Online Appendix to "Weather and the Decision to Go Solar: Evidence on Costly Cancellations"

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A Kleissl (2013) PV Performance Model

The PV performance model used in this paper is developed by Kleissl (2013), which is funded by the CSI Research, Development, Demonstration and Deployment (RD&D) Program. It uses satellite solar resource data to simulate PV power output while accounting for local weather conditions and system characteristics. It explicitly modeled the following components: irradiance on tilted surface, panel temperature effect on efficiency, DC-AC conversion efficiency, and maximum power point efficiency. The model parameters are then calibrated using CSI PV performance data.

I use this model to construct the solar production index, which is intended to measure how favorable the weather is for solar generation. The main weather inputs are daily solar insolation, maximum temperature, and wind speed. I use the same tilt, azimuth angle and system size for all applications so that the variations in the index only reflect differences in weather conditions. The predicted output for each application is then averaged over the relevant period and normalized to have mean zero and standard deviation one. Therefore, it is not necessary for the modeled output to completely match actual solar generation.

Kleissl (2013) has validated the 30-minute output of this model against measured power output at 192 PV sites over SDG&E, SCE, and PG&E territories. Fig 7-1 in Kleissl (2013) shows that the predictions are unbiased with typical errors of 4-9%. Because this measure is averaged over a much longer period in the current paper, such measurement errors should be significantly reduced.

The performance of this model is also compared against the PVWATTS model at three representative sites. PVWATTS is a standard calculator of PV performance in the industry.

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Table 6-1 in Kleissl (2013) shows that they have similar performance in terms of the relative mean bias error and relative mean absolute error, and the current model is slightly better calibrated for California.

B Late Cancellation Reporting

In the CSI dataset, the majority of cancellations have a reported cancellation period beyond one year, which is the program deadline for installation. These observations are referred to as "late reports" henceforth. In this section, we examine these late reports more closely to shed light on the nature of this data issue. We will first look at patterns in the timing of these reports and then move on to understanding the potential roles of program administrators and contractors.

Figure B1 plots the distribution of reported cancellations by calendar month. Between 2007 and 2016, the number of reported cancellations varies substantially across calendar months. However, there is no discernible seasonal pattern, which suggests the reports are not likely to be driven by seasonal production cycles. Additional analysis also shows no evidence of concentrated reporting right before or after incentive step changes in the program.[1] Figure B2 breaks down the sample by whether the observation is reported before or after the deadline. Again, there is no seasonal pattern in either of the distributions. [2]

Figure B3 plots the full distribution of cancellation duration. Here, we find clear evidence of bunching right after the one-year deadline. More than half of the late reports are within 30 days from the deadline and 92.8% are within 180 days. Such bunching strongly suggests that the timing of these reports are related to the program deadline rather than the true time frame of cancellation. There is no incentive for the contractor or the customer to report a cancellation in time. As a result, a likely scenario is that the cancellation would remain unknown to the program administrator until the deadline when a report on the project status is required. Moreover, some cancellations reported before the deadline might also be subject to delay due to the same incentive problem.

The accuracy of the reported dates might be related to practices of the program administrator (PA). There is a separate PA for each of the three investor-owned utilities: Pacific Gas and Electric (PG&E), Southern California Edison (SCE), and Center for Sustainable

[1] Results available upon request.

[2] October 2012 appears to be an outlier with an unusually high number of cancellations reported before the deadline. On close scrutiny, this is mainly due to October 11 and 12. Moreover, over 95% of cancellations reported on these two days are associated with Vertigo Solar. This suggests at least some cancellations reported before the deadline are subject to contractor delay.

Energy (for San Diego Gas and Electric (SDG&E) territory). In Figure B4, I plot the distribution of reported cancellation duration separately for each of them. The pattern for each PA is qualitatively similar to the aggregate: most of the cancellations are reported late with clear bunching immediate after the deadline. This suggests that the administrative process is similar across PAs.

Next, we turn our attention to the contractors. As many contractors handle the CSI application for their customers, they might play a major role in determining how promptly the cancellations are reported. Table B1 below lists the top 30 contractors by size (as indicated by the number of applications). There are a total of 2,398 contractors in the data, but the size distribution is highly right-skewed. For example, SolarCity is the largest contractor in the market with 15.1% of applications. It also has the largest number of cancellations and late reports. Together, the top 30 contractors account for about 60% of all applications, cancellations, and late reports. Among them, late reporting appears to be universal. The probability is substantial across the board and varies around the sample average of 0.62.

To sum up, we have three main findings. First, there is no seasonal pattern regarding the report timing of cancellations. Second, there is strong evidence of bunching right after the individual deadlines, suggesting the reported dates reflect more on program rules rather than the actual cancellation time frame. Last but not least, the problem is pervasive in the program regardless of the associated program administrator and the contractor.

Figure B1: Monthly Distribution of Reported Cancellations

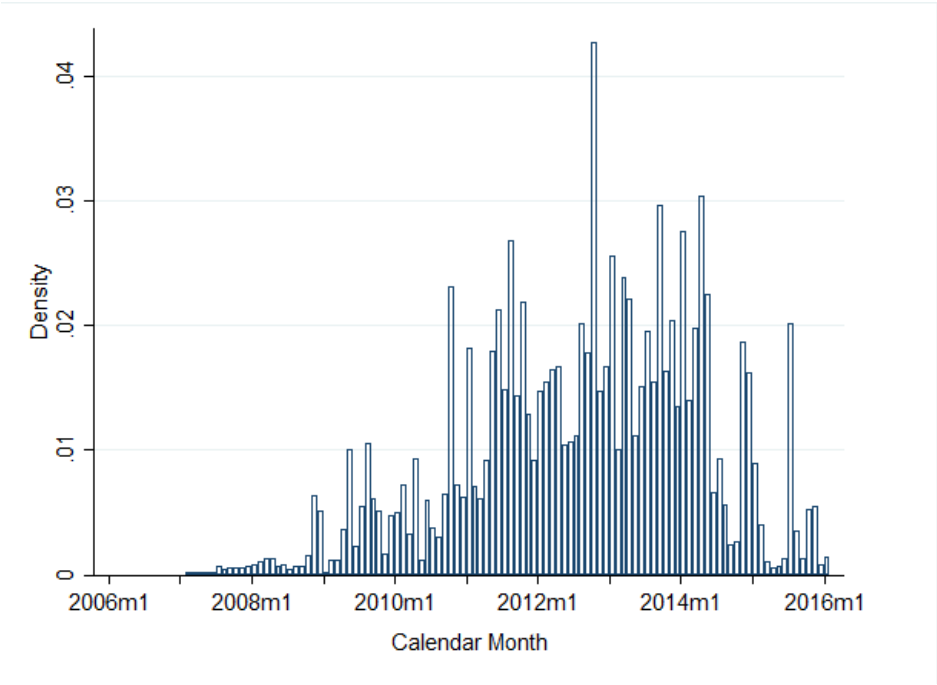


Figure B2: Monthly Distribution of Reported Cancellations by Late Status

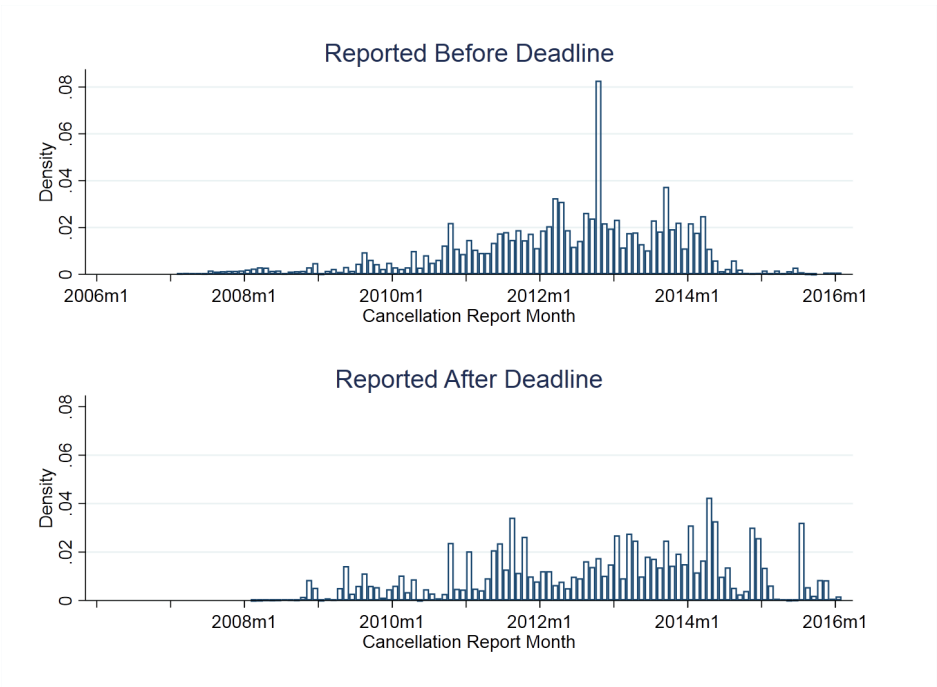
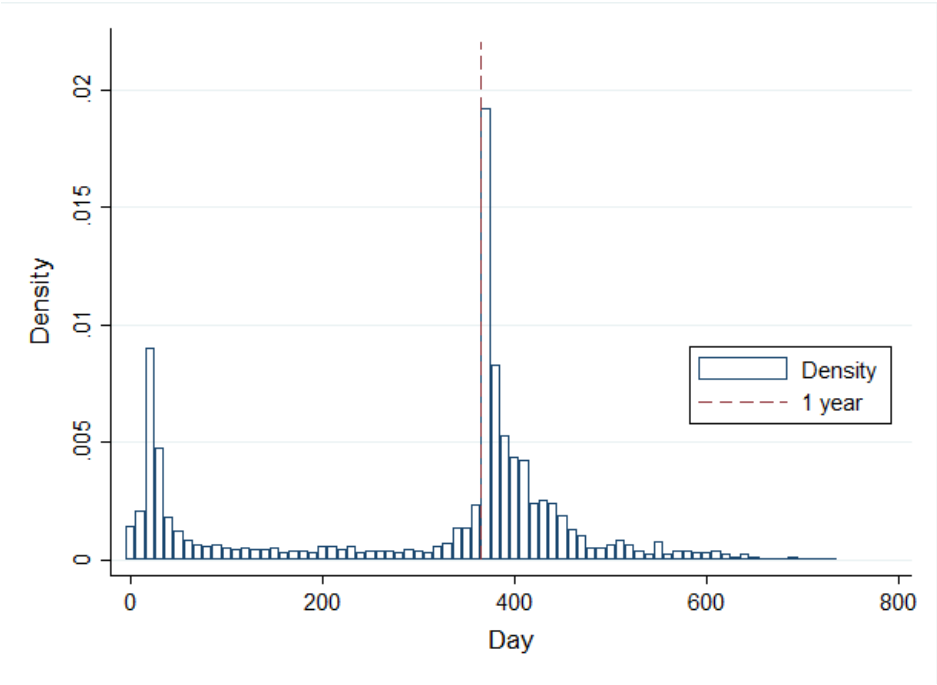
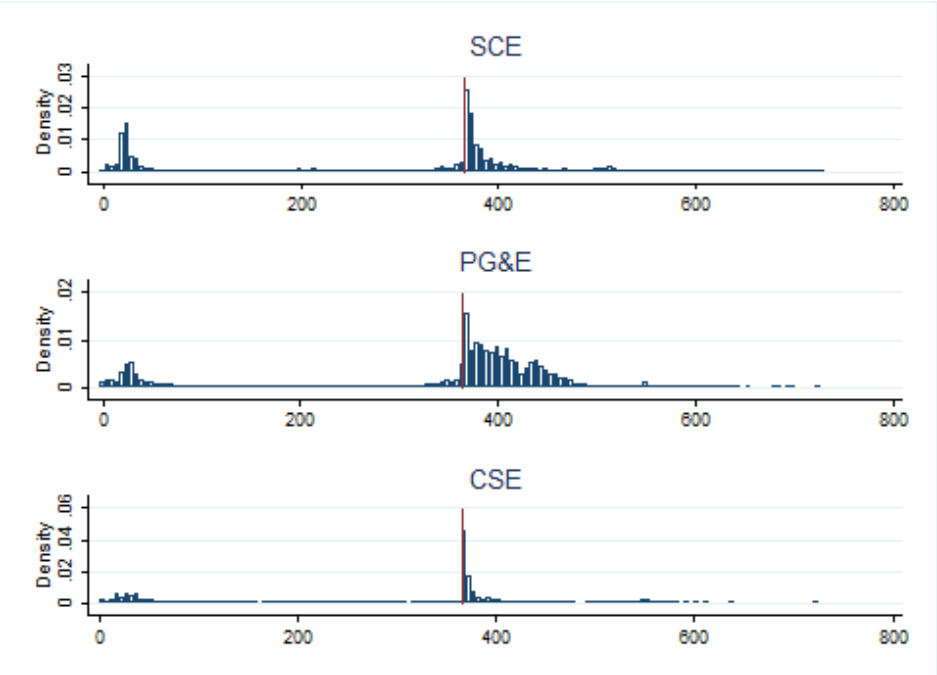


Figure B3: Full Distribution of Reported Cancellation Duration



Note. The red vertical line indicates the deadline at one year.

Figure B4: Distribution of Reported Cancellation Duration by Program Administrator



Note. The red vertial line indicates the deadline at one year. SCE accounts for 53.69% of all cancellations, PG&E 37.09%, and CSE 9.23%.

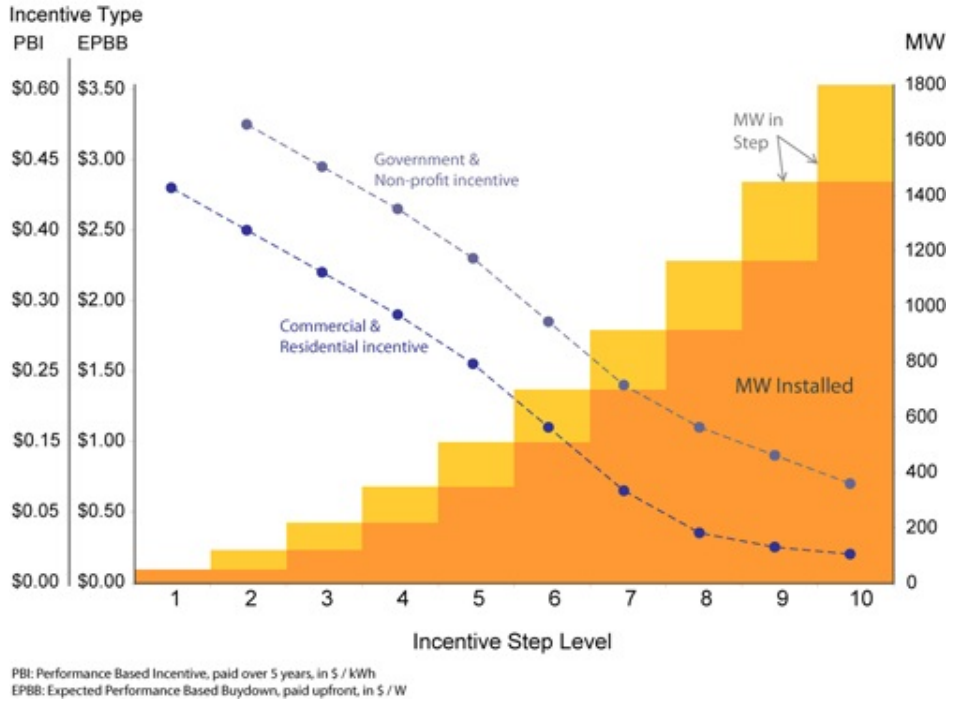
Table B1: Top 30 Contractors by Number of Applications

Contractor	Rank	Apps %	Cancel %	Late %	Duration mean	Pr(Late)
SolarCity	1	15.10	15.82	17.83	347.7	0.697
Verengo Solar	2	7.748	11.98	9.081	282.3	0.469
Rec Solar	3	5.608	4.743	5.808	351.4	0.758
Real Goods Energy	4	3.827	2.289	2.686	330.5	0.726
Petersen-Dean	5	3.085	5.348	4.723	287.9	0.546
Sungevity	6	2.672	2.008	2.170	334.2	0.668
American Solar Direct	7	2.029	1.188	0.925	234.9	0.481
Akeena Solar	8	1.372	0.820	0.889	337.8	0.671
Galkos Construction	9	1.252	1.271	0.916	221.3	0.446
Burke Electric	10	1.252	2.058	2.855	378.9	0.858
Future Energy Corporation	11	1.074	0.473	0.107	98.87	0.140
HelioPower	12	1.072	1.150	1.388	331.4	0.746
Sullivan Solar Power	13	1.028	0.688	0.694	289.6	0.624
Solar Service Center	14	0.982	0.583	0.596	291.1	0.632
The Solar Company	15	0.906	0.677	0.720	333.6	0.659
Smart Energy Solar	16	0.803	0.930	0.694	221.1	0.462
Energy Efficiency Solar	17	0.747	0.556	0.614	309.4	0.683
Baker Electric Solar	18	0.736	0.341	0.231	222.9	0.419
Stout & Burg Electric	19	0.704	0.226	0.0800	213.9	0.220
Solar West Electric	20	0.581	0.138	0.0978	202.4	0.440
Vivint Solar Developer Llc	21	0.567	0.286	0.382	362.3	0.827
Advanced Solar Electric	22	0.565	0.501	0.569	377.9	0.703
Solar Network	23	0.553	0.374	0.382	281.9	0.632
Natural Energy	24	0.549	0.253	0.222	283.1	0.543
Sunlogic	25	0.545	0.462	0.543	349.8	0.726
Elite Electric	26	0.541	0.792	0.756	278.2	0.590
Mohr Power Solar	27	0.516	0.743	0.720	301.6	0.600
Sierra Pacific Home & Comfort	28	0.504	0.880	1.245	382.9	0.875
Sungate Energy Solutions	29	0.477	0.347	0.240	209.5	0.429
Skytech Solar	30	0.447	1.370	2.081	393.0	0.940
All Others	–	42.16	40.70	39.75	281.5	0.604
Total	1-2398	100	100	100	281.83	0.619

Note. This table lists top 30 contractors by the number of applications. Columns 1-2 shows contractor name and rank, respectively. Column 3 shows, among all applications, the percentage associated with each contractor. Similarly, columns 4 and 5 show these percentages for cancellations and late cancellation reports, respectively. Column 6 shows the average duration as reported. Column 7 shows the probability of late report, which is the number of late reports divided by the number of cancellations. The second to last row shows aggregate statistics for the remaining contractors, and the last row shows aggregate statistics for all contractors.

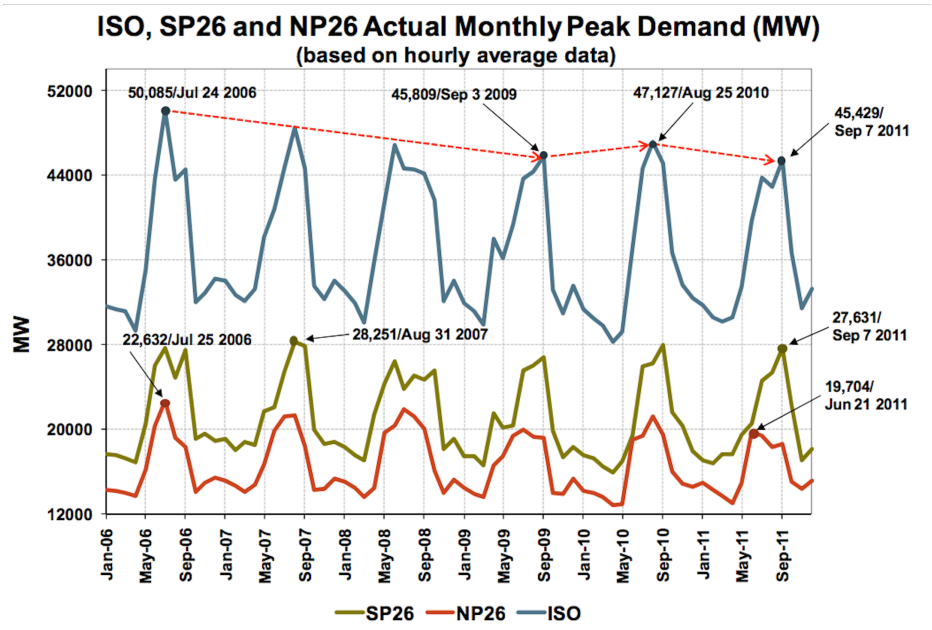
C Appendix Figures

Figure C1: CSI Incentive Step Design



Source. http://www.gosolarcalifornia.ca.gov/csi/rebates.php

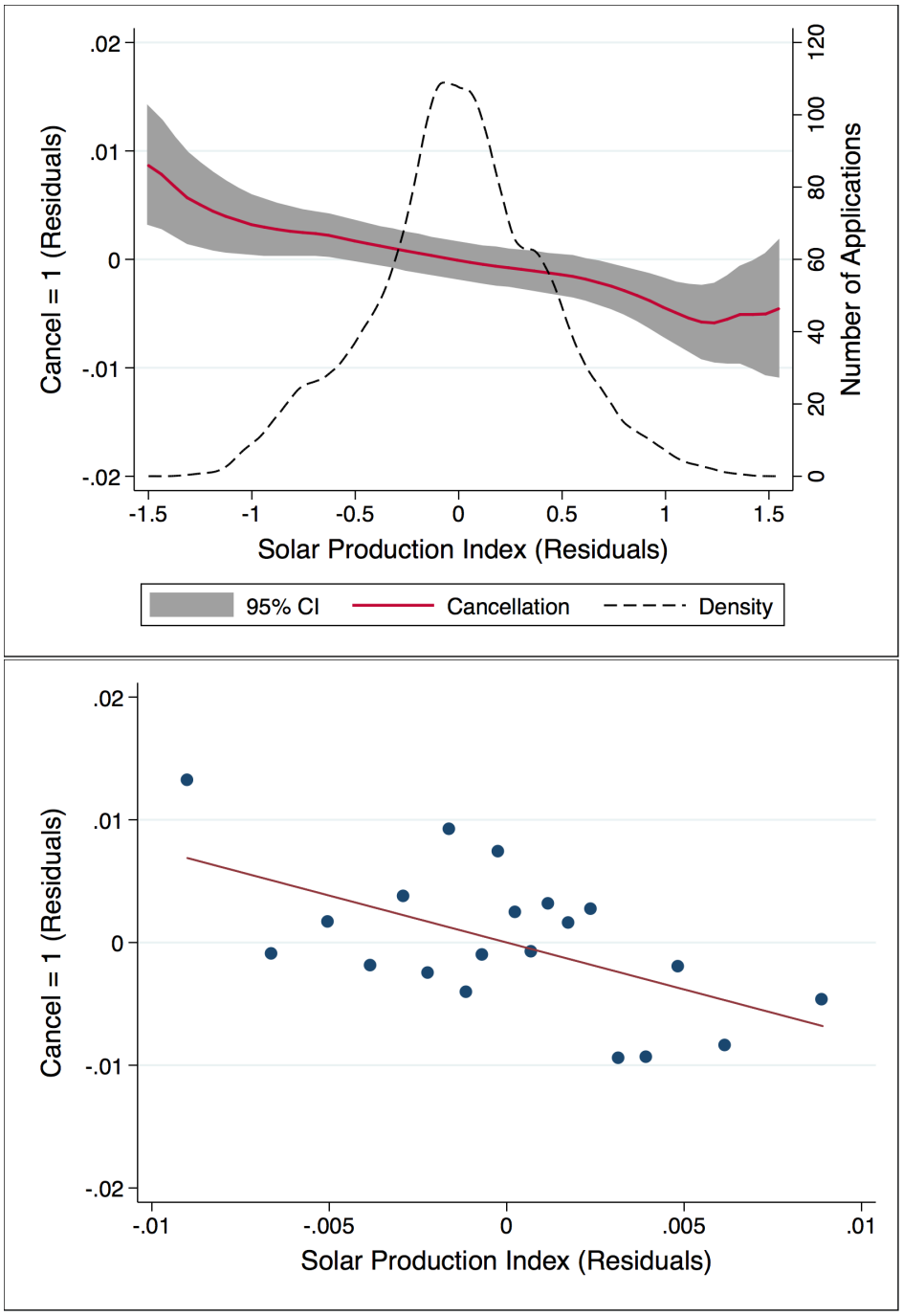
Figure C2: Monthly Peak Demand in California, 2006-2011



Source. California ISO (2012).

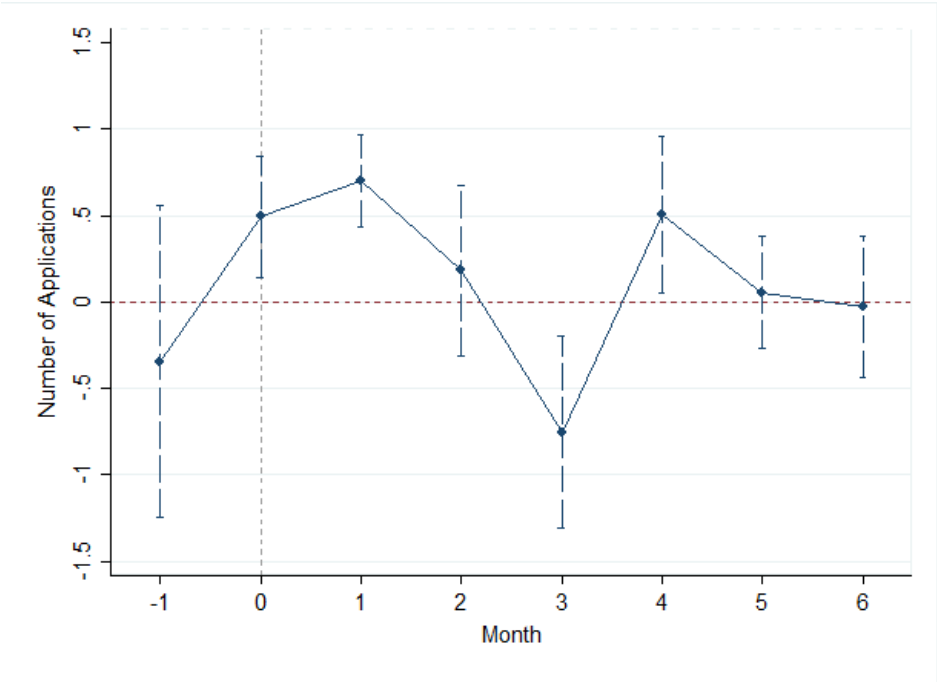
Note. This graph shows the actual monthly peak demand for southern California (SP26), northern California (NP26), and the entire California ISO system over the years 2006-2011.

Figure C3: Support for Linear Specification



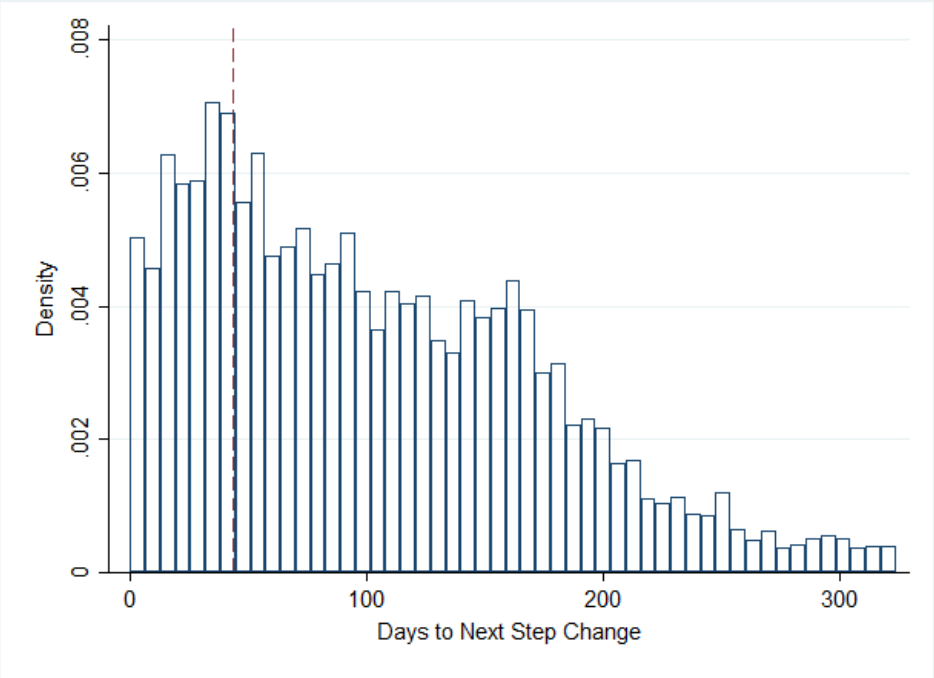
Note. These graphs verify the linear relationship between the probability of cancellation and solar production index using two approaches. The upper panel fits the relationship with a flexible local polynomial, and the lower one uses a binned scatter plot by dividing the observations into twenty bins.

Figure C4: Harvesting Effects in Sign-ups



Note. This graph plots the contemporaneous and lagged effects of the production index on sign-ups. The dependent variable is the number of applications by zip code by month, and the main regressors are the average production index in the same month, its lead and six lags. The controls include monthly economic conditions as well as zip code, month-in-year, and year fixed effects. Point estimates and 95 percent confidence intervals are shown. Standard errors are clustered by county.

Figure C5: Density of Days to Next Incentive Step Change



Note. This graph plots the distribution of days to next incentive step change. The vertical dashed red line represents 47 days, the cutoff used in the heterogeneity analysis.

D Appendix Tables

Table D1: Cancellation and Solar Insolation (113 Days After Sign-up)

Cancel = 1	(1)	(2)	(3)	(4)	(5)
solar insolation	−0.146	−0.203	−0.110	−0.121	−0.143
	[0.055]**	[0.045]***	[0.051]**	[0.057]**	[0.085]*
wind speed	0.262	0.799	−0.065	0.314	0.105
	[0.241]	[0.271]***	[0.204]	[0.256]	[0.243]
#days(tmax < 40)	1.055	1.406	0.658	0.757	1.071
	[0.383]***	[0.520]***	[0.348]*	[0.304]**	[0.394]***
#days(tmax≥100)	−0.020	−0.024	−0.019	−0.024	−0.006
	[0.023]	[0.021]	[0.024]	[0.022]	[0.025]
CSI Rating	0.590	0.592	0.589	0.578	0.588
	[0.091]***	[0.091]***	[0.087]***	[0.086]***	[0.091]***
unit cost	0.000	0.000	0.000	0.000	0.000
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
third-party ownership	0.833	0.830	0.962	0.962	0.840
	[0.520]	[0.514]	[0.510]*	[0.508]*	[0.520]
CA leading index	0.457	0.506	0.435	1.860	0.378
	[0.485]	[0.481]	[0.499]	[0.552]***	[0.515]
CA unemployment rate	−0.782	−0.735	−0.990	0.746	−0.711
	[0.460]*	[0.543]	[0.453]**	[0.833]	[0.529]
prime interest rate	−2.084	−2.155	−2.289	−2.103	−2.345
	[1.102]*	[1.061]**	[1.111]**	[1.199]*	[1.354]*
index of consumer sentiment	0.188	0.205	0.202	0.125	0.149
	[0.058]***	[0.053]***	[0.052]***	[0.070]*	[0.054]***
index of buying conditions	−0.134	−0.141	−0.143	−0.119	−0.092
	[0.040]***	[0.039]***	[0.038]***	[0.045]**	[0.040]**
R^2 (within)	0.033	0.035	0.042	0.051	0.034
N	154,519	154,518	154,513	154,465	154,519
Fixed Effects					
Zip Code	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes			Yes
Quarter	Yes		Yes		
Month					Yes
County-quarter		Yes			
County-year			Yes		
County-quarter-year				Yes	

Note. This table reports estimates based on a time frame of 113 days following the application date. Columns (1)-(2) show full results of regressions (1)-(2) in table 2. Columns (3)-(5) shows results with other fixed-effect specifications. The mean of the dependent variable is 12.06%. Coefficients are multiplied by 100 for legibility. Standard errors (in squared brackets) are clustered by county. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

Table D2: Cancellation and Solar Insolation (60 Days Before Completion/Cancellation)

Cancel = 1	(1)	(2)	(3)	(4)	(5)
solar insolation	−0.186	−0.192	−0.181	−0.185	−0.090
	[0.045]***	[0.045]***	[0.048]***	[0.051]***	[0.113]
wind speed	0.815	0.754	0.728	0.719	0.787
	[0.173]***	[0.162]***	[0.185]***	[0.208]***	[0.169]***
#days(tmax < 40)	−1.278	−1.572	−1.482	−2.069	−1.206
	[0.489]**	[0.361]***	[0.417]***	[0.391]***	[0.494]**
#days(tmax≥100)	−0.256	−0.330	−0.261	−0.336	−0.250
	[0.030]***	[0.065]***	[0.032]***	[0.069]***	[0.031]***
CSI Rating	0.590	0.592	0.589	0.578	0.588
	[0.091]***	[0.091]***	[0.087]***	[0.086]***	[0.091]***
unit cost	0.000	0.000	0.000	0.000	0.000
	[0.000]**	[0.000]**	[0.000]**	[0.000]***	[0.000]**
third-party ownership	0.766	0.767	0.691	0.638	0.766
	[0.362]**	[0.349]**	[0.366]*	[0.372]*	[0.364]**
CA leading index	−0.100	−0.173	−0.139	1.071	−0.321
	[0.269]	[0.269]	[0.274]	[0.516]**	[0.289]
CA unemployment rate	−0.780	−0.736	−0.811	−0.142	−0.436
	[0.374]**	[.378]*	[0.397]**	[0.930]	[0.473]
prime interest rate	−0.556	−0.324	−0.576	−0.315	0.026
	[0.924]	[0.983]	[0.939]	[1.136]	[1.118]
index of consumer sentiment	0.266	0.253	0.285	0.244	0.242
	[0.090]***	[0.097]**	[0.092]***	[0.118]**	[0.093]**
index of buying conditions	−0.086	−0.082	−0.099	−0.121	−0.064
	[0.037]**	[0.039]**	[0.037]**	[0.056]**	[0.040]
R^2 (within)	0.072	0.076	0.081	0.098	0.073
N	62,069	62,062	62,053	61,951	62,069
Fixed Effects					
Zip Code	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes			Yes
Quarter	Yes		Yes		
Month					Yes
County-quarter		Yes			
County-year			Yes		
County-quarter-year				Yes	

Note. This table reports estimates based on a time frame of 60 days prior to the completion/cancellation date. Columns (1)-(2) show full results of regressions (3)-(4) in table 2. Columns (3)-(5) shows results with other fixed-effect specifications. The mean of the dependent variable is 6.70%. Coefficients are multiplied by 100 for legibility. Standard errors (in squared brackets) are clustered by county. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

Table D3: Robustness Check: Varying Controls

Cancel = 1	(1)	(2)	(3)	(4)	(5)	(6)
solar insolation	−0.129	−0.151	−0.219	−0.254	−0.115	−0.094
	[0.041]***	[0.039]***	[0.044]***	[0.053]***	[0.045]**	[0.035]***
wind speed			0.797	0.791		
			[0.259]***	[0.168]***		
#days(tmax $<$ 40)					1.460	−1.622
					[0.550]**	[0.366]***
#days(tmax $\geq$ 100)					−0.021	−0.333
					[0.020]	[0.066]***
R^2 (within)	0.035	0.073	0.035	0.074	0.035	0.076
N	154,518	62,062	154,518	62,062	154,518	62,062
Sample						
Time Frame	First 113	Last 60	First 113	Last 60	First 113	Last 60
Duration	All	0-100	All	0-100	All	0-100
D.V. Mean	12.06	6.70	12.06	6.70	12.06	6.70

Note. All regressions control for system characteristics and monthly economic conditions, as well as zip code, year, and county-quarter fixed effects. All coefficients are multiplied by 100 for legibility. Standard errors (in squared brackets) are clustered by county. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

Table D4: Robustness Check: Zip-Code-Specific Time Trends

Cancel = 1	(1)	(2)	(3)	(4)
solar insolation	−0.104	−0.171	−0.119	−0.184
	[0.051]**	[0.045]***	[0.047]**	[0.045]***
wind speed	−0.061	0.745	0.178	0.746
	[0.215]	[0.189]***	[0.238]	[0.201]***
#days(tmax < 40)	0.569	−1.634	0.672	−1.806
	[0.362]	[0.451]***	[0.384]*	[0.376]***
#days(tmax≥100)	−0.022	−0.265	−0.023	−0.271
	[0.022]	[0.030]***	[0.023]	[0.033]***
R^2 (within)	0.053	0.103	0.053	0.104
N	154,513	62,053	154,513	62,053
Time Trend				
Zip-year	Yes	Yes		
Zip-quarter-year			Yes	Yes
Sample				
Time Frame	First 113	Last 60	First 113	Last 60
Duration	All	0-100	All	0-100
D.V. Mean	12.06	6.70	12.06	6.70

Note. This table shows the results from adding two types of zip-code-specific time trends to the main specifications. All regressions control for system characteristics and monthly economic conditions, as well as zip code, year, and county-quarter fixed effects. All coefficients are multiplied by 100 for legibility. Standard errors (in squared brackets) are clustered by county. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

Table D5: Robustness Check: Logit Model

Cancel = 1	(1)	(2)	(3)	(4)
solar insolation	−1.071	−1.540	−1.206	−1.656
	(0.293)***	(0.425)***	(0.436)***	(0.785)**
wind speed	4.038	2.567	2.187	0.911
	(1.609)**	(1.746)	(1.795)	(1.810)
#days(tmax < 40)	9.284	9.843	10.734	10.011
	(4.222)**	(4.221)**	(4.166)***	(4.204)**
#days(tmax≥100)	−0.294	−0.190	−0.166	−0.050
	(.125)**	(0.131)	(0.132)	(0.140)
Fixed Effects				
Zip Code	Yes	Yes	Yes	Yes
Year	Yes		Yes	
Quarter	Yes		Yes	
Quarter-year		Yes		Yes
Month				Yes

Note. This table reports estimates based on a time frame of 113 days after the sign-up. All regressions control for system characteristics and monthly economic conditions. The number of observations is 153,452 for all regressions. All coefficients are multiplied by 100 for legibility. Marginal effect calculations are not feasible due to the fixed effects, and specifications with county-interacted fixed effects are omitted due to computation problems. Standard errors (in parentheses) are clustered by zip code. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

Table D6: Robustness Check: Varying Period Length

Cancel = 1	(1) 70 days	(2) 70 days	(3) 90 days	(4) 90 days	(5) 113 days	(6) 113 days
solar insolation	−0.147	−0.185	−0.157	−0.206	−0.146	−0.203
	[0.045]***	[0.043]***	[0.048]***	[0.043]***	[0.055]**	[0.045]***
wind speed	0.319	0.652	0.317	0.751	0.262	0.799
	[0.210]	[0.248]**	[0.220]	[0.249]***	[0.241]	[0.271]***
#days(tmax $<$ 40)	0.358	0.511	0.379	0.569	1.055	1.406
	[0.351]	[0.400]	[0.352]	[0.421]	[0.383]***	[0.521]***
#days(tmax $\geq$ 100)	−0.042	−0.052	−0.030	−0.036	−0.020	−0.024
	[0.024]*	[0.022]**	[0.025]	[0.023]	[0.023]	[0.021]
R^2 (within)	0.033	0.035	0.033	0.035	0.033	0.035
N	154,519	154,518	154,519	154,518	154,519	154,518
Fixed Effects						
Zip Code	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes
Quarter	Yes		Yes		Yes	
County-quarter		Yes		Yes		Yes

Note. Columns (1)-(2), (3)-(4), and (5)-(6) report estimates based on a time frame of 70, 90, and 113 days following the application date. All regressions control for system characteristics and monthly economic conditions. The mean of the dependent variable is 12.06%. All coefficients are multiplied by 100 for legibility. Standard errors (in squared brackets) are clustered by county. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

Table D7: Robustness Check: Different Subsamples

Cancel = 1	(1)	(2)	(3)	(4)	(5)	(6)
solar insolation	−0.185	−0.208	−0.113	−0.129	−0.104	−0.117
	[0.055]***	[0.064]***	[0.047]**	[0.054]**	[0.038]***	[0.044]**
wind speed	0.478	0.470	0.229	0.254	0.214	0.258
	[0.292]	[0.391]	[0.208]	[0.273]	[0.178]	[0.219]
#days(tamx<40)	0.513	0.895	0.360	0.499	0.434	0.484
	[0.226]**	[0.331]***	[0.176]**	[0.240]**	[0.173]**	[0.228]**
#days(tmax≥100)	0.019	0.012	0.016	0.014	0.016	0.019
	[0.022]	[0.013]	[0.014]	[0.010]	[0.009]*	[0.009]**
R^2 (within)	0.070	0.073	0.047	0.049	0.039	0.041
N	62,069	62,062	93,061	93,055	111,654	111,650
Sample						
Duration Restriction	0-100	0-100	0-150	0-150	0-200	0-200
D.V. Mean	6.70	6.70	4.97	4.97	4.49	4.49
Fixed Effects						
Zip Code	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes
Quarter	Yes		Yes		Yes	
County-quarter		Yes		Yes		Yes

Note. This table reports estimates based on a time frame of 60 days prior to the completion/cancellation date. Columns (1)-(2), (3)-(4), and (5)-(6) restrict the sample to those with reported duration within 100, 150, and 200 days, respectively. All regressions control for system characteristics and monthly economic conditions. All coefficients are multiplied by 100 for legibility. Standard errors (in squared brackets) are clustered by county. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

Table D8: Channel: Solar Production vs. Energy Demand (Alternative Time Frame)

Cancel = 1	(1)	(2)	(3)	(4)	(5)	(6)
ProdIndex	−1.343	−1.486	−1.529	−1.639	−1.208	−1.277
	[0.300]***	[0.311]***	[0.300]***	[0.351]***	[0.359]***	[0.360]***
CDD			0.376	0.312		
			[0.261]	[0.248]		
TDD					0.287	0.506
					[0.243]	[0.251]**
R^2 (within)	0.071	0.074	0.071	0.074	0.071	0.074
N	62,069	62,062	62,069	62,062	62,069	62,062
Fixed Effects						
Zip Code	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes
Quarter	Yes		Yes		Yes	
County-quarter		Yes		Yes		Yes

Note. This table reports estimates based on a time frame of 60 days prior to the completion/cancellation date. All regressions control for system characteristics and monthly economic conditions. The mean of the dependent variable is 6.70%. All indices are normalized. All coefficients are multiplied by 100 for legibility. Standard errors (in squared brackets) are clustered by county. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

Table D9: Attenuation Bias with Different Period Lengths

Cancel = 1	(1) 10 days	(2) 30 days	(3) 50 days	(4) 70 days	(5) 90 days	(6) 113 days
ProdIndex	0.057	−0.249	−0.443	−0.542	−0.692	−0.761
	[0.141]	[0.141]*	[0.144]***	[0.154]***	[0.172]***	[0.191]***
Test: Equality of Coefficients with Column (6)						
$\chi^2 : \beta_{(i)} = \beta_{(6)}$	25.38***	13.70***	6.90***	5.00**	1.89	-

Note. The length of the post-contract period used to calculate the production index is indicated in the header. All regressions control for system characteristics and monthly economic conditions, as well as zip code, year, and quarter fixed effects. The mean of the dependent variable is 12.06%. All indices are normalized. All coefficients are multiplied by 100 for legibility. Standard errors (in squared brackets) are clustered at county level. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

Table D10: Potential Selection by Pre-contract Weather (System Size)

System Size	(1) 1 month	(2) 1 month	(3) 2 months	(4) 2 months
ProdIndex (pre)	0.024	0.020	0.006	0.004
	[0.014]*	[0.014]	[0.013]	[0.012]
R^2 (within)	0.204	0.206	0.204	0.206
N	153,108	153,108	153,108	153,108
Fixed Effects				
Zip Code	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Quarter	Yes		Yes	
County-quarter		Yes		Yes

Note. All regressions control for monthly economic conditions. The mean of the dependent variable is 4.69. All indices are normalized. Standard errors (in squared brackets) are clustered by county. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

Table D11: Responses to Weather Updates

Cancel = 1	(1)	(2)	(3)	(4)	(5)
ProdIndex (pre)	−0.039	−0.854	−0.591		
	[0.246]	[0.374]**	[0.354]		
Update		−0.769	1.170	0.472	0.588
		[0.264]***	[0.653]*	[0.252]*	[0.352]
Indicator:					
Update < 0			−0.000		
			[0.005]		
ProdIndex (pre) > $\overline{\text{Index}}_z$				−0.014	
				[0.004]***	
ProdIndex (post) < $\overline{\text{Index}}_z$)					0.006
					[0.004]
Update × Indicator			−2.779	−1.705	−1.053
			[0.600]***	[0.332]***	[0.280]***
R^2 (within)	0.033	0.033	0.034	0.033	0.033
N	154,519	154,519	154,519	154,519	154,519

Note. "ProdIndex (pre)" is the normalized average production index for a 60-day pre-contract period. "Update" is the average post-period index minus the pre-period one. The first indicator indicates whether the update variable is negative. The second indicates whether the pre-period index is higher than the zip-code average, and the third is whether the post-period one is lower than average. All regressions control for system characteristics and monthly economic conditions, as well as zip code, year, and quarter fixed effects. The mean of the dependent variable is 12.06%. All coefficients are multiplied by 100 for legibility. Standard errors (in squared brackets) are clustered by county. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

Table D12: Heterogeneous Effects by Area Characteristics

	Panel A. Local Demographics			
Cancel = 1	Median Income Above Median (1)	% White Above Median (2)	% College Above Median (3)	Household Size Above Median (4)
β_1: ProdIndex	−0.664	−0.802	−0.715	−0.731
	[0.386]*	[0.292]***	[0.321]**	[0.337]**
β_2: ProdIndex × 1(Character)	−0.125	0.079	−0.064	−0.045
	[0.283]	[0.231]	[0.239]	[0.247]
$\beta_1 + \beta_2$	−0.789	−0.723	−0.779	−0.776
p-value: $\beta_1 + \beta_2 = 0$	0.003***	0.013**	0.006***	0.004***
	Panel B. Housing and Geographic Characteristics			
Cancel = 1	% Urban > 0.5 (5)	Housing Cost Above Median (6)	Northern California (7)	Non-coastal Counties (8)
β_1: ProdIndex	0.381	−0.575	−0.875	−0.840
	[0.442]	[0.335]*	[0.313]***	[0.261]***
β_2: ProdIndex × 1(Character)	−1.211	−0.249	0.177	0.314
	[0.362]***	[0.233]	[0.211]	[0.260]
$\beta_1 + \beta_2$	−0.830	−0.824	−0.698	−0.526
p-value: $\beta_1 + \beta_2 = 0$	0.003***	0.003***	0.010***	0.137

Note. The area characteristic of interest is indicated in the header. The last two rows in each panel show the value of $\beta_1 + \beta_2$, which is the weather effect in zip codes with the characteristic of interest, and the corresponding p-value. All regressions control for system characteristics and monthly economic conditions, as well as zip code, year, and quarter fixed effects. The production index is normalized. All coefficients are multiplied by 100 for legibility. Standard errors (in squared brackets) are clustered by county. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

Table D13: Does Current Weather Predict the Near Future?

Future Index	(1)	(2)	(3)	(4)
ProdIndex	−0.001	−0.008	0.033	−0.114
	[0.026]	[0.025]	[0.027]	[0.136]
R^2	0.740	0.881	0.882	0.953
N	154,104	154,104	154,103	154,054
Fixed Effects				
Zip Code	Yes	Yes	Yes	Yes
Year		Yes	Yes	
Quarter		Yes		
County-quarter			Yes	
County-quarter-year				Yes

Note. The dependent variable is mean daily production index in the one-year period starting right after the 113-day post-period. Standard errors (in squared brackets) are clustered at county level. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

Table D14: Weather and Complete Duration

Complete Duration	(1)	(2)	(3)	(4)	(5)	(6)
ProdIndex (post)	−3.402	−3.170	−3.568	−3.430		
	[2.024]*	[1.951]	[2.235]	[2.200]		
ProdIndex (pre)			−1.710	−2.729		
			[2.719]	[3.429]		
#days(prcp > 0)					−0.093	−0.121
					[0.133]	[0.190]
wind speed					−2.186	−2.420
					[1.067]**	[1.595]
#days(tmax < 40)					3.790	5.451
					[3.282]	[3.961]
#days(tmax > 100)					0.238	−0.001
					[0.122]*	[0.085]
R^2	0.115	0.123	0.115	0.123	0.115	0.123
N	130,162	130,161	130,162	130,161	130,166	130,165
Fixed Effects						
Zip Code	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes
Quarter	Yes		Yes		Yes	
County-quarter		Yes		Yes		Yes

Note. The post-period production index is calculated based on the reported duration for each observation. All regressions control for system characteristics and monthly economic conditions. The mean of the dependent variable is 128.11. Standard errors are clustered at county level. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

References

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