

Bill Confusion

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Motivation: Utility bills are often combined bills

- PG&E energy bill = Electricity + Gas
- City of Palo Alto utility bill = Electricity + Gas + Water + Sewage + Garbage
- AT&T bill = Cell Phone + Data Plan + Land Phone + Internet

Pacific Gas and Electric Company		WE DELIVER ENERGY.™		Energy Statement																																		
99901234567890100000xxxx00000xxxxx																																						
Account Number	Bill Date	Amount Due	Due Date	Amount Enclosed																																		
1234567890-1	mm/dd/yyyy	\$xxx.xx	mm/dd/yyyy																																			
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201.1205			Please return this portion with your payment. Thank you.																																			
Telephone Assistance 1-800-743-5000 Assistance is available by telephone 24 hours per day, 7 days per week.		ACCOUNT SUMMARY																																				
Local Office Address 111 ALMADEN BLVD SAN JOSE CA 95113		<table border="1"><thead><tr><th>Service</th><th>Service Dates</th><th>Amount</th></tr></thead><tbody><tr><td>Gas</td><td>mm/dd/yyyy – mm/dd/yyyy</td><td>\$xxx.xx</td></tr><tr><td>Electric</td><td>mm/dd/yyyy– mm/dd/yyyy</td><td>xx.xx</td></tr><tr><td>Gas PPP Surcharge</td><td></td><td>x.xx</td></tr><tr><td>Energy Commission Tax</td><td></td><td>x.xx</td></tr><tr><td>Utility Users' Tax</td><td></td><td>x.xx</td></tr><tr><td>Total Energy Charges</td><td></td><td>\$xxx.xx</td></tr><tr><td>Other Products and Services Charges</td><td></td><td>\$xxx.xx</td></tr><tr><td>TOTAL CURRENT CHARGES</td><td></td><td>\$xxx.xx</td></tr><tr><td>Previous Balance</td><td></td><td>xxx.xx</td></tr><tr><td>mm/dd Payment – Thank You</td><td></td><td>xxx.xx-</td></tr></tbody></table>				Service	Service Dates	Amount	Gas	mm/dd/yyyy – mm/dd/yyyy	\$xxx.xx	Electric	mm/dd/yyyy– mm/dd/yyyy	xx.xx	Gas PPP Surcharge		x.xx	Energy Commission Tax		x.xx	Utility Users' Tax		x.xx	Total Energy Charges		\$xxx.xx	Other Products and Services Charges		\$xxx.xx	TOTAL CURRENT CHARGES		\$xxx.xx	Previous Balance		xxx.xx	mm/dd Payment – Thank You		xxx.xx-
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Research question

- Do combined bills confuse or weaken price signals of each product?
- Two possibilities:
 - 1) Standard theory: consumers capture each price signal correctly
 - 2) Heuristic: consumers may respond to “bill” or average price of “bill”
 - React to irrelevant prices
 - Under-react to relevant prices
 - Literature: limited attention to complex price signals
 - Under-react to non-salient taxes (Chetty, Looney, and Kroft 2009)
 - Under-react to lower digit numbers (Lacetera, Pope, and Sydnor 2012)
- We test this hypothesis by examining electricity demand in PG&E
 - PG&E customers receive either combined bills or split bills of gas & electric
 - Changes in natural gas price ---> affect electricity demand differently?

Combined bill and Split bill customers in Kern County

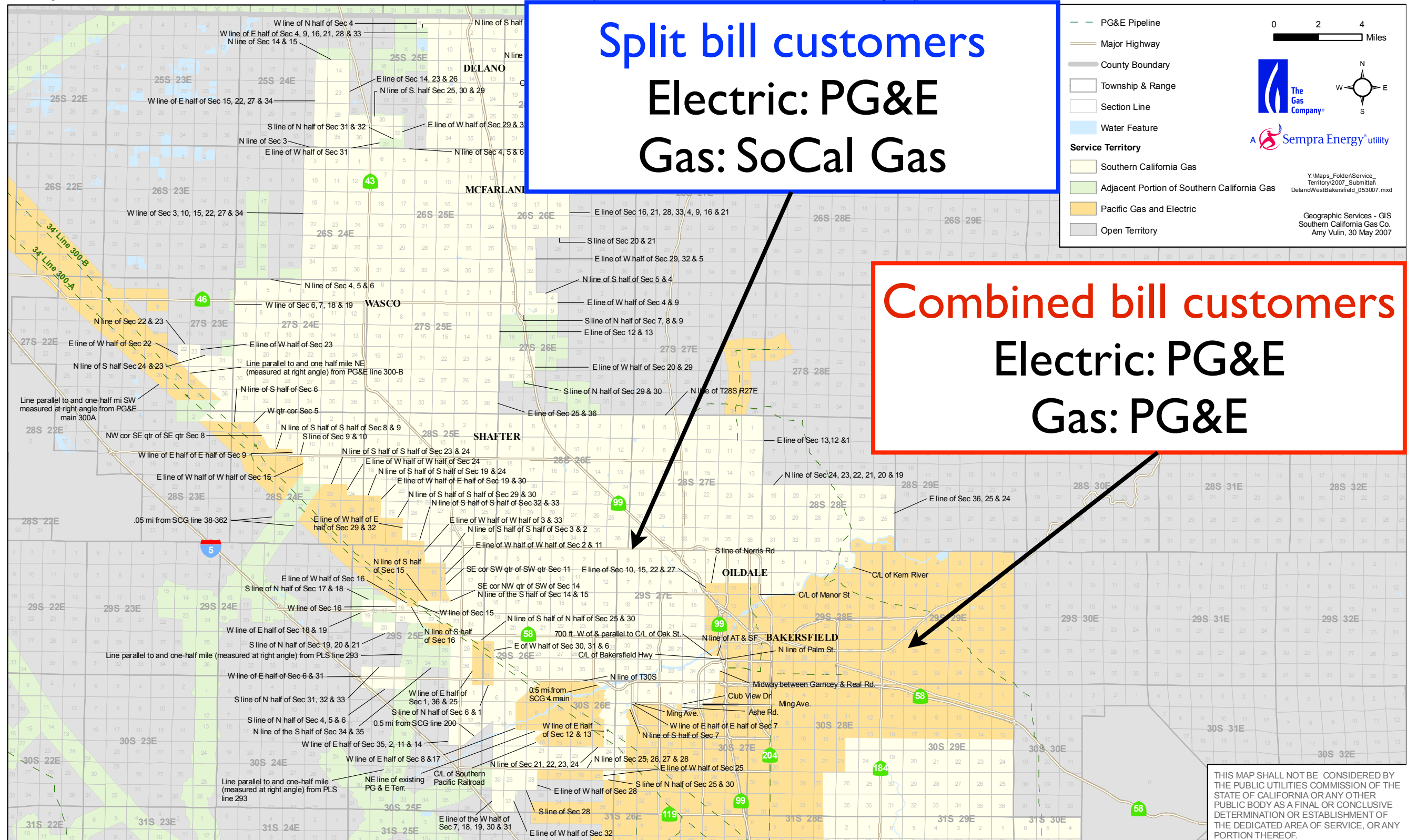
SOUTHERN CALIFORNIA GAS COMPANY
Los Angeles, California

Map Showing Delano-West Bakersfield Service Area in
Kern County of Southern California Gas Company

REVISED CAL. P.U.C. SHEET NO. 41965-G
CANCELING REVISED CAL. P.U.C. SHEET NO. 28514-G

Split bill customers
Electric: PG&E
Gas: SoCal Gas

Combined bill customers
Electric: PG&E
Gas: PG&E



ADVICE LETTER NO. 3750
DECISION NO. 62681

ISSUED BY
LEE SCHAVRIEN
SENIOR VICE PRESIDENT
REGULATORY AFFAIRS

DATE FILED June 6, 2007
EFFECTIVE July 6, 2007
RESOLUTION NO. G-3197

Focus on Combined and Split bill customers in the city of Bakersfield

Split bill customers

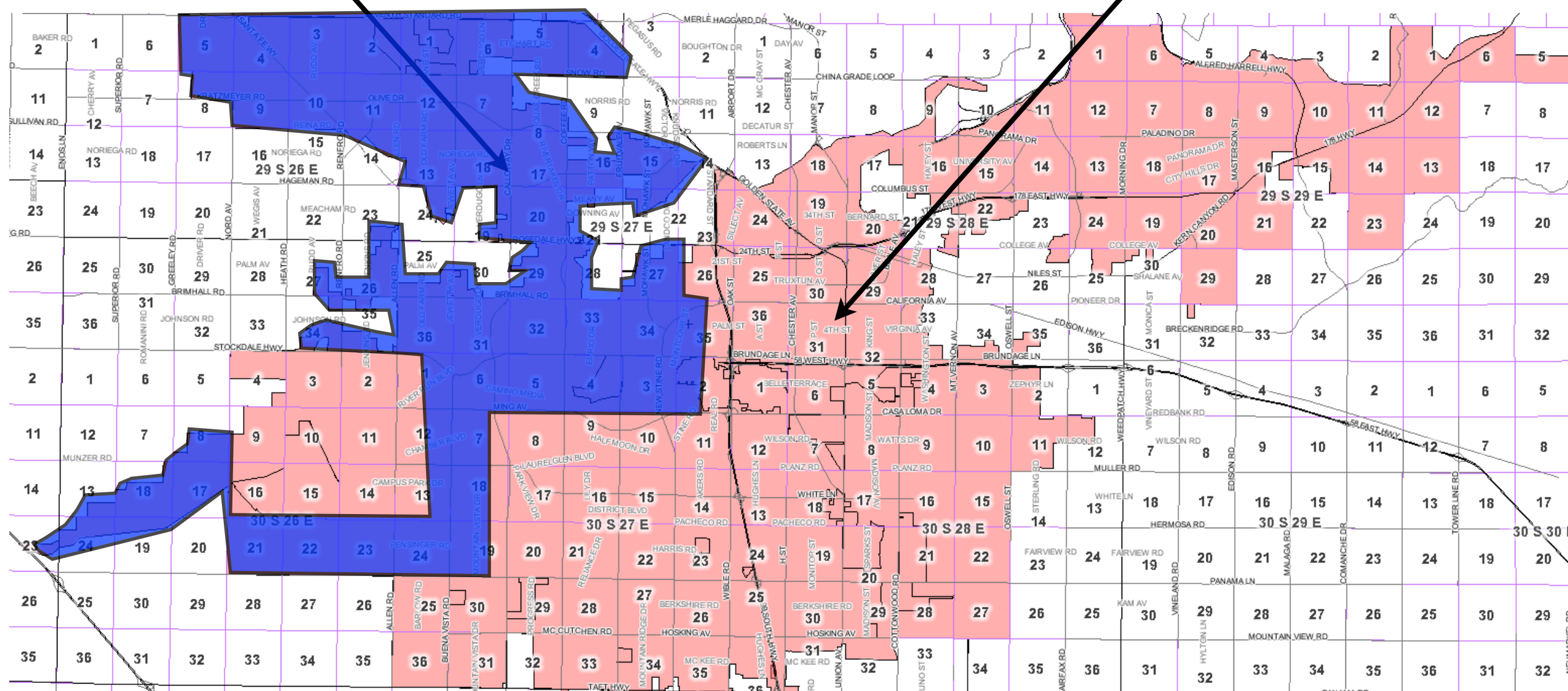
Electric: PG&E

Gas: SoCal Gas

Combined bill customers

Electric: PG&E

Gas: PG&E

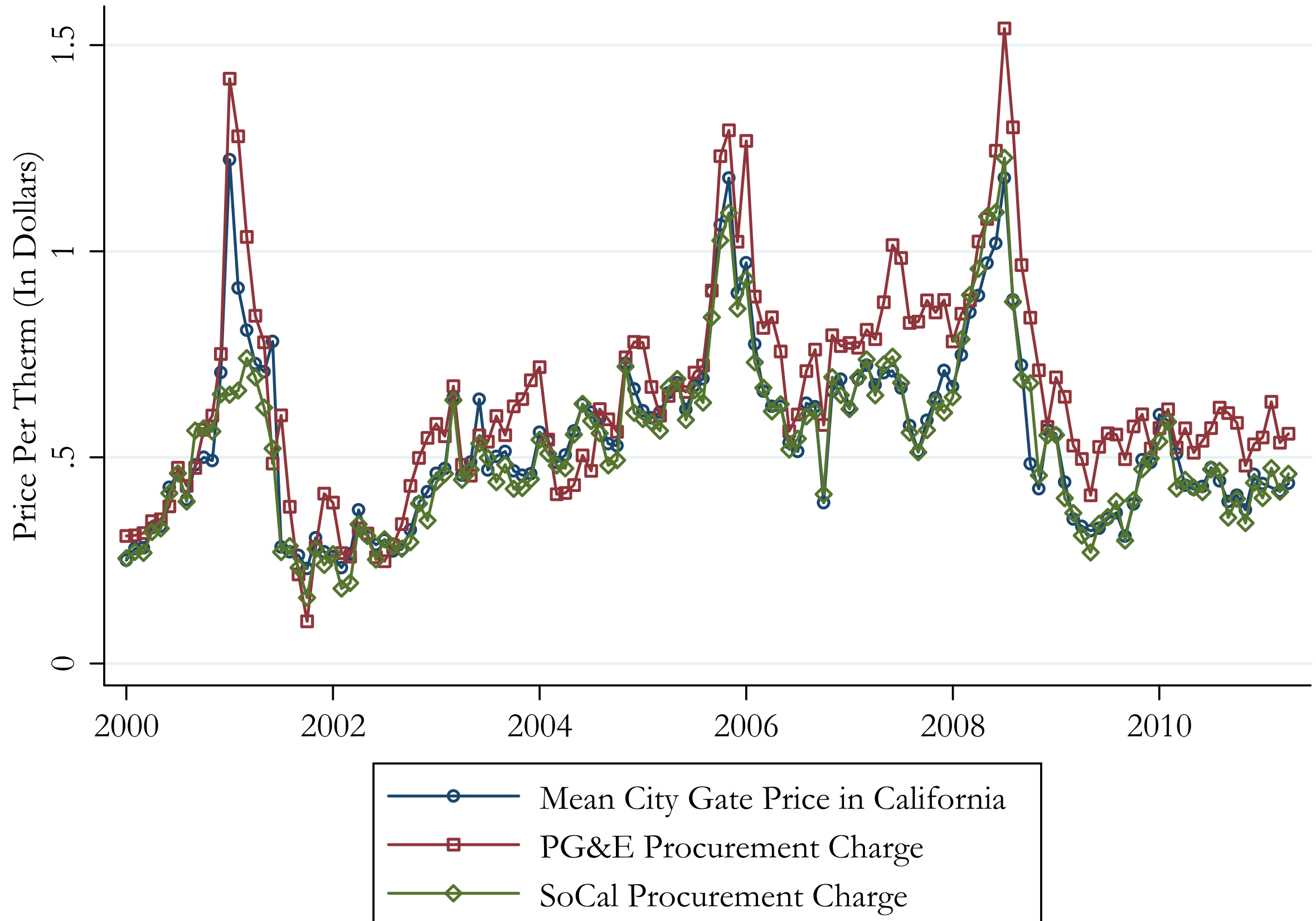


Basic idea behind our research design

- Natural gas price (P_G) can affect electricity demand in two ways
 - Cross price elasticity ($\theta_1 > 0$)
 - Bill confusion effect ($\theta_2 < 0$)
- Required assumption in our research design:
 - Underlying elasticity is the same between “combined” and “split” customers

	Substitution effect	Bill confusion effect
Split Bill Customers	θ_1	none
Combined Bill Customers	θ_1	θ_2

Movement of procurement charges in PG&E and SoCal Gas (\$ per therm)



- Household-level monthly electricity billing data from PG&E
 - Nine-digit zip code (e.g. 94720-5180)
 - Premise ID and customer account ID
 - Ideal data: List of premise ID with their natural gas provider
- Map of natural gas service territories in Kern County
 - Township and sections
 - We match 1) nine digit zip code with 2) township-sections
 - Caveat:
 - We are still not 100% sure how accurate the map's boundaries are
 - Currently asking PG&E to share the list of premise & gas provider

- Weather data
 - We can include month-by-year FE
 - But customers have different billing cycles
 - Our regression includes quadratic controls of CDD and HDD
 - 4km by 4km daily temperature data
 - Algorithm used by Schlenker and Roberts (2009)
- Natural gas price data
 - Residential natural gas price data from PG&E and SoCal Gas
 - Both of their gas price schedules are two-tier increasing block pricing

Identification strategy

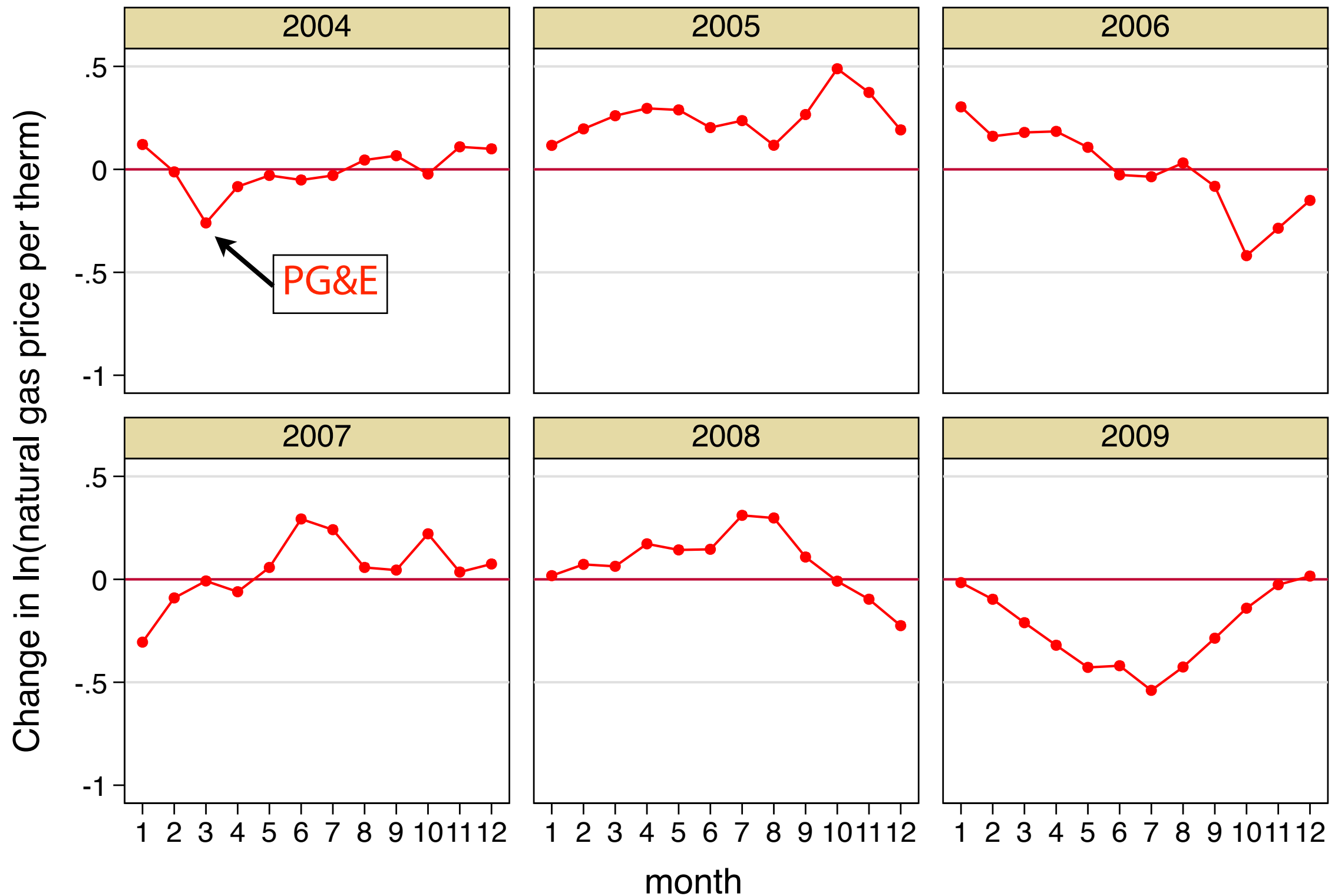
$$\ln Q_{i,t} = c_{i,m} + c_t + \theta_1 \cdot \ln P_{Gi,t} + \theta_2 \cdot \text{Comb}_i \cdot \ln P_{Gi,t} + \eta \cdot X_{i,t} + u_{i,t}$$

$Q_{i,t}$	Electricity consumption of household i in t
$c_{i,m}$	Household-month fixed effect
c_t	Time fixed effect
θ_1	Cross-price elasticity
$P_{Gi,t}$	Natural gas price
θ_2	Bill confusion parameter
Comb_i	Dummy variable for combined bill customers
$X_{i,t}$	Controls for weather

- Samples are households in the city of Bakersfield
- We use $P_{Gi,t}$ = the second tier rate of two-tier increasing block price schedules
- Using the first tier rate does not change the results

Price variation in retail natural gas price

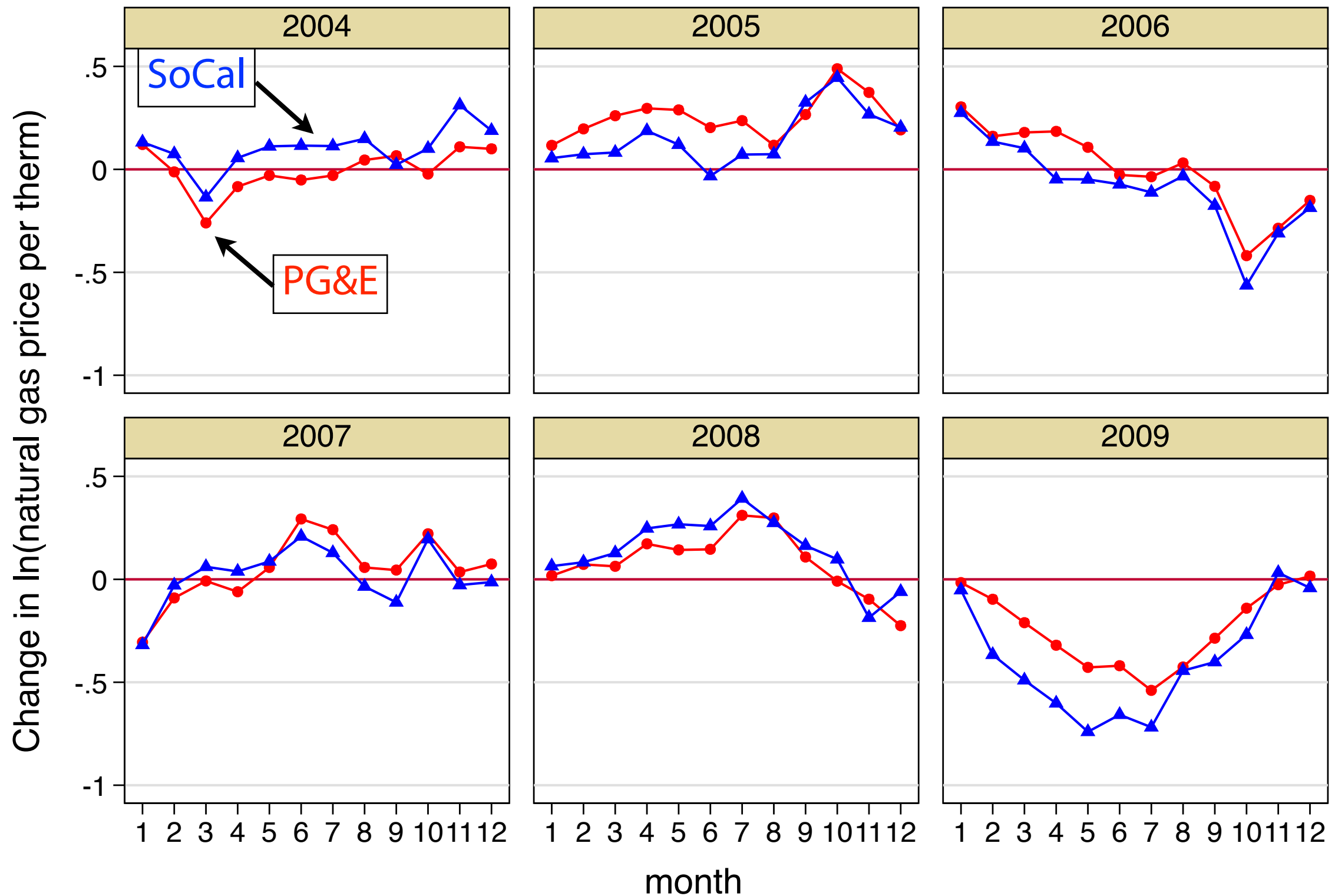
$$\text{e.g.) } \Delta \ln P_{2005,m10} = \ln P_{2005,m10} - \ln P_{2004,m10}$$



Graphs by year

Price variation in retail natural gas price

$$\text{e.g.) } \Delta \ln P_{2005,m10} = \ln P_{2005,m10} - \ln P_{2004,m10}$$



Graphs by year

Preliminary result: Dependent variable = $\ln(\text{Electricity Consumption})$

$$\ln Q_{i,t} = c_{i,m} + c_t + \theta_1 \cdot \ln P_{Gi,t} + \theta_2 \cdot \text{Comb}_i \cdot \ln P_{Gi,t} + \eta \cdot X_{i,t} + u_{i,t}$$

	(1)	
$\ln(\text{Natural Gas Price})$	0.009 (0.013)	← $\theta_1 = \text{cross elasticity}$
$\text{Comb} \cdot \ln(\text{Natural Gas Price})$	-0.041*** (0.008)	← $\theta_2 = \text{bill confusion parameter}$
Cooling Degree Days	0.039*** (0.001)	
Cooling Degree Days ²	0.0003 (0.0002)	
Heating Degree Days	0.009*** (0.001)	
Heating Degree Days ²	0.001*** (0.0001)	
N	455514	

*** 1% significance level
Standard errors are clustered at the household-level

Next steps

- Hopefully, we can get a list of premise ID and natural gas providers
 - Exact matching of premise ID and gas providers
 - See if the results are robust if we limit the sample closer to the border
- Think through more about the model of bill confusion
 - “bill confusion parameter” in the current estimation is very “reduced form”
 - Working on building a simple model that leads to a estimating equation
- We also need to include “electricity price”
 - Potentially, bill confused consumers under-react to electricity price

Thank you!

Thank you for your attention!

Backup Slides

Focus on Combined and Split bill customers in the city of Bakersfield

Split bill customers

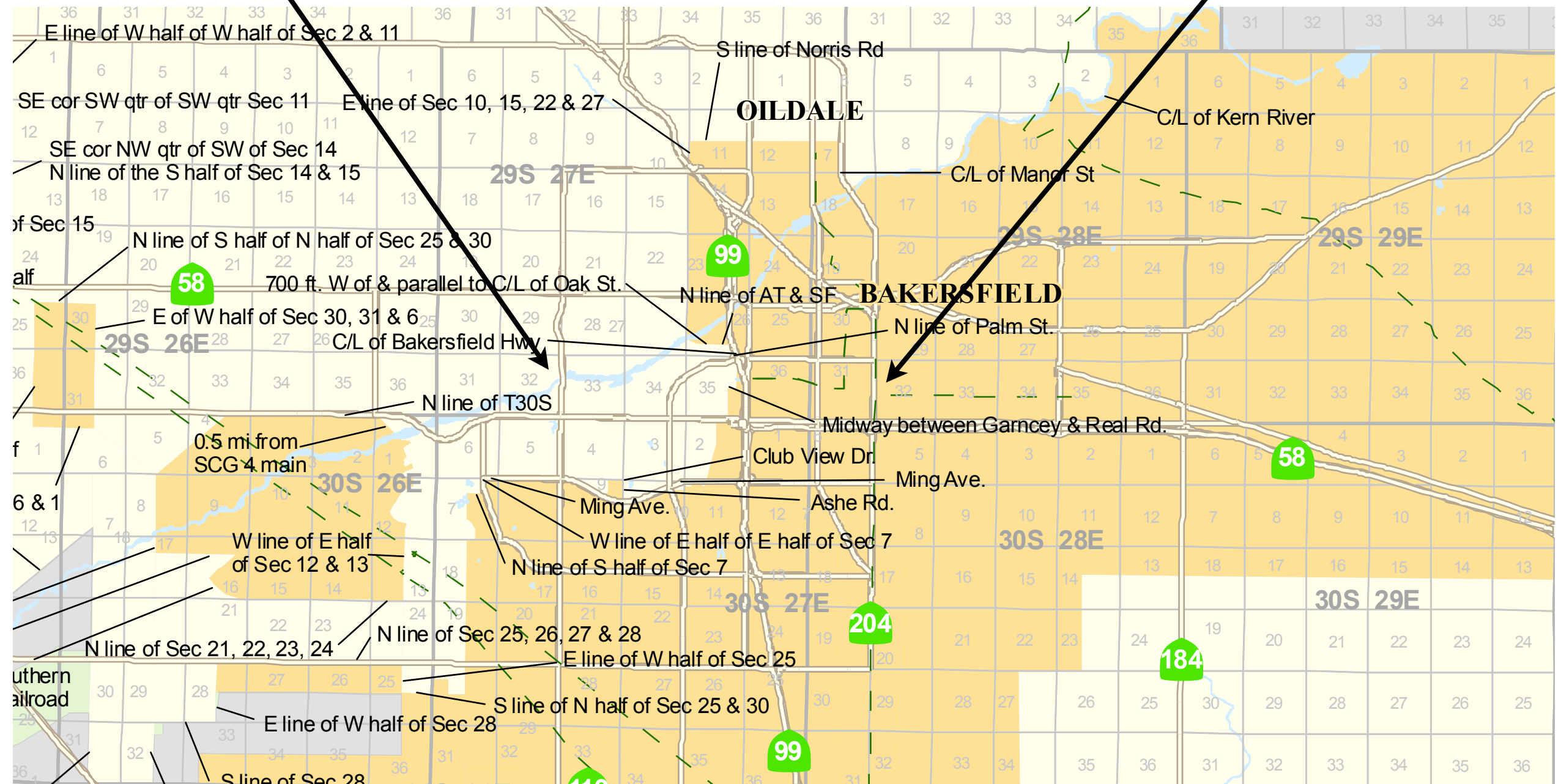
Electric: PG&E

Gas: SoCal Gas

Combined bill customers

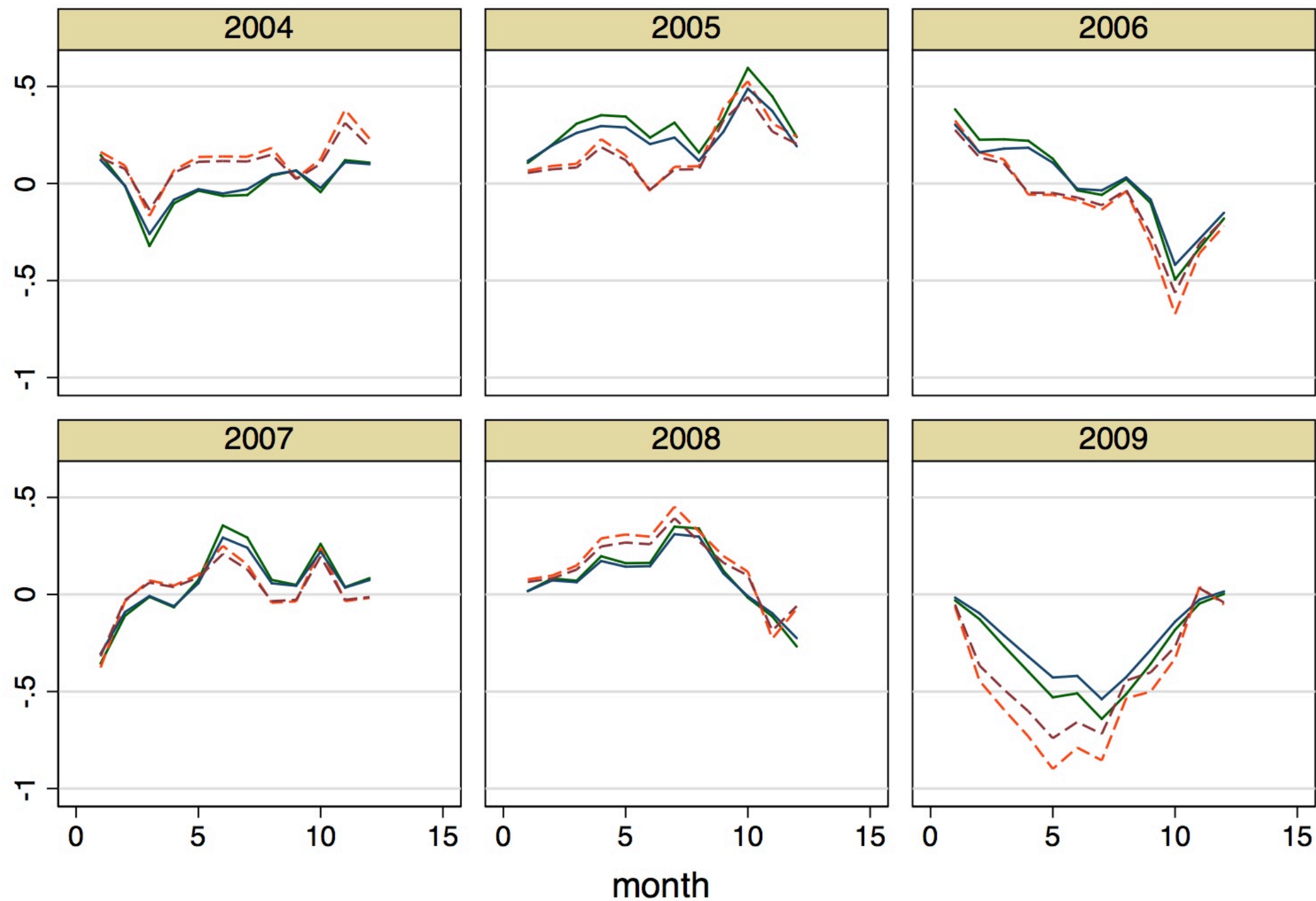
Electric: PG&E

Gas: PG&E



Price variation in retail natural gas price = $\Delta \ln(\text{price per therm})$

e.g.) $\Delta \ln P_{2005,m10} = \ln P_{2005,m10} - \ln P_{2004,m10}$



— PG&E tier1
— PG&E tier2

--- SoCal tier1
--- SoCal tier2