The Impact of Regulatory Change on Retail Pricing: The New York State Milk Price Gouging Law

Adam N. Rabinowitz and Yizao Liu

This study examines the causal effect of a change in administration of the New York State milk price gouging law on retail milk prices. Specifically, we focus on the November 2008 shift from a threshold pricing policy that consisted of monthly announced prices to a fixed margin policy. Using a regression discontinuity approach, we find lower prices and thus increased consumer welfare for retail milk purchasers in New York State. Furthermore, the change in application of the law may have eliminated previously hypothesized coordination in pricing by retailers through a more competitive retail milk environment.

Key Words: milk, price gouging, regression discontinuity design, regulatory policy, retail prices

Pricing of retail milk in much of the United States has become a complicated entanglement of federal regulations, consolidation of the processing industry, market power of supermarkets, and, in some geographic areas, state pricing policies (Johnson 1985, Hendrickson et al. 2001, Cotterill 2006). State laws often attempt to protect farmers from retailer loss-leader pricing; current laws in Maine and Pennsylvania, for example, set minimum retail prices. Other state laws attempt to protect consumers from high prices. One example is New York State's (NYS's) milk price gouging law, which was passed in 1991.

Several studies have examined the effect of implementation of New York's law on farm-to-retail price spreads and farm price transmission. Romain, Doyon, and Frigon (2002) and Bolotova and Novakovic (2012) both found evidence of symmetric price transmission after the law was implemented. Other studies of the price gouging law have documented its effect on consumers through lower

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retail prices, which improve consumer welfare (Cotterill 2006, Rabinowitz 2012).

While government regulation is designed to correct market imperfections, it can yield results that are less than perfectly competitive. Despite increased consumer welfare, concern developed with the NYS milk price gouging law regarding retailers' ability to potentially engage in tacit collusion. And as a result, the application of the law was changed in November 2008. To date, no one has empirically studied the effect of this significant regulatory change on the retail price of milk in New York. In this study, we determine how the retail price of milk available in the product space has changed since the law's revision.

We empirically examine retail prices available to consumers in their choice set of regular white milk and how those prices have changed in response to the change in regulatory practice. Our focus is the Syracuse, New York, Scantrack market, and we use supermarket scanner data for 2007 through 2012. Using a regression discontinuity (RD) design, we use a quasi-experimental analysis to estimate the causal effect of the change in policy on the prices available to retail milk consumers. RD has been used to measure policy and program effects in labor economics, political economy, health, crime, and the environment (e.g., Davis 2008, Bento et al. *forthcoming*).

The New York State Milk Price Gouging Law

June 1991 was a time in NYS when farm prices suffered large drops and retail prices declined only minimally. To provide both farmers and consumers with relief from the growing price differential, the NYS legislature passed a retail regulation known as the milk price gouging law.[1] The regulation was designed to prohibit sales of fluid milk at prices deemed to be "unconscionably excessive." Enforcement of the law was undertaken by the NYS Department of Agriculture and Markets (DAM), which adopted a threshold price of 200 percent of the federally announced monthly farm price for milk plus an approximated cooperative over-order premium.[2] DAM used the federally announced Class I price in New York City and Syracuse to calculate threshold prices for two geographic areas: (i) metro New York, including Long Island, New York City, and parts of the lower Hudson valley; and (ii) upstate New York, which covered the rest of the state. Each month, the threshold price was announced and retailers responded by setting prices accordingly. However, the threshold was not a maximum price and was targeted only at supermarkets (including supercenters) even though it was perceived by many as a price ceiling that applied to all retailers of milk. In fact, the law was designed to allow retailers to sell milk for more than 200 percent of the farm price if invoicing and other justifications proved that their processor wholesale prices and in-store costs were particularly high.

In addition, retailers only have to price their cheapest regular white milk products according to the threshold. After the lowest priced milk products meet the standards of the milk price gouging law, the retailer is free to charge higher mark-ups for other milk. Since private-label milk most often has the lowest retail price, it is the product generally chosen by retailers for compliance

[1] New York General Business Code, Article 26, § 396-rr.

[2] Over-order premiums are additional amounts that processors pay farmers for their milk. They typically are negotiated and paid through cooperative arrangements after cooperative handling fees are deducted.

with the law. The benefit to consumers is significant since private-label milk accounts for more than half of all milk sales in the United States (Grill-Goodman 2013). Furthermore, there is little or no difference in quality between private-label and branded milk despite a documented price differential (Bonanno and Lopez 2005). This application of the law continued until November 2008.

In November 2008, state officials were concerned that collusive pricing of milk was occurring based on research by Bolotova and Novakovic (2012).[3] DAM consequently eliminated monthly threshold prices and implemented a fixed retail margin of $0.58 per gallon, $0.37 per half-gallon, and $0.26 per quart. Retailers no longer have a variable margin tied to the farm price; instead, they are restricted to charging a fixed margin above processors' invoice prices. The new margin, however, remains a target only. Higher prices can be charged with justification, and currently there is no active enforcement of the justification requirement.

This new administrative policy is likely to change not only the overall retail price for milk but also the retail price differential between types of milk since processors' invoice prices should vary according to the amount of butterfat the product contains. This is expected to occur because milk with a higher butterfat content has a higher raw value due to the price differential between butterfat and skim milk. In other words, the raw price of whole milk is higher than the raw price of 2-percent milk, which is higher than the price of 1-percent milk, which is higher than the price of fat-free milk.

It is logical to expect that an input price differential will translate directly to a differential in retail prices. However, Rabinowitz and Cotterill (2009) documented existence of a phenomenon known as "flat milk pricing"—retailers offer all milk at the same price regardless of butterfat content. In related research, Carman and Sexton (2005) examined supermarket pricing of fluid milk in nine markets in the western United States with a focus on horizontal differentiation of milk in terms of retail pricing strategies for whole, 2-percent, 1-percent, and skim (fat-free) milk. They hypothesized that retailers with market power may be able to exploit horizontal differentiation in consumer demand for milk. In fact, none of the individual markets included in their study showed evidence of milk pricing consistent with perfect competition.

Prior to November 2008, threshold prices were based on the full price of Class I milk, which contains 3.5 percent butterfat (greater than whole milk's 3.25 percent). There was no announced price differential for milk of lower value. The fixed mark-up over invoice established in 2008 should have created a differential in retail prices based on the amount of butterfat in each type of milk. In fact, there is a price differential in the raw value based on butterfat content; typically, relative to whole milk, the raw value of 2-percent milk is roughly 9 percent lower, 1-percent milk is approximately 16 percent lower, and fat-free milk is about 20 percent lower.[4] We are therefore interested not

[3] Bolotova and Novakovic (2012) hypothesized that NYS's announced price facilitated tacit collusion by supermarkets via transmission of farm prices. The authors found that, upon passage of the law, price transmission of farm price increases and decreases were nearly identical and thus suggested the possibility of coordination in pricing. However, a more direct explanation is that the law squeezed margins in down markets. Firms could have unilaterally found that charging the announced price was the best they could do absent a cost justification for a higher price. Thus, the price transmission similarities can be explained without any sort of tacit collusion.

[4] The actual difference is based on a given month's announced prices for butterfat and skim milk. The percentages provided in the text are based on several random samples of representative butterfat and skim milk prices and are provided for illustrative purposes only.

only in how overall pricing of retail milk has changed under the new regulatory policy but also whether retail prices for milk of various butterfat contents have changed.

Model Specification

Within our framework, we are addressing a real-world problem and can observe firm behavior during a period in which there was a distinct structural change in regulatory behavior. A natural experiment and difference-in-difference method would seem like an ideal approach but would require construction of an appropriate control group. Since all NYS retailers and milk prices were subject to the same policy change, no retailer could be considered as untreated by the policy. One method by which to estimate treatment effects when a control is not present is regression discontinuity.

The RD approach is a quasi-experimental design that allows for identification of the effects of a treatment variable for a defined subpopulation with good internal validity (Thistlethwaite and Campbell 1960, Hahn, Todd, and Van der Klaauw 2001). It is, therefore, much like an experimental design except that the levels of the treatment variable are not assigned randomly by the researcher. Instead, there is a jump in the conditional mean of the treatment variable at a known cut-off in another variable, which is called an assignment variable. The assignment variable is perfectly observed and allows us to estimate the effect of the treatment as if it had been randomly assigned in the neighborhood of the known cut-off. RD has been used to estimate program effects in a wide variety of economic contexts (Angrist and Lavy 1999, Van der Klaauw 2002, Davis 2008).

When implementing RD, one must first specify an outcome variable, which in our case is the retail milk price charged to consumers in supermarkets. The treatment in this quasi-experimental design is the regulatory change in the price gouging law and is denoted by a dummy variable, Law_t. One must also specify an assignment variable, time (t) in our case. In this analysis, the cut-off point is the date of the regulatory change, November 2008, and is denoted by time c. Therefore, for any milk product on the market,

$$Law_t = 1 \quad \text{if } t \geq c \text{ and } 0 \text{ if } t < c.$$

In other words, Law_t takes a value of 0 in all periods prior to the regulatory change and a value of 1 in all subsequent periods.

Since all brands of regular white milk are subject to the regulatory change, a sharp regression discontinuity (SRD) design is appropriate. We perform a nonparametric local linear regression to estimate the treatment effect of the regulatory change (Hahn, Todd, and Van der Klaauw 2001).[5] Specifically, we fit linear regression functions to observations that are within distance h on either side of the discontinuity point (the cut-off point). h represents the bandwidth. In the SRD estimation, the optimal bandwidth is calculated following Imbens and Kalyanaraman (2009) to minimize mean square error (squared bias plus variance). We use a triangle kernel and calculate robust standard errors.

We estimate the following equation:

[5] For detailed descriptions of the estimation procedures, see Hahn, Todd, and Van der Klaauw (2001), Imbens and Lemieux (2008), and Lee and Lemieux (2009).

$$(1)\quad \ln(P_{it}) = \alpha + \beta \times Law_t + \gamma_1 Class\ I_t + \gamma_2 \times Whole_i + \gamma_3 \times Percent2_i + \gamma_4 \times Percent1_i + \gamma_5 \times 128oz_i + \gamma_6 \times 64oz_i + \gamma_7 \times Private_i + \gamma_8 \times Unemployment_t + \gamma_9 \times Plastic_t + \gamma_{10} \times Electricity_t + \gamma_{11} \times Wages_t + \gamma_{12} \times Advertising_t + \gamma_{13} \times CPI\_FB_t + \epsilon_{it}$$

where P_{it} is the retail price of milk product i at time t and milk product i is defined as a combination of brand, butterfat content, and package size. For example, a half-gallon of Brand A 2-percent milk, a gallon of Brand A whole milk, and a half-gallon of Brand A 1-percent milk are considered to be different products that are indexed separately by i. $Class\ I_t$ represents the Class I milk price, a significant factor in the cost of processed retail milk. $Whole_i$, $Percent2_i$, and $Percent1_i$ are dummy variables for the butterfat content of milk product i with fat-free skim milk excluded as the base variable. To control for container size, which affects the price of a product, we include two variables, $128oz_i$ and $64oz_i$; $32oz_i$ is excluded as the base variable. $Private_i$ is a dummy variable that equals 1 when product i is a store's private-label brand of milk. Generally, prices of private-label products are lower than those of national brands so retailers may price their private-label and national-brand milks differently in response to the regulatory change.

Processing and retailing components also affect the overall retail price of milk. To control for these cost shifters and their variation over time, we include the price of plastic, $Plastic_t$, since it is the major input in bottling milk at the processing stage. At the retail level, the majority of value-added costs are in refrigeration, stocking, and checkout. We include electricity prices, $Electricity_t$, and retail wages, $Wages_t$. A final cost of doing business that affects the retail price and is included in our model is total expenditure on advertising of milk, $Advertising_t$, during the period for all products in the market.

Controlling for costs is essential, but we also must control for changes in demand that affect the retail price of milk. These include macroeconomic conditions and the price of substitute goods. The period covered by our data, 2007 through 2012, coincides with significant macroeconomic changes in the U.S. economy during and after the 2008 recession. It is therefore important to adequately control for effects of the broader economy and not just the milk marketing channel. We include a measure of the monthly metropolitan statistical area's unemployment rate, $Unemployment_t$. In addition, we incorporate the consumer price index (CPI) for food and beverages, CPI_FB_t, to proxy for overall changes in prices in that sector in general. Of particular interest is β, the coefficient that captures the effect of the 2008 change in how the price gouging law is applied. Provided that all other factors that affect milk prices are continuous when the policy changed, the RD method will yield consistent estimates of β that can be interpreted as a causal effect of the regulatory change.

Data and Descriptive Statistics

We use Nielsen Scantrack supermarket scanner data for the Syracuse, New York, market for November 5, 2007, through October 27, 2012, aggregated to four-week periods. This type of point-of-sale data is obtained from supermarkets as it is recorded at checkout scanners; it includes data on prices, distribution, sales volumes, and promotion for all products that have universal product codes (UPCs) sold by food stores, mass merchandisers, and drug and convenience

stores. We restrict our analysis to food (supermarket/grocery) stores since that is where the vast majority of milk sales occur and the in-store costs of retailing milk are similar among such stores and relatively stable. In fact, announcement of the change in how the law would be applied emphasized the law's focus on supermarkets and that the new fixed retail margins included supermarket in-store handling costs and net profits.

Nielsen scanner data are collected in many markets in the United States, and each geographic area is considered a unique Scantrack market. The Syracuse Scantrack market consists of 20 counties in the central part of upstate New York. It is the only Scantrack market that is contained entirely in NYS and thus is entirely affected by upstate New York pricing policies.[6] We also obtained data for the Hartford Scantrack market to provide a means of comparing Syracuse with a market that is not subject to retail pricing policies. The Hartford Scantrack market consists of counties in Connecticut and central Massachusetts.

Table 1 reports descriptive statistics for milk prices in the Syracuse and Hartford markets for all brands in the market and for private labels since private-label milk has a significant impact on consumer welfare in the milk market. We show means and standard deviations for Syracuse and Hartford before and after the regulatory change in November 2008. The average unit price for all types of milk and types of packages in the Syracuse market falls from $2.13 before the change to $1.98 after. Conversely, the average unit price in the Hartford market rises from $2.82 to $2.96. Note that these prices represent the average shelf price of the products available to consumers and not consumers' overall purchasing behavior.

When we break down the averages by milk type and package type, we find that the average price of every milk type and package type in the Syracuse market decreases after the application of the law was changed. And again, the opposite trend is seen in the Hartford market for all types of milk and for half-gallon (64-ounce) containers; the average Hartford price for quart containers remains flat and the price for gallon containers decreases.

The bottom half of Table 1 displays average unit prices for private-label milk only. The average unit price in the Syracuse market is $1.99 before the regulatory change and $1.75 after, and the average unit price once again drops for every milk and package type. In the Hartford market, the average unit price of private-label milk increases, though by a smaller amount, and average unit prices for 1-percent and fat-free products and for gallon and quart packages decrease.

We supplemented the Nielsen data for the Syracuse and Hartford markets with information on costs and demand shifters (see Table 2). In all cases, monthly data have been converted to four-week averages based on the weighted number of days from each month in a given period.

Class I milk prices are from the U.S. Department of Agriculture (USDA) Agricultural Marketing Service Dairy Programs.[7] Figure 1 shows Class I prices

[6] The New York City Scantrack market consists of the lower portion of New York State and parts of New Jersey and Connecticut. Because Nielsen aggregates the data for each Scantrack market, multistate markets are not suitable for our analysis.

[7] We did not include any premiums (cooperative or over-order) because data on premiums in the New York market were not available. Historically, the NYS DAM had consistently used an over-order premium of $0.90 per hundredweight, which translates to about 13 cents per gallon. We also know from announced premiums in other areas subject to Federal Milk Marketing Order 1 (the Northeast Milk Marketing Order) that the premium payments typically remain constant for long periods of time. Thus, there is no need to control for the premium cost.

Table 1. Descriptive Statistics of Price, Milk Type, and Package Type

	Syracuse Market				Hartford Market			
	Before Regulatory Change		After Regulatory Change		Before Regulatory Change		After Regulatory Change	
Variable	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
All Brands								
Unit price (dollars)	2.13	0.95	1.98	0.81	2.82	1.00	2.96	1.04
Unit Price by Milk Type (dollars)								
Whole milk	2.15	0.97	1.97	0.81	2.76	1.00	2.94	1.05
2-percent	2.11	0.93	2.00	0.81	2.83	1.04	2.97	1.06
1-percent	2.13	0.96	1.95	0.80	2.82	0.99	2.97	1.05
Fat-free	2.14	0.93	2.01	0.83	2.88	0.96	2.98	1.02
Unit Price by Package Type (dollars)								
128 ounce package	3.54	0.39	2.95	0.49	4.17	0.38	4.11	0.71
64 ounce package	2.11	0.38	2.09	0.51	2.72	0.41	2.74	0.40
32 ounce package	1.10	0.11	1.07	0.13	1.64	0.20	1.64	0.18
Total observations for all types	1,009		4,155		1,116		4,654	
Private Label								
Unit price (dollars)	1.99	0.94	1.75	0.70	2.39	0.87	2.41	0.83
Unit Price by Milk Type (dollars)								
Whole milk	2.13	1.06	1.79	0.84	2.24	0.75	2.35	0.81
2-percent	1.77	0.77	1.71	0.63	2.28	0.83	2.38	0.83
1-percent	2.01	0.93	1.77	0.65	2.54	0.97	2.43	0.83
Fat-free	1.95	0.77	1.66	0.58	2.56	0.91	2.51	0.87
Unit Price by Package Type (dollars)								
128 ounce package	3.22	0.40	2.48	0.43	3.70	0.11	3.47	0.19
64 ounce package	2.04	0.23	1.94	0.33	2.41	0.13	2.44	0.22
32 ounce package	1.02	0.08	0.94	0.10	1.54	0.27	1.48	0.18
Total observations for all types	281		1,192		260		726	

Table 2. Descriptive Statistics of Cost and Demand Shifters

Variable	Unit	Mean	Std. Dev.	Min.	Max.
Syracuse					
Class I price	Dollars per gallon	1.61	0.27	1.05	2.08
Unemployment rate	Percent	7.76	1.37	4.32	9.53
Plastic prices	Index	150.17	13.24	125.37	169.29
Electricity rate	Cents per kilowatt hour	1.40E-01	3.5E-03	1.30E-01	1.40E-01
Supermarket wages	Average weekly dollars	355.60	10.58	332.00	374.00
Advertising expenditure	Dollars	8,768.9	2,465.9	2,967.8	12,826.6
CPI food and beverage	Index	141.57	5.40	130.47	150.15
Total number of four-week periods: 65					
Hartford					
Class I price	Dollars per gallon	1.67	0.27	1.11	2.14
Unemployment rate	Percent	8.04	1.50	4.70	10.00
Plastic prices	Index	150.17	13.24	125.37	169.29
Electricity rate	Cents per kilowatt hour	1.80E-01	7.1E-03	1.60E-01	2.00E-01
Supermarket wages	Average weekly dollars	445.16	4.80	434.00	451.00
Advertising expenditure	Dollars	8,791.8	2,473.4	2,963.9	12,835.7
CPI food and beverage	Index	226.96	7.99	210.58	240.51
Total number of four-week periods: 65					

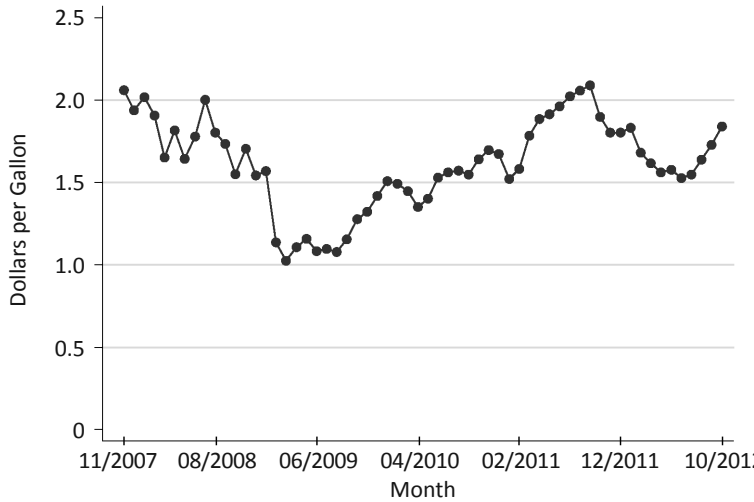

Figure 1. Class I Price in the Syracuse Market

Source: U.S. Department of Agriculture, Federal Milk Marketing Order 1.

per gallon for November 2007 through October 2012. Like global commodity prices at the time, the Class I price for milk declined sharply in late 2008 and early 2009, winding up at roughly half the per-gallon price in late 2007. Between mid-2009 and late 2011, the price slowly recovered, returning to levels seen prior to the recession. A second drop and recovery occurred in late 2011 and 2012.

Other data used for estimation came from the U.S. Bureau of Labor and Statistics (BLS) (see Table 2 for descriptive statistics of the data). Included in the analysis are a monthly producer price index of resin and plastic materials, monthly unemployment rates for the Syracuse and Hartford metropolitan statistical areas, and the average weekly wage paid by grocery stores (NAICS 4451) based on the quarterly census of employment and wages for Onondaga County in New York and Hartford County in Connecticut. BLS CPIs are used for monthly electricity prices (cents per kilowatt hour in northeast areas) and food and beverage prices. In both cases, the CPIs are segregated by class size. We use size A for Syracuse and size B/C for Hartford. We also obtained data from Kantar Media for total expenditures on television, print, radio, and outdoor advertising of all nonorganic unflavored milk products in the Syracuse and Hartford markets and nationwide.

Empirical Results

RD estimates for the Syracuse market are presented in Table 3. Examining the overall effect of the regulatory change for all brands of regular white milk, we find a statistically significant coefficient of –0.086. Since this coefficient represents a dummy variable on the log of price, it is interpreted as an approximate percentage change in price. In other words, the overall effect of the change in the regulation is an approximate 8.6 percent decrease in the retail price of milk. Given an average unit price of $2.13 per gallon in the Syracuse market prior to November 2008, an 8.6 percent decrease corresponds to 18.3 cents per gallon.

We next examine the results by the milks' fat content. We find a negative effect of –11.3 percent for whole milk, –14.7 percent for 2-percent milk, –8.0 percent for 1-percent milk, and –10.1 percent for fat-free milk, all of which are statistically significant at the 1 percent level. In an analysis by package size, similar negative results are obtained for quart and gallon containers. The estimate for a half-gallon container is not statistically different from zero. Thus the change in application of the law did not influence the price of half-gallon containers. This is an important distinction. When we see from the descriptive statistics in Table 1 that the average price of half-gallon containers is lower after the regulatory change, we can conclude, based on the results in Table 3, that this is not the result of the change in regulatory practice and is instead a function of other market forces.

We then examine the results for private-label milk. Overall, the price of private-label milk drops 13.5 percent (26.9 cents less than the average price of $1.99 per gallon) as a result of the change in regulation. This decrease in the price of private-label milk is 50 percent larger than the overall decrease in price for all brands, indicating a larger decrease for the most purchased brand of milk.

One of the more interesting results is the estimates for private-label milk in Syracuse by fat content. The estimates show a decline in price of 9.3 percent for

whole milk, 18.3 percent for 2-percent milk, 10.5 percent for 1-percent milk, and 18.9 percent for fat-free milk. The key to understanding this differential comes from an examination of the primary input costs used to determine retail prices. Recall that processing and retailing activities are not influenced by the milks' fat content. However, the value of the raw milk input rises with the fat content of the final product. Thus, if New York retailers moved away from flat milk pricing, they would create a price differential based on fat content. Interestingly, the average price of milk prior to the change in regulation declined with the butterfat content in all cases except 2-percent milk, which had a lower average price than fat-free milk. After the regulatory change, the prices of whole and 1-percent milk dropped by about the same percentage while 2-percent and fat-free milk dropped about twice as much. These results identify a greater differential for the milk that is least expensive to produce (fat-free) and the milk generally sold at the lowest price (2-percent).

Figure 2 allows a visual inspection of discontinuities at the point of change in the law. It plots the results of the local linear regression estimating the effects

Table 3. Regression Discontinuity Estimates for the Syracuse Market

	Regulatory Change Coefficient				
	Overall	**Whole Milk**	**2-percent**	**1-percent**	**Fat-free**
All brands	–0.086**				
	(0.045)				
Observations	5,164				
All brands by fat content		–0.113***	–0.147***	–0.080***	–0.101***
		(0.005)	(0.008)	(0.009)	(0.010)
Observations		1,480	1,380	1,249	1,055
		128 Ounces	**64 Ounces**	**32 Ounces**	
All brands by size		–0.134***	0.026	–0.044***	
		(0.005)	(0.090)	(0.004)	
Observations		1,222	2,358	1,584	
	Overall	**Whole Milk**	**2-percent**	**1-percent**	**Fat-free**
Private label	–0.135***				
	(0.006)				
Observations	1,473				
Private label by fat content		–0.093***	–0.183***	–0.105***	–0.189***
		(0.009)	(0.008)	(0.011)	(0.005)
Observations		494	390	394	195
		128 Ounces	**64 Ounces**	**32 Ounces**	
Private label by size		–0.114***	–0.048***	–0.159	
		(0.008)	(0.007)	(0.100)	
Observations		422	527	524	

Notes: The dependent variable is $\ln(P_{it})$. Standard errors are enclosed in parentheses. *, **, and *** represent significance at a 10 percent, 5 percent, and 1 percent level respectively.

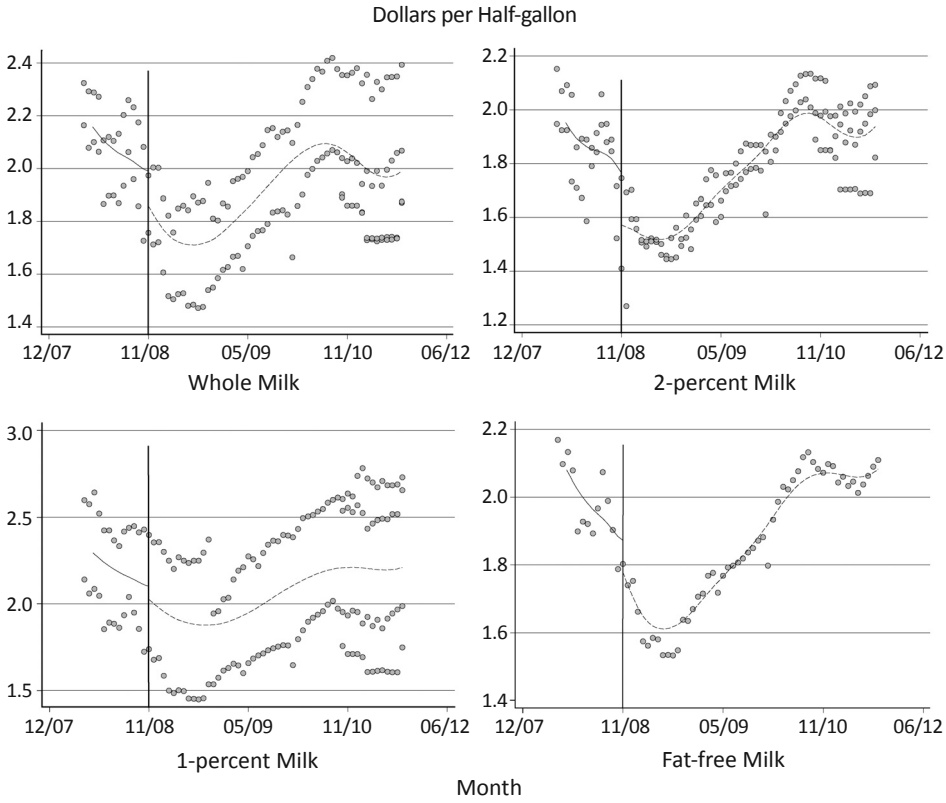

Figure 2. Syracuse Retail Milk Prices and Local Linear Regression Lines for a Half-gallon of Private-label Milk

of regulatory change on the retail price in the Syracuse market of a half-gallon container of private-label milk for each percentage of butterfat. Contrary to the evidence provided by the descriptive statistics, Figure 2 shows a sharp drop in the unit price of whole milk at the point of the November 2008 regulatory change. The figures for the other milk types show similar drops in price for 2-percent, 1-percent, and fat-free milk. Most importantly, all four graphs depict lower prices after the change in regulation, a result that is consistent with the RD estimates shown in Table 3.

While the RD results for the Syracuse market show that the change in approach had an overwhelming negative effect on the retail price of milk, one must consider the basic assumption of the RD model—to prove causation between the event (the change in regulatory approach) and the result (the price change), either no other event can have taken place at the same time or the model must control for all other events. One method of accomplishing this is examination of a comparable market in which no such event occurred. There is no retail price law in the Hartford market so we expect that the RD model will show no statistically significant discontinuity in November 2008.

Table 4 presents RD estimates for the Hartford market. Signs in the Hartford estimates are mixed and are insignificant with the exception of gallon-size containers of private-label milk. Its coefficient is negative, indicating a 21.8

percent decrease in price. The reason for significance in this one subsample is unclear. However, the mixed signs and insignificant results in the rest of the Hartford estimates support our overall conclusion that the change in administration of the NYS milk price gouging law resulted in a decrease in retail prices to consumers. Figure 3 presents graphical illustrations of the Hartford results for the same half-gallon of private-label milk of various butterfat contents. *A priori*, we expect no discontinuity in pricing in November 2008, and the charts show relatively continuous local regression functions indicating that there was no change in pricing behavior in Hartford when NYS changed the application of its law. Therefore, New York retail milk prices were higher under the original threshold approach than they could have been under the fixed retail margin approach. These results support the hypothesis that there was some coordination of pricing under the threshold approach and that the change in regulation has decreased prices and increased consumer welfare in the NYS dairy market.

Table 4. Regression Discontinuity Estimates for the Hartford Market

	Regulatory Change Coefficient				
	Overall	**Whole Milk**	**2-percent**	**1-percent**	**Fat-free**
All brands	0.167				
	(0.126)				
Observations	5,770				
All brands by fat content		–0.012	–0.120	–0.027	–0.037
		(0.013)	(0.102)	(0.026)	(0.065)
Observations		1,599	1,349	1,405	1,417
		128 Ounces	**64 Ounces**	**32 Ounces**	
All brands by size		–0.124	0.079	–0.014	
		(0.099)	(0.085)	(0.022)	
Observations		1,858	2,603	1,309	
	Overall	**Whole Milk**	**2-percent**	**1-percent**	**Fat-free**
Private label	0.003				
	(0.052)				
Observations	986				
Private label by fat content		0.057	0.030	0.002	0.014
		(0.063)	(0.042)	(0.025)	(0.016)
Observations		271	247	273	195
		128 Ounces	**64 Ounces**	**32 Ounces**	
Private label by size		–0.218***	0.218	–0.007	
		(0.036)	(0.145)	(0.017)	
Observations		286	338	362	

Notes: The dependent variable is $\ln(P_{it})$. Standard errors are enclosed in parentheses. *, **, and *** represent significance at a 10 percent, 5 percent, and 1 percent level respectively.

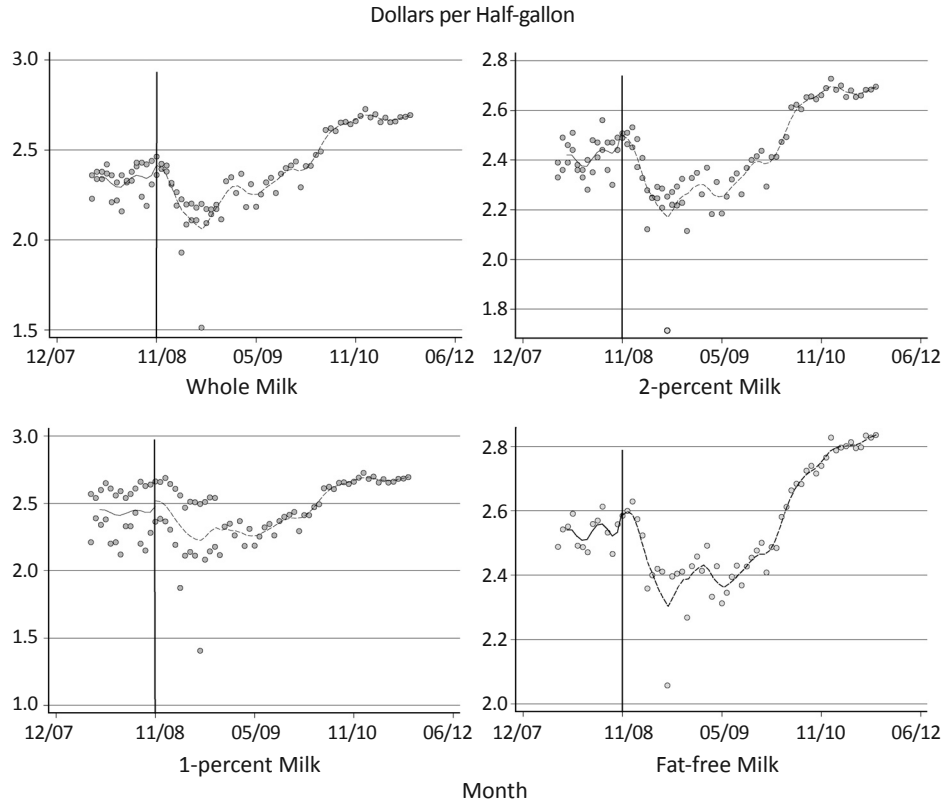

Figure 3. Hartford Retail Milk Prices and Local Linear Regression Lines for a Half-gallon of Private-label Milk

Conclusions

We use regression discontinuity to estimate the effect of a change in administration of New York's milk price gouging law on the retail price of milk in NYS. The study contributes to our understanding of retail milk pricing within the regulatory environment of the fluid milk industry and provides an analysis with direct implications for policy and administrative strategies in real-world settings.

We find that the shift from a threshold price to a fixed retail margin over invoice resulted in lower milk prices and increased consumer welfare in NYS. Therefore, even though NYS consumers had previously paid lower prices than their neighbors in southern New England (Rabinowitz 2012), the revised approach for regulating the price of milk further reduced prices and increased benefits to consumers. Furthermore, the new approach may have eliminated coordination of pricing by retailers since the announced threshold price was perceived as a ceiling. Simply put, the NYS milk market may be more competitive under the new regulatory structure.

We acknowledge several limitations of this study. The data used for the analysis were aggregated at the market level while compliance with the law takes place at the individual store level. A store complies with the regulation by

selling only their least expensive brand of each type of milk at the announced threshold price. Since our market data did not focus strictly on the lowest priced milk, we cannot comment on retailers' compliance with the law. Our estimates of the average market effect for private-label milk, which typically is the lowest priced milk in the store, inform this question, but we cannot truly speak to compliance.

Future research is recommended in two areas. First, a store-level analysis of compliance could determine the extent of the revised approach's benefit to consumers and retailers' ongoing observance of the law. A second area for follow-up is a more recent analysis of retail costs to determine if the fixed retail margins set by DAM are sufficient to cover retailers' costs and provide a reasonable profit. To date, there has been no adjustment to the retail margin in response to changing economic conditions. Updated margin estimates and a comparison with actual margins could further delineate the effect of the regulatory change on retailers' profit margins. Ensuring that retail margins are neither too high nor too low is important to the continued success of the retail milk market and the consumer benefits provided by the NYS milk price gouging law.

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