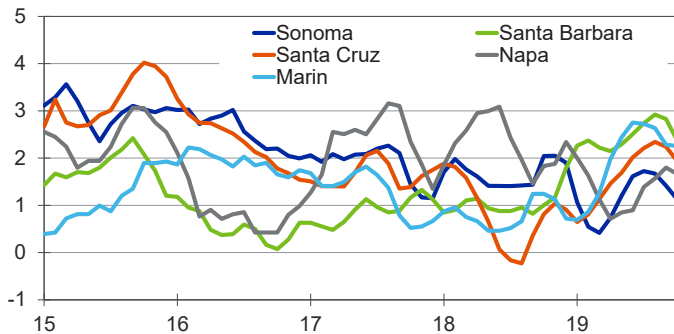
Sources: BLS, Moody's Analytics

the county's traditional drivers is bifurcated: Healthcare and manufacturing are driving robust gains while leisure/hospitality payrolls have seesawed and remain roughly unchanged from a year prior.

The county has moved back in line with its peers in the state, slightly trailing Napa and Santa Barbara but ahead of Monterey. The jobless rate is trending lower once again, putting it within striking distance of its all-time low. Accordingly, the tightening labor market is driving modest acceleration in hourly earnings. The housing market is a mixed bag. Prices are only now recovering after moderating for the past year. Permit issuance is cooling but remains elevated in light of rebuilding efforts that are still underway in the aftermath of the Tubbs, Nuns and Atlas fires that occurred during the fall of 2017.

All told, Sonoma's economy is performing well and roughly tracking those of similarly sized metro areas in California (see Chart 1). Supply constraints are growing increasingly evident as the national economy ages into its longest expansion on record, and a thinning supply of workers coupled with weaker demographics is reining in job growth across the region.

Public Safety Power Shutoffs

California has experienced dramatic environmental changes in recent years, resulting in record drought, massive tree mortality, record heat waves, and extremely strong wind events. In light of one of the most destructive wildfire seasons on record in 2017, the California Public Utilities Com-

mission issued resolution ESRB-8 in July 2018, which supports the de-energization of portions of its service territory in an effort to mitigate wildfire risks. The first of these events, which are referenced as Public Safety Power Shutoffs, occurred in October 2018. Since then, PSPS have been implemented during weather conditions conducive to wildfires.

The PSPS outages became more commonplace and widespread in 2019. Sonoma County, in particular, experienced five unique shutoff events prior to, during and after the outbreak of the Kincade Fire, during which tens of thousands of Sonoma residents experienced days-long power outages.

Kincade Fire

Despite the efforts of the PSPS, the Kincade Fire broke out in the northeast portion of Sonoma County late on October 23 and was only fully contained on November 6. The Kincade Fire was the largest in Sonoma County's history, and though less damaging than the October 2017 wildfires, it forced widespread evacuations throughout much of the county, with approximately 180,000 residents forced to vacate during the peak of the fire. Physical damage was more limited. According to CAL FIRE, 374 residential and commercial structures were destroyed, and an additional 60 structures were damaged.

Methodology

Moody's Analytics quantifies the impact of exogenous shocks to local economies on a regular basis. This most frequently includes analysis of natural disasters such as hurricanes and wildfires, although other events such as snowstorms, power outages or terrorist attacks are also analyzed using the same framework. Our methodology is most frequently used to calculate an initial estimate of the total impact of an event that is either ongoing or recently took place; this

typically tracks closely with final numbers that may not be available until months, or even years, after the event has concluded.[1]

Before delving into assumptions, it is important to clarify what this framework does and does not cover. Most significant, any cost estimates do not account for the impact of lives that are lost. This, of course, is the most severe ramification of any disaster, but because this involves costs that are far deeper than economic ones, they cannot be meaningfully quantified as part of an exercise like this. Further, assessing the economic value of a lost human life tends to be an actuarial exercise that requires detailed microdata.

Instead, estimates of the toll of a negative event revolve around two key elements: property damage and lost output. The former tends to dominate when natural disasters or other major negative shocks occur. Hurricanes and fires, for example, can damage or destroy thousands of structures, as well as personal property and vehicles. To quantify this impact, we leverage estimates from state and local officials along with press reports to understand how many structures have been compromised. Where possible, this is broken down into homes versus commercial properties. However, if outside sources do not provide information on the value of the properties that were damaged, median single-family prices, compiled for each county by the National Association of Realtors, can be used as a proxy for the value at risk. Multiplying the number of homes damaged or destroyed by the median or average price provides a sense of how much property damage is likely to occur, with additional adjustments made for commercial real estate, where possible.

Personal property is also factored into the damage calculations. Based on information from the Insurance Information Institute, coverage for personal belongings generally accounts for 50% to 70% of the insurance on the structure of a home.[2]

1   For more detail, see Sweet, Kamins, and Velarides, "The Economics of Natural Disasters" from the November 2017 Regional Financial Review.

2   https://www.iii.org/article/what-covered-standard-home-owners-policy

With this in mind, the value of property that is at risk or compromised is increased by about 50% to address the loss of possessions. Vehicle damage is also included, based on media accounts or known losses from similar events. Where necessary, state vehicle registrations can be used to provide a rough estimate of cars and trucks that are in harm's way, although this is far less useful in a state as large as California. Typically, vehicle damage accounts for a trivial share of the overall price tag, except when flooding occurs, as was the case in New Orleans during Hurricane Katrina and Houston during Hurricane Harvey.

Lost output is associated with a wider set of economic events, from catastrophic disasters to more mundane occurrences such as power outages. To calculate this, Moody's Analytics estimates of county-level nominal GDP by industry for the relevant time period—in this case, an average of forecast third and fourth quarter 2019 values for the Santa Rosa metro area—are used as a starting point to capture the amount of output lost. These are converted into daily figures, allocated across weekdays and weekends depending on the nature of the industry to capture the short-term disruption to an economy.

In addition, assumptions are made about the extent to which work can be made up or done remotely. For example, many office workers can telecommute, but transportation and logistics tend to be shut down more completely if travel becomes impossible. Ultimately, any assumptions about industry-specific impacts are informed by a combination of our own intuition and, where possible, supplemental data. The explicit assumptions underlying the calculations that were done for Sonoma County are outlined below.

PSPS assumptions

The rolling power outages conducted by PG&E throughout the fall affected almost 195,000 residents, based on data compiled by ESRI and provided by the Sonoma County EDB. Dividing this figure by the county's population of approximately 500,000 indicates that the share of the county affected by the outages was just below 39%. Know-

ing that about 2 million residents were affected statewide, we assumed that about 10% of affected California residents in subsequent blackouts reside in Sonoma County.

Based on press releases from PG&E, four other events took place in California. One coincided with a period in which the entire county was already experiencing a severe loss of economic output due to the Kincade Fire, meaning that no PSPS impact was calculated to avoid double counting. In total, then, four outages were considered: October 9-12, for which ESRI data can be used to determine the scale; October 23-24, in which 500,000 customers were affected statewide; October 26-27, in which just fewer than 1 million customers were affected in California; and November 20, when about 7,000 Sonoma County customers lost power.

Combining all events means that the average affected resident experienced a disruption of just over four weekdays and two weekend days. Once accounting for the fact that less than half of Sonoma County residents were affected by any single shutoff, this takes the average closer to 2½ days.

Next, assumptions were made regarding the impact of the outages on specific industries. This was based on a combination of existing Moody's Analytics methodology, which typically uses economic intuition and historical precedent. For Sonoma County, however, we supplemented this with data from a survey that the EDB distributed to businesses following the first set of outages (see Chart 2). Because this covered the entire county, firms that indicated no impact from the outages or less than a quarter of output lost—totaling about 60% of respondents—were assumed to be outside of the outage zones, given that this share roughly aligns with the percentages implied by the ESRI figures. The remaining three groups were

Chart 2: PSPS Impact Was Far-Reaching
Estimated share of revenue lost by Sonoma businesses, %
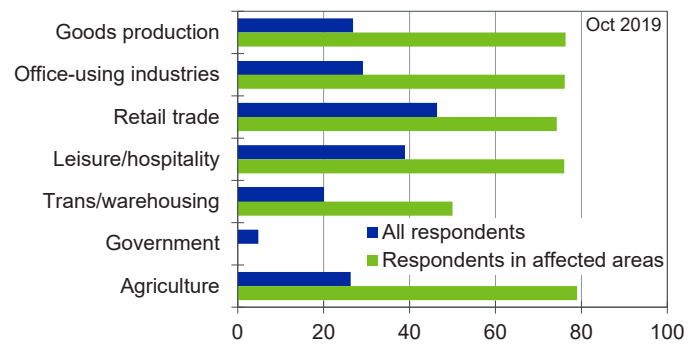
Sources: Sonoma County EDB, Moody's Analytics

assumed to be in affected areas, with the midpoint of their range used to calculate a rough lost output figure per industry, based on combined industry definitions that align with prior work that we have done. Finally, those results were calibrated to ensure that any conclusions were reasonable and consistent with past findings.

Kincade Fire: Lost output assumptions

Lost output from the Kincade Fire was calculated using the same broad methodology employed for power outages. Lost output was generally assumed to be the same as it was for power outages, based on earlier survey results, with the only qualitative adjustment made to goods-producing industries. While respondents indicated that about two-thirds of output was lost due to the shutoff, we assume that while the fires were raging, any areas that were shut down experienced an even greater loss of goods-producing employment. Manufacturing output is typically difficult to make up anyway, barring idle capacity, but any potential ramp-up through more overtime hours, for example, could be offset by physical damage to some plants. In addition, the ability to make up for lost construction output would likely be sacrificed to a need for rebuilding, meaning that delays to projects would be difficult to recoup. Still, the impact was capped at 80% to account for the fact that some activity continued to occur and disruptions to the supply chain were not as severe as they could have been, as U.S. 101 remained open to the

south, keeping the county connected to key economic hubs.

The impact on other industries was unchanged from the power shutoff assumption. That includes government, which was assumed to lose only 10% of output despite office and school closures. This is due primarily to the fact that firefighters and other first responders worked extremely long hours and many officials were tasked with coordinating a response, partly offsetting any loss to office-using government or public school-based positions.

Understanding the degree to which Sonoma County was affected on a day-by-day basis is key to developing a meaningful estimate of lost output. To get at this, two factors were considered most closely. The first was the share of residents under mandatory evacuation, which peaked at 36% from October 27-29 based on information from CAL FIRE. The second is a list of school closures. This is traditionally considered a reasonable proxy for lost output; with all schools in Sonoma County closed during the fire's peak intensity and a few days before and after, we assumed that the entire county was affected in some way during the worst of it.

Using an evacuation timeline that begins October 23 and ends November 3, day-by-day impacts were calculated. For each day during that period, whatever number is higher when comparing current-day evacuees and those from the previous day was used. The logic for this is that even if evacuees drop from, say, 180,000 to 30,000 on a given day, the 150,000 returning residents will be in transit and addressing post-evacuation responsibilities, meaning that they will be unavailable to work.

A ratio was then calculated, based on the assumption that all of Sonoma County was affected on peak fire days, even though only 36% of residents had evacuated. To get to 100% geographic coverage from 36%, a ratio (25/9) was applied to the percentage of evacuees. The daily share of output lost was then calculated for all combined weekdays and weekends, yielding around 3.3 lost weekdays of productivity per resident and 1.64 weekends of lost output.

These durations were fed into the lost output model without any further adjustment; whereas the lost output associated with the PSPS outages was discounted to reflect the fact that not all residents were affected, the share of affected residents is already incorporated into the lost output calculation.

Kincade Fire: Property damage assumptions

Property damage associated with the Kincade Fire was the more costly consideration, as is typically the case for natural disasters. To calculate this, first the value of the typical structure in the county was considered. While the median single-family house price of just less than $675,600 would typically be used, a slightly more precise figure of 221 structures totaling $150 million being at risk was reported by CoreLogic and cited by numerous press outlets.[3] Dividing the two figures yields an average value of about $678,700, close enough to the median single-family house price to make sense as an average price. Further, using this figure incorporates commercial real estate and reflects all properties instead of the midpoint of the distribution.

The next step involved multiplying the average value by the 374 homes destroyed. For those properties, an additional 50% was included to reflect the value of personal property that was lost. In other words, just over $1 million was assumed lost with each destroyed property. The assumption of 50%, as opposed to something on the higher end of the 50% to 70% range, is based on the idea that most residents had enough advance notice to bring some of their more valuable possessions with them when evacuating. This is supported by the fact that thankfully nobody was killed in the fire. A significant number of casualties would have signaled that there was less opportunity to escape, but Sonoma County residents were prepared and received enough advance warning to minimize the number who had to

endure harrowingly close calls in which they left virtually all possessions behind.

Damage to the wine industry was also captured as part of this calculation. However, the Kincade Fire mostly spared the county's many wineries. While a few sustained damage, only one—Soda Rock Winery in Healdsburg—was destroyed. Even there, the cost was kept in check because 99% of its harvest was complete and winemaking and storage take place offsite.[4]

Vehicle damage was also minimal during the fire. Given that evacuees needed to leave their homes by car and, in many cases, used their advance notice to pack multiple vehicles and drive them both out of harm's way, any impact on cars and trucks was likely to prove minimal. With little evidence of vehicle damage cited in the press, this assumption appears solid.

Last, standard practice involves a heavily discounted damage number being applied to places that were not destroyed but compromised in some fashion. In events such as hurricanes and floods, this can be closer to 10% or more, but fires are rather binary as disasters go. Structures that were not engulfed likely emerged with relatively minor repairs needed, so only 5% of the typical home's value, just shy of $34,000, was assumed to be the average loss to the 60 damaged properties. We assumed that personal possessions remained fully intact when damage, but not total destruction, occurred.

Short-term costs

Public Safety Power Shutoffs

As PG&E took preventive measures in an attempt to prevent another outbreak of wildfires this fall, Sonoma County found itself in the dark on five separate occasions. As described earlier, one of those overlapped with the wildfires, but the other four were examined based on duration and industry impact assumptions.

Each outage was costly, but the price was far smaller than that of a fire. Most important, most of the price tag associated with fires comes from property damage, but a

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3   See, for example, https://sf.curbed.com/2019/10/30/20940125/healdsburg-winery-destroyed-kincade-fire-soda-rock-kincade.

4   https://fortune.com/2019/11/06/california-wildfires-wine-industry-kincade-fire-sonoma/

Table 2: Cost Estimates for Sonoma County
$ mil

	Kincade Fire	Power outages
Lost economic output	$235	$105
Property damage	$385	NA

Source: Moody's Analytics

Chart 3: Kincade Does Not Crack Top 10
Structures* destroyed in most destructive California wildfires, ths

*Includes homes, commercial properties and outbuildings (that is, barns, garages, sheds)

Sonoma County fires in green

Sources: CAL FIRE, Moody's Analytics

power outage leaves structures fully intact. In addition, because the power shutoffs carried some advance warning, allowing firms and individuals to do some degree of advance planning, the price tag was lower as well. Finally, much of the county was spared the impact of the outages, keeping the price tag relatively in check.

Ultimately, the cost associated with the shutoffs was approximately $105 million in lost output (see Table 2). While significant, this amounts to about one-third of 1% of annual GDP in the county. The majority comes from goods-producing and office-using industries, which were disrupted by the outages. However, the cost was held back by one of the significant outages occurring on a weekend, significantly reducing the impact on most industries, with the exceptions of retail and leisure/hospitality.

Kincade Fire

We estimate that the Kincade Fire cost about $620 million. This includes $235 million in lost economic output and $385 million in property damage. The output loss has been revised lower from initial estimates, based on more complete information about the scale and timing of evacuations and the size and duration of the fire itself. Ultimately, while a significant setback for Sonoma County, the fire was extinguished more rapidly than many expected early on, when it was barely contained.

Still, due to extremely dry conditions and high winds, the fire took nearly two weeks to contain and will go down as the largest in California in 2019. According to CAL FIRE, the blaze encompassed more than 77,000 acres. But with no deaths reported and other events, like last year's Camp Fire, proving far more traumatic in terms of lives lost and acreage covered, the Kincade Fire's impact

was far less severe than it could have been (see Chart 3).

Damage to homes was the most significant culprit when it comes to the Kincade Fire's price tag. Even though the fire's worst effects bypassed highly populated areas, the destruction of hundreds of homes is more costly than it would be in most places. House prices in the county rank in the top 1% nationally, with median single-family prices nearly 1.5 times greater than those of the U.S. As a result, even a relatively small footprint can prove costly.

While the fire's price tag was significant, even when factoring in damage—much of which will be paid for by insurance or government aid—it accounts for about 2% of total output. This is enough to set the economy back in the fourth quarter, but rebuilding efforts and the inflow of funds into the area will help to ensure that the economy gets back on track relatively quickly.

It is worth noting that when Moody's Analytics produces an initial estimate of the cost of a natural disaster, a range is typically provided. This is done to account for uncertainty as an event unfolds and the fact that on-the-ground information can be unreliable in real time. Because this study was undertaken more than a month after the Kincade Fire was extinguished and included additional research into local effects, there is less uncertainty around these estimates. However, it is important to avoid attaching too much precision to them. The assumptions described earlier have been deemed reasonable, but there is room for interpretation around many of them. In addition, potential medium- and long-term effects are not captured in these
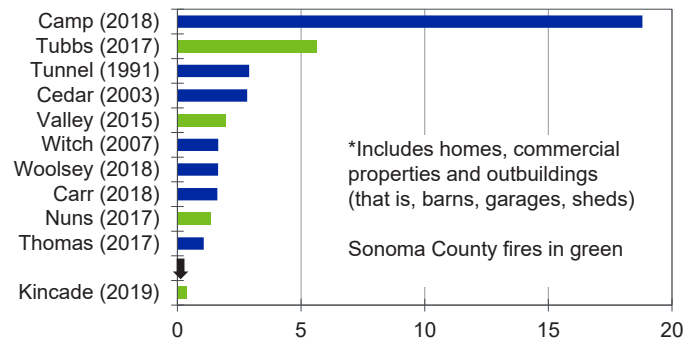
estimates, although they are discussed later in this report.

Costs per resident and business

To further contextualize the full economic impact calculations, we have expressed the results in terms of the average economic impact per Sonoma resident and average cost per business. In general, we assume that property damage was mostly borne by individuals, while lost output accrued primarily to businesses. This, of course, is overly simplistic, but one can assume that spillover between the two categories is roughly equivalent, which would result in a similar conclusion.

On a per resident basis, this approach results in a price tag of approximately $765 per Sonoma County resident, representing a little less than 2% of median household income for residents. It is important to note, however, that much of the county was unaffected by either event, resulting in a top-heavy distribution. Insurance will cover the majority of losses, but it can take some time to resolve claims, potentially leading to lingering short-term weakness as residents await a check.

Another way to put the results in context is on a per business basis. Using the approximately $340 million in total lost output from the PSPS and evacuations and dividing by the number of establishments in the county using the Quarterly Census of Employment and Wages, we estimate that the average county establishment suffered an economic loss of approximately $16,500.

Chart 4: Visitor Spending Holds Strong

Tourism spending, $ mil
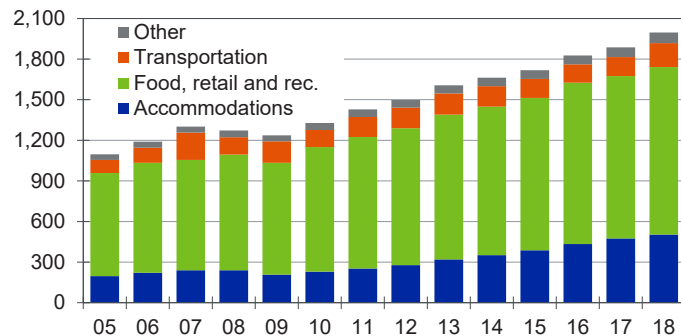
Sources: Visit California, Dean Runyan Associates, Moody's Analytics

This represents around 1% of the county's annual gross metro product.

Other recent disasters

Tubbs, Nuns and Atlas fires

The Tubbs Fire, which occurred in late 2017, affected a smaller area than the Kincade Fire did, but the physical damage was much more severe. Because densely populated residential areas were affected, that fire destroyed more than 5,600 structures, of which approximately half were residential structures in Santa Rosa. This is more than twice as many structures as were destroyed or damaged in the Kincade Fire. The Insurance Information Institute estimates that insured losses from the Tubbs Fire totaled from $7.5 billion to $9.7 billion when it occurred, making it the costliest fire in California history at the time, surpassed only by the Camp Fire nearly a year later at $8.5 billion to $10.5 billion in estimated property losses.

The Nuns Fire broke out concurrently with the Tubbs Fire, and burned a similar sized area across Napa and Sonoma counties. According to CAL Fire, approximately 1,300 structures were destroyed across the two counties, and press releases estimate about 600 homes were destroyed in east Sonoma County.[5] The Atlas Fire destroyed an additional 780 structures, though this was contained to Napa and Solano counties, according to CAL Fire. All told, the October 2017 wildfires caused around $14.5 billion in damage across Northern California counties.

The economic impact of the Tubbs, Nuns and Atlas fires was most apparent in the housing market. The combined loss of more than 5,000 homes in Sonoma County represented around 2.5% of the county's housing stock, exacerbating affordability issues that have plagued Sonoma in the current economic expansion. House prices initially spiked in the wake of the fires. The Case-Shiller index reached its cycle high in January 2018 before retreating through the remainder of the year. The county has made strides in expediting the permitting process, and residential permit issuance surged due to rebuilding efforts. According to Permit Sonoma, about 300 rebuilds are complete. More than two years out from the fire, the effects on the housing market are still reverberating through the economy. An estimated two-thirds of Sonoma County fire survivors were underinsured on their homes, with a handful more than $1 million underwater, according to a survey by United Policyholders, a nonprofit that assists consumers with insurance information.[6] It will take time for the housing market to rebalance given the slow nature of the rebuild.

Insurance payouts to cover temporary living expenses to residents whose new homes are still unfinished have eased some of the burden. Most insurance plans cover up to two years of temporary living expenses. A new state law, enacted in 2018, has extended coverage for a third year, but it will not retroactively apply to 2017 wildfire victims. Thus far, 26 home insurers have voluntarily expanded to comply. Notably, three of the biggest property insurance companies, including State Farm, Allstate and Nation-

wide, have rebuffed the request. According to the insurance commissioner's office, the 12 insurers who have declined to extend living expense coverage represent about half of the insured losses from the North Bay fires. In context of the Kincade Fire and PSPS outages, the lingering impact of the 2017 fires will likely prove a bigger hurdle for Sonoma's economy.

The tourism industry likewise suffered through a soft patch. Still, despite hurdles and a wave of cancellations in the immediate aftermath of the October 2017 wildfires, annual visitor spending totals rose 4.4% in 2018, a slight deceleration from the previous two years but roughly in line with the average annual growth rate from 2010-2018 (see Chart 4).

Russian River Flood

Beyond the wildfires, Sonoma County also suffered from a significant flood in February 2019. Days of heavy rains and flooding along the Russian River dealt an estimated $155 million in damage, according to county officials.[7] Approximately 2,600 properties were affected by the flood. Unlike fire-related claims, home and business owners must buy a separate policy to insure structures and contents damaged by floodwaters. If a property is in a high-risk flood zone, flood insurance is required. However, in a case such as the Russian River Flood, record rainfall led to extensive flooding outside of the high-risk flood zones. In Sonoma County, there are around 2,300 flood insurance policies, with one-fifth of them covering properties outside of high-risk flood zones, according to FEMA. As a result, the flooding created more economic pain for residents than its price tag might imply at first glance. Furthermore, evacuations and power outages mean that some output was lost, although this figure is far smaller than the damage estimate.

Long-term ramifications

Tourism

One of the avenues in which the Kincade Fire and PSPS outages have the potential to leave a lingering impact is through tour-
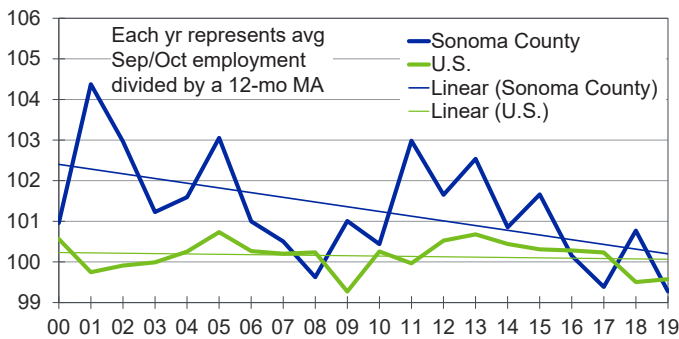
5   https://www.pressdemocrat.com/news/7588914-181/cal-fire-4658-homes-destroyed?sba=AAS

6   https://www.uphelp.org/data-collection-surveys

7   https://www.pressdemocrat.com/news/9359379-181/although-flood-was-worst-in

Chart 5: Wither Seasonality in Sonoma?

Sep/Oct accommodations employment, index, NSA

Sources: BLS, Moody's Analytics

ism. Sonoma County's economy relies heavily on the tourism industry. Leisure/hospitality accounts for approximately 12% of employment, nearly a full percentage point higher than the national average. According to Visit California, state and local travel-generated tax revenue climbed to $200 million in 2018. Visitors spend approximately $2 billion in the county each year, and tourists are key pillars of support for retailers, restaurants, hotels, and a host of other industries.

Tourism in Sonoma County has navigated a steady road back from the October 2017 wildfires. Although physical damage to the county's main tourist attractions was limited, Sonoma battled a perception issue in the wake of fires throughout the state. Hospitality operators in the county have struggled to attract the same type of demand that characterized the preceding years in light of the negative perceptions.

Still, the impact of the fire is difficult to isolate. Napa County, which suffered through the Atlas Fire at about the same time as the Tubbs and Nuns fires, has outperformed Sonoma County by a significant margin. In general, hotel lodging statistics on their own paint an incomplete picture but are worth keeping an eye on given their timely nature relative to other tourism statistics.

The cumulative effect of three significant weather events—the 2017 wildfires, the Russian River Flood, and the Kincade Fire—may be enough to dissuade tourists from vacationing in Sonoma County. While the lodging statistics lend some credence to that theory,

county-level employment figures paint a more upbeat picture. The QCEW indicates an acceleration in tourism-related job growth following a decline during the closing months of 2017. Leisure/hospitality payrolls have drifted modestly higher over the past two years, rather than declining, as the payroll survey suggests they have.

Part of the slowdown in 2019 may be attributable to a healthy but slowing national economy. Consumer spending growth remained modest but healthy in September, though it remains near the low end of its recent range as slower job growth and numerous uncertainties, including a volatile stock market, take their toll. Despite this cooling, consumers continue to contribute powerfully to growth. Spending accounted for more than all the growth in GDP over the last two quarters as the rest of the economy contracted.

Further, the impact of wildfires may be muted slightly due to reduced reliance on early-autumn visits to Sonoma County. Traditionally, the period from June through October has attracted the most visitors, and that remains the case. However, harvest season may no longer dominate the calendar the way that it once did.

An examination of not seasonally adjusted employment figures for the accommodations and food services industry indicates that the degree to which September and October stand out relative to the rest of the year is diminishing (see Chart 5). This implies that in recent years, Sonoma County's reliance on visitors during the portion of its high season that overlaps with fire season has diminished. While lower employment during that period in 2017 likely reflects the impact of the Tubbs and Nuns fires, the 2019 figures were collected before the Kincade Fire broke out. This signals this year's results

were not simply the result of a wave of fire-related cancellations.

Not seasonally adjusted employment, of course, does not completely capture the tourism industry, but it is corroborated by figures showing that hotel occupancy was higher in June than in October during each of the past two years. Such trends signal that visitors may be shifting the timing of their trips to avoid fire season, which would mean fewer fire-related cancellations for hotels and restaurants. On the other hand, this may also reveal that some tourists who would have visited during the autumn are choosing to go elsewhere, driving reduced seasonality. This, of course, would speak to the broader toll associated with wildfires.

Put more succinctly, an apparent reduced reliance on September and October visitors can be interpreted as either a positive or negative sign. Some tourists may have been deterred from visiting during the fall in recent years, but that may be helping to insulate the area from the impact of future fires on tourism.

Demographics

In the aftermath of repeated disasters, it is natural to wonder whether the Kincade and Tubbs and Nuns fires will materially affect population growth in Sonoma County. After all, widely circulated images of burning homes, residents who lost everything, and of course the tragic stories of those who did not survive could give pause to anyone who is thinking about relocating to the county. Similarly, those who have endured the fires may decide that they would prefer to live elsewhere. Because population growth is arguably the most important factor in unlocking a region's economic potential, a surge in out-migration could have severe long-term consequences for Sonoma.

At first glance, the data support the notion that wildfires may be driving weak demographics in Sonoma County. In 2018, the last year for which data are available, the county's population fell by nearly 0.7%, marking just the fourth decline since tracking began nearly a half-century ago, and by far the sharpest drop in that period. The mid-year estimate, reflecting July-to-July losses,

corresponds with the aftereffects of the October 2017 fires. And more troubling, the culprit was net out-migration, as opposed to natural population growth.

Yet recent dynamics are more complex than they appear. High costs are also driving residents out of Sonoma County, mirroring a statewide trend. Population growth in California for 2018 was the weakest since statistics were kept beginning in 1900, with an increasing number of residents moving elsewhere, especially the Mountain West, due to housing shortages and affordability concerns. So it would be overly simplistic to pin the recent decline solely on the aftermath of the 2017 wildfires.

To better decouple the impact of broader economic considerations and the effects of fires, we ran a series of regressions. The endogenous variable in these regressions was net domestic migration per resident, which captures the direction and magnitude of in- or out-migration within the U.S. while also controlling for size. A series of macroeconomic drivers including the unemployment rate, the Moody's Analytics Cost of Living Index, and housing affordability were used as explanatory variables. So too was a dummy variable intended to capture the impact of wildfires. Based on a detailed review of the most severe wildfires to strike the state this century, six of California's 29 metro areas were classified as highly exposed: Napa, Oxnard-Thousand Oaks-Ventura, Redding, San Diego-Carlsbad, Santa Maria-Santa Barbara, and Santa Rosa.

Chart 6: Affordability Outweighs Fire Risk

Housing affordability (X-axis) vs. net domestic mig. rate, % (Y-axis)
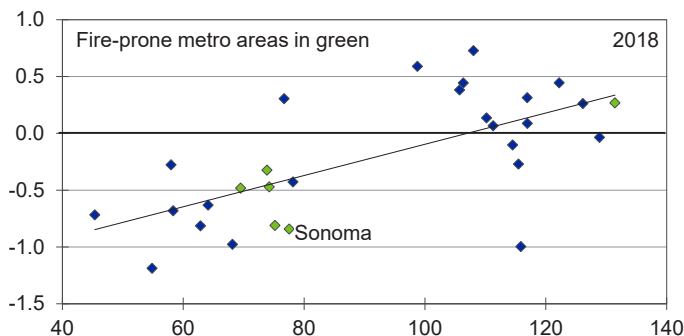
Sources: Census Bureau, NAR, BEA, Moody's Analytics

Table 3: Cross-Sectional Regressions: Sonoma County Demographics

Dependent Variable: Net domestic migration/population, 2018

Included observations: 29

	(1)	(2)	(3)
Constant	-0.0015	-0.0141***	0.0116***
standard error	0.0011	0.0024	0.0035
Fire Exposure Dummy	-0.0030	-0.0017	-0.0024
standard error	0.0025	0.0016	0.0017
Unemployment rate gap		-0.0026***	-0.0027***
standard error		0.0007	0.0008
Housing affordability index		0.0001***	
standard error		0.0000	
Cost of living index (2017)			-0.0001***
standard error			0.0000
R-squared	0.0517	0.6459	0.5659
Adjusted R-squared	0.0166	0.6034	0.5138
Durbin-Watson statistic	2.1752	2.2938	2.3280

*** indicates statistical significance at the 1% level.

Source: Moody's Analytics

First, cross-sectional regressions were run to capture how important wildfire exposure is to 2018 migration patterns. Table 3 contains a series of regression specifications that were generated to quantify the impact of wildfire exposure. Equation (1) involves a simple regression in which 2018 per capita net domestic migration is the dependent variable, and the wildfire dummy is the driver. This reveals a negative relationship between fire exposure and domestic migration, as one would expect. But the wildfire dummy is not statistically significant, and the equation has minimal explanatory power.

Equations (2) and (3) provide a more complete accounting of the factors that drive net domestic migration. Both adapt the methodology that is used to drive state domestic migration forecasts in the Moody's Analytics state model as their starting point, using a measure of economic health and cost. Each equation contains an unemployment rate gap term that is statistically significant at the 1% level. This term, which uses the average unemployment rate in 2018 and compares it to the lowest measure from two previous expansions (using a range from 1995 to 2010), indicates that economies that are at or beyond full employment are more likely to attract residents. Each equation also includes a cost term, with equation (2) indicating that housing affordability, which is based loosely on the ratio of incomes to house prices, is strongly positively correlated with in-migration; in other words, more affordable areas in California attract more people. Similarly, the Moody's Analytics Cost of Living Index, for which 2017 is the most recent year, is negatively linked to domestic migration and also highly significant.

Adding those two terms to the original equation greatly enhances its explanatory power. Meanwhile, the fire exposure dummy remains insignificant. In other words, whether looking at a simple comparison of fire exposure to net migration or considering it alongside other key demographic predictors, there is little evidence that residents of California have been making location decisions with wildfire risk in mind.

These results are also clear when examining a scatter plot of housing affordability and net domestic migration

Table 4: Simple Panel Regression Using Fire Dummies

Dependent Variable: Net domestic migration/population, 2005-2018

Included observations: 406

AR(1)	0.7542***
standard error	0.0257
Fire Exposure Dummy (t-1)	-0.0011
standard error	0.0012
Fire Exposure Dummy (t-2)	-0.0003
standard error	0.0015
R-squared	0.6599
Adjusted R-squared	0.6582
Durbin-Watson statistic	1.8021

*** indicates statistical significance at the 1% level.
Source: Moody's Analytics

Table 5: Panel Regression Using Fire Dummies and Economic Drivers

Diff(Dependent Variable: Net domestic migration/population, 2005-2017)

Included observations: 377

Fire Exposure Dummy (t-1)	-0.0002
standard error	0.0018
Fire Exposure Dummy (t-2)	0.0000
standard error	0.0018
Diff(Cost of living index)	-0.0001*
standard error	0.0001
Diff(Unemployment rate)	-0.0002
standard error	0.0002
R-squared	0.0098
Adjusted R-squared	0.0018
Durbin-Watson statistic	1.9175

* indicates statistical significance at the 10% level.
Source: Moody's Analytics

per resident (see Chart 6). There is a clear positive relationship between the two, while there is little to suggest that exposure to wildfires is making a significant dent in population growth in the metro areas listed earlier.

To get a more complete picture of how fires affect demographics over time, we also used time series data to run a panel regression. In this case, the metro-level fire dummies reflected a time series instead of a snapshot; in other words, for Sonoma County, the series was set equal to 1 in 2015 and 2017 to reflect the Valley, Tubbs and Nuns fires in those years. For all other periods, it equaled zero. This approach allows one to understand whether the immediate aftermath of a fire brings about a decline in migration.[8]

The first step involved a simple panel regression that used one- and two-year lags of the fire dummy. This was done to account for the mismatched timing of demographic series, which the Census Bureau reports as mid-year estimates, and fire season, which takes place later in the year. As a result, a one-year lag of the fire dummy represents the first potential instance of a fire influencing location decisions. The two-year lag is also included because it incorporates an additional year for residents to

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8   Classifications are based on data found here:
https://www.fire.ca.gov/media/5511/top20_destruction.pdf

fully incorporate information from the previous year into any moving decision.

When using per capita net domestic migration, an autoregressive term, and fire dummies, the resulting regression shows that the fire variables are not significantly different from zero, with all of the equation's explanatory power derived from the AR term (see Table 4). Adding terms for the unemployment rate and cost of living does little to change the equation's performance, although both of those variables are closer to being significant than the fire dummies are.

An alternative specification involves the change in net domestic migration regressed against the change in costs and broader economic health, along with fire dummies (see Table 5). While the explanatory power of such an equation is predictably far lower than one that uses levels and an AR term, costs begin to display borderline significance and an intuitive negative sign. Yet the fire dummies remain insignificant. In other words, while the change in costs may influence moving decisions within California from one year to another, a fire in the preceding year or two remains immaterial to residents' decisions.

The finding that people are generally undeterred by wildfires may seem counterintuitive, but it is consistent with trends that are observed elsewhere. One recent example of this phenomenon is Houston, where devastating floods have become commonplace due in part to overbuilding and the elimination of natural flood plains. Following Hurricane Harvey in 2017, some predicted that potential residents would think twice about living in the metro area, and that flood-weary Houstonians would depart. Instead, net domestic migration increased slightly from 2017 to 2018, with the sharp drop the previous year likely reflecting weaker economic conditions due to fallout from the oil price bust that took place a few years prior. Simply put, economic characteristics were a far more powerful deterrent to in-migration in Houston than recurrent natural disasters were.

More broadly, a similar mentality is evident when considering coastal building. Despite stronger and more frequent hurricanes and the threat associated with rising sea levels, waterfront property remains very

Chart 7: U.S. Economy Gradually Slows

Payroll employment, % change yr ago
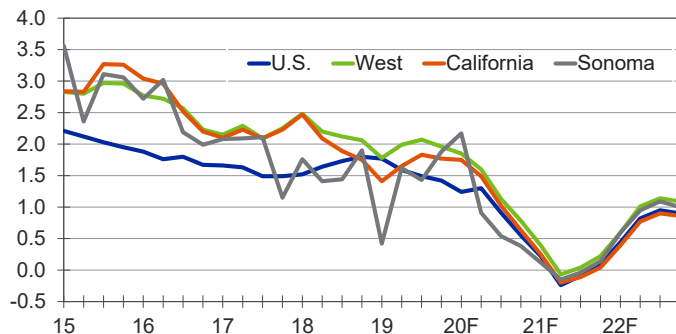
Sources: BLS, Moody's Analytics

much in demand. The relatively flat East Coast has seen a continued increase in development in beach towns, and prices remain as high as ever. For example, the Case-Shiller condominium and single-family indexes in the Miami metro area, where hurricanes are a constant threat, have continued to rise in recent years despite increasingly dire warnings about the potential threats facing South Florida.

In other words, while it is naïve to assert that two significant wildfires in three years will have no impact on population growth in Sonoma County, there is little empirical evidence to suggest that they will prove meaningful drivers of demographic trends. Instead, broader macroeconomic factors

such as costs, availability of jobs, and more qualitative considerations such as weather and quality of life are more predictive of population growth—and consequently, economic potential—in the long run.

Key takeaways

The Kincade Fire and PSPS had a noticeable, but temporary, impact on the Sonoma County economy. The disruptions from large-scale power outages, evacuations, and property damage affected residents and businesses in the fourth quarter of 2019. All told, however, the effects do not materially affect the outlook moving into 2020. Rebuilding efforts should provide a temporary boost, and there is little to suggest that demographic trends will deteriorate meaningfully. As a result, Sonoma is well-positioned to track the performance of California's coastal metro areas (see Chart 7).

The tourism industry may suffer a brief blip given the negative headlines that Sonoma has generated in recent months. However, recent data coupled with the re-

covery in the aftermath of the October 2017 wildfires give credence to the notion that tourists will continue to seek out Sonoma as a vacation destination. While the lost output to businesses and the property damage for individuals will sting, Sonoma firms will likely navigate any hurdles and insurance payouts will offset much of the damage incurred by residents.

Still, **f**ires are increasing in frequency and severity. The deadliest and most destructive fires in California's history were in 2017 and 2018. These are a natural part of California's ecosystem, but extremely dry and windy conditions are fueling fires of unprecedented size and intensity. This is due in part to climate change—warmer springs and summers, less snow, and early melting are exacerbating dry conditions in fire season, which has increased by two months or more in some parts of the state.

As these events grow more frequent and intense, the costs of fires and shutoffs may become greater and the modest impact on tourism and demographics that has been observed to date could grow far more significant. So while the fall 2019 price tag of about $725 million looks more like a paper cut than a permanent scar, the cumulative impact of future events could drive steeper short- and long-term costs moving forward.

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