Temporary Wholesale Gasoline Price Spikes have Long-lasting Retail Effects: The Aftermath of Hurricane Rita

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Abstract

I show that very short lived geographical differences in the severity of wholesale gasoline price spikes following Hurricane Rita are associated with long-lasting geographical differences in retail prices. In most U.S. cities, wholesale prices spiked significantly for a period of just over two weeks. However, in cities for which this spike was particularly large, retail margins remained higher than other cities for nearly two months. I also show that the nature of pricing competition in each city significantly affected the duration of above normal retail margins after the hurricane.

*Address: 410 Arps Hall, 1945 N. High St., Columbus, OH 43210. E-mail: mlewis@econ.ohio-state.edu. This work is preliminary. Please do not cite without permission. I would like to thank Severin Borenstein, Trevon Logan and seminar participants at The Ohio State University and Kent State University for helpful comments.

Introduction

The summer of 2005 was a particularly bad hurricane season for the Gulf of Mexico region, as two severely destructive hurricanes, Katrina and Rita, hit within one month of each other in August and September. Though the most significant losses resulting from the hurricanes occured in the Gulf region, one of the most immediate and well publicized impacts the hurricanes had on the rest of the U.S. was its effect on gasoline prices and other energy markets. Most of the oil extraction, transportation and refining facilities concentrated in the Gulf region were either damaged or temporarily closed during the storms, causing major disruption in the nation's supply of petroleum products.[1] Much of the South, East Coast, and Midwest are dependent on both crude oil and refined gasoline produced in or imported through the Gulf region. As a result, average retail gasoline prices in the eastern half of the U.S. jumped nearly 60 cents/gallon during the week of Hurricane Katrina. This spike only added to already high prices that had increased 35 cents/gallon over the preceding month due to refinery problems and rising oil prices. News reports cited countless consumers concerned about how higher gas prices would impact their budgets. Unfortunately, the high retail gas prices did not disappear as fast as they came.

It may not be surprising to see retail gasoline prices rise quickly and fall more slowly. A growing empirical literature has uncovered widespread evidence that retail gasoline price respond more quickly to increases in wholesale costs than to decreases.[2] This study looks more closely at how a significant but temporary wholesale price shock impacts retail markets, and in particular, how and why these retail impacts differ geographically. In the days surrounding each of the hurricanes wholesale prices increased dramatically and large regional price differences developed. Retail prices rapidly responded accordingly. While these wholesale price effects quickly subsided, retail prices (and retail margins) remained higher than normal. Surprisingly, I show that the peak height of a city's wholesale price shock,

[1] Nearly all of the oil production and refining in the Gulf region stopped for one to two weeks during Hurricane Rita. Half of the refining capacity and two-thirds of the oil production capacity in the area remained down for over a month. The Gulf region accounts for over 50% of domestic crude oil production capacity and around 33% of domestic refining capacity. See Hibbard (2006).

[2] See, for example, Borenstein, Cameron and Gilbert (1997), Deltas (2004), and Lewis (2005)

though it only lasted a few days, had a large and long-lasting positive impact on the retail margins earned in that city in the subsequent months. In other words, local retail prices increased only to the extent that local wholesale prices increased. However, once high, local retail prices fell slowly. Retail prices and margins remained higher in some cities long after the wholesale price differences between cities disappeared. I also show that the length of time a city's retail margins remained high after wholesale costs fell depended on the nature of retail price competition that typically occurs in that city. Cities in which retail prices tend to change more frequently saw retail prices decline much more quickly after wholesale prices fell.

Following a Congressional mandate, the Federal Trade Commission investigated the effects of the hurricanes on gasoline prices and of the possibility for price manipulation.[3] The FTC report describes geographical differences in the size of the resulting price spikes, and concludes that most of the retail price differences were driven by wholesale prices. However, the report does not analyze the geographical differences in the speed with which retail prices fell over the following months or how this may have been impacted by the local competitive environment.

Data

Daily retail and wholesale gasoline prices are observed for 85 cities throughout the Midwest, Mid Atlantic, and Southern states.[4] Retail prices are average prices from samples of stations within each city and are reported with all relevant taxes removed.[5] Wholesale prices are observed at local distribution racks. These are facilities located near the city where gasoline is drawn out of a pipeline and loaded onto tanker-trucks for transport to local gas stations. The rack price for *unbranded* gasoline is used as the wholesale price for each city because it represents the true local marginal cost of the homogeneous commodity coming off the

[3]Federal Trade Commission (2006) is a written account of the results of this investigation.

[4]Daily wholesale and retail price surveys were collected by Oil Price Information Service, and are observed for all of 2004 and 2005. States with cities in the sample include: AL, AR, GA, IA, IL, IN, KS, KY, MI, MN, MO, NC, NE, NY, OH, OK, PA, TN, TX, WI, WV.

[5]The price collected from each station is for unleaded 87-octane gasoline

pipeline. This unbranded gasoline is then sold by local unbranded stations, or is combined with the additives of a major gasoline brand (ie. BP, Shell, Chevron, etc.) and marked up for sale to that company's own branded station operators.

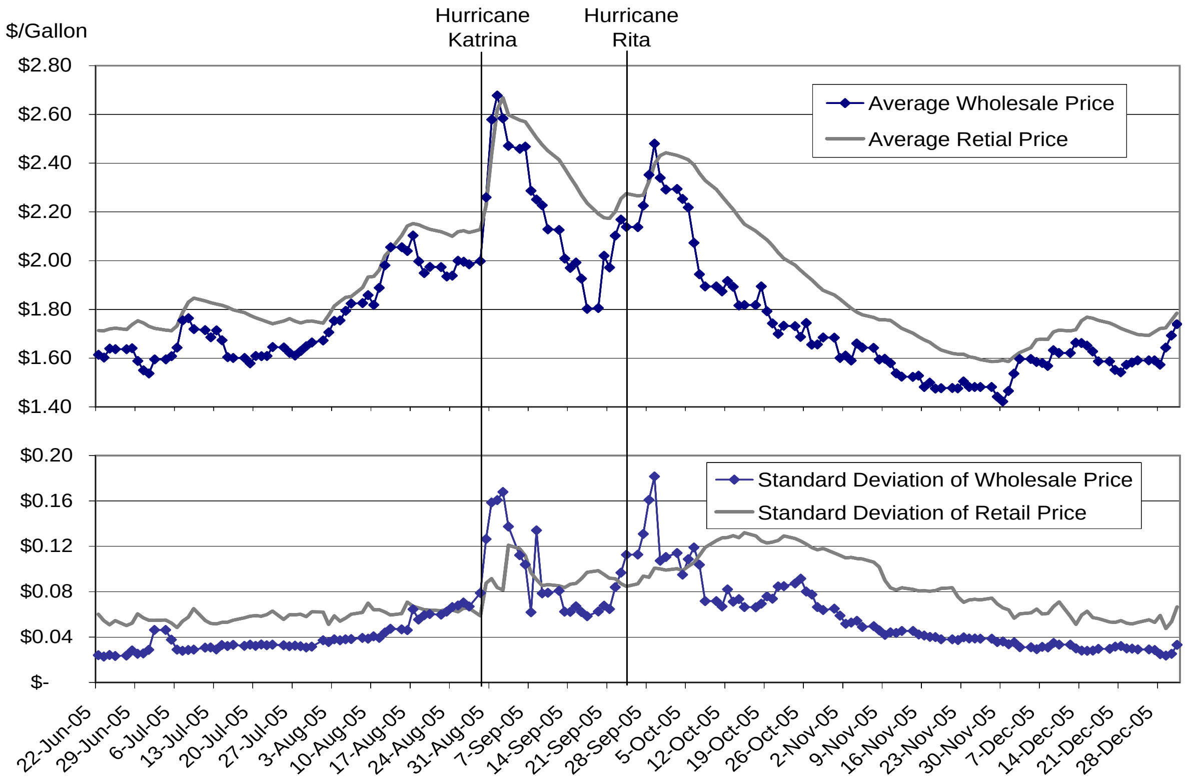
What Happened?

Figure 1 shows the daily average retail and wholesale prices across the 90 cities observed during the time period surrounding the hurricanes. It also shows the standard deviation in the observed prices across cities in the sample. The average retail and wholesale price series reveal the large price increases that occured in response to the two hurricanes as well as a gradual increase in prices in July and August resulting from increased oil prices and a number of U.S. refinery outages. Average prices only tell part of the story, though, as is indicated by the large increase in the standard deviation of wholesale prices across cities in response to the hurricanes. For example, immediately after Hurricane Rita wholesale gasoline prices topped out at $2.92 per gallon in Charlotte, NC and $2.27 per gallon in Syracuse, NY. These temporary wholesale price differences arose because certain regions are more dependant on gasoline produced at Gulf Coast refineries or on crude oil and gasoline transported using pipelines or ports affected by the hurricanes.[6] In the days following each disruption adjustments were made within the supply network to mitigate the regional price differences, and the standard deviation of wholesale prices decreases fairly quickly towards more normal levels.

Interestingly, regional differences in retail prices grow larger well after regional wholesale price differences have returned to normal. (See the standard deviation series for retail prices in Figure 1.) The following analysis examines these retail differences and describes how both the extent of local wholesale disruption and the nature of local retail competition affect how retail prices respond after significant supply disruptions.

[6] Regions such as the Upper Midwest and Northeast have some refining capacity of their own and have access to imported oil and/or refined products from Canada or elsewhere (through marine terminals in the Great Lakes and New England). Price spikes in these areas tended to be smaller.

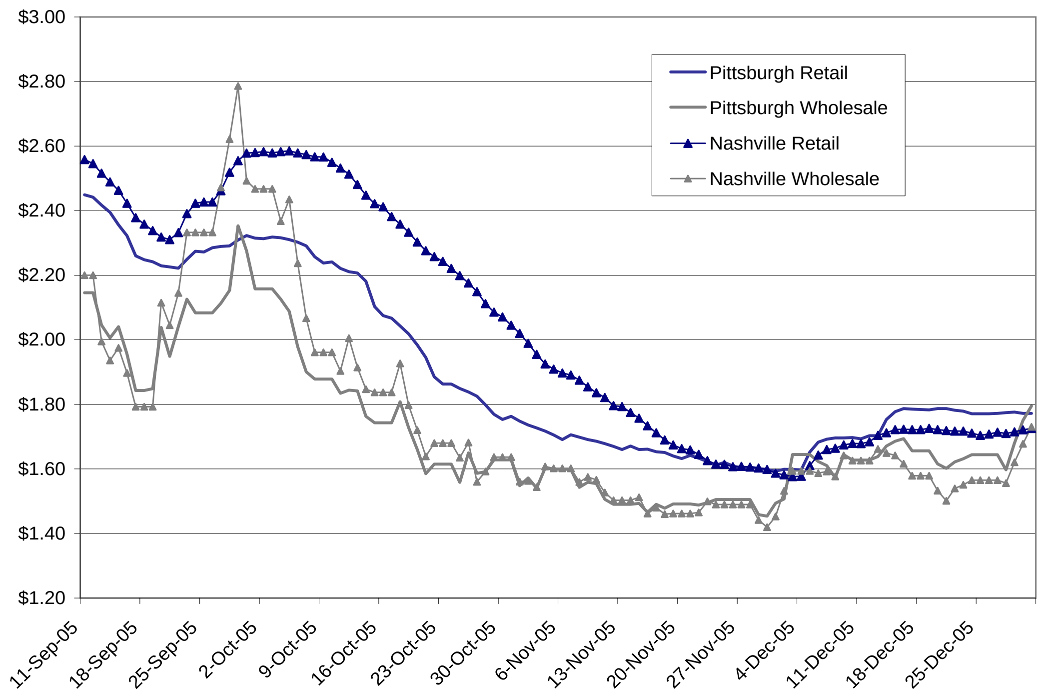
Figure 1: Means and Standard Deviations of Gasoline Prices Across Cities.



Lasting Retail Price Impacts from a Transitory Wholesale Shock

Though wholesale prices in certain areas remained much higher than in others for only a week or two after each disruption, retail prices and retail margins in these particular areas remained much higher than in other areas for several months. Figure 2 illustrates how temporary differences between the wholesale prices in two different cities lead to large differences in retail prices long after wholesale prices had converged. Retail prices in Nashville increased more than in Pittsburgh because Nashville experienced a larger wholesale price spike (roughly 43 cents/gal. higher) following the hurricane. However, retail prices (and margins) remained higher in Nashville long after the wholesale price had fallen close to the levels seen in Pittsburgh. The persistent difference in retail margins appears to be economically significant. One month after Rita, wholesale prices in Pittsburgh and Nashville were fluctuating within a few cents of each other while retail prices in Nashville were still

Figure 2: Prices in Nashville and Pittsburgh Before and After Hurricane Rita.



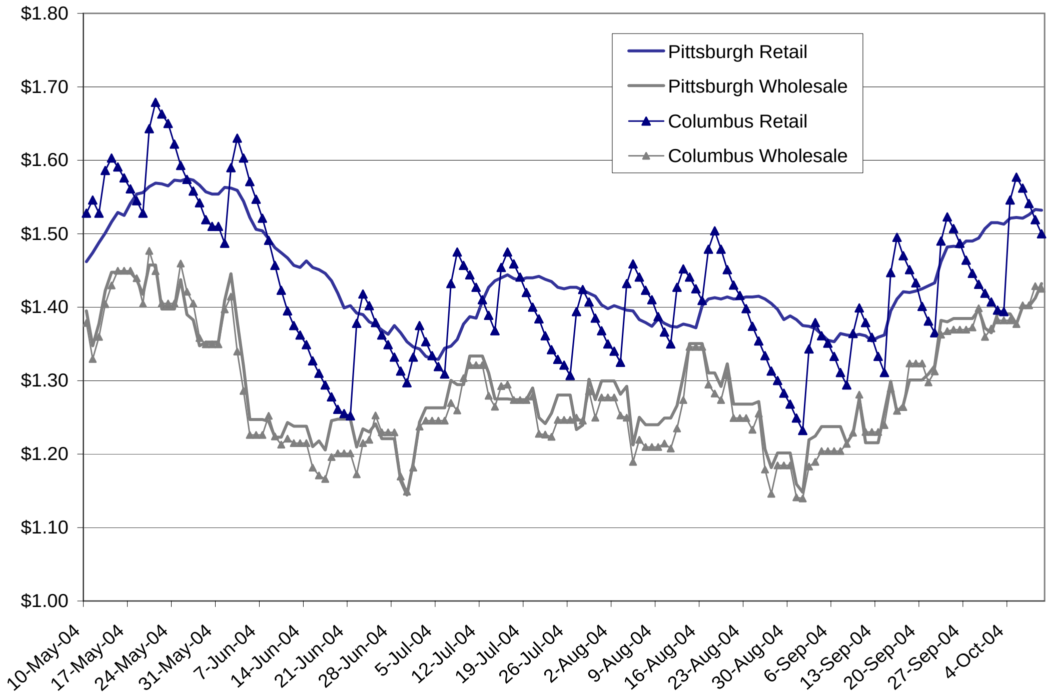
30 cents/gal. higher. The following empirical analysis attempts to more systematically examine whether temporary geographic differences in wholesale prices led to large and fairly persistent geographic differences in retail prices.

Importance of the Local Competitive Environment

The magnitude of the local wholesale price spike associated with Hurricane Rita appears to have influenced the size of retail margins remaining after wholesale prices declined. However, the persistence of these high margins over the following months seems to be related to the type of local competitive environment that exists between retail gas stations in each city. Retail prices fell more quickly in regions that exhibit a particular type of local competition characterized by retail margins that fluctuate in cyclical patterns.

Eckert (2003) and Noel (2006) examine retail gasoline markets in Canada, and find that prices in some cities appear to follow a cyclical equilibrium rather than maintaining

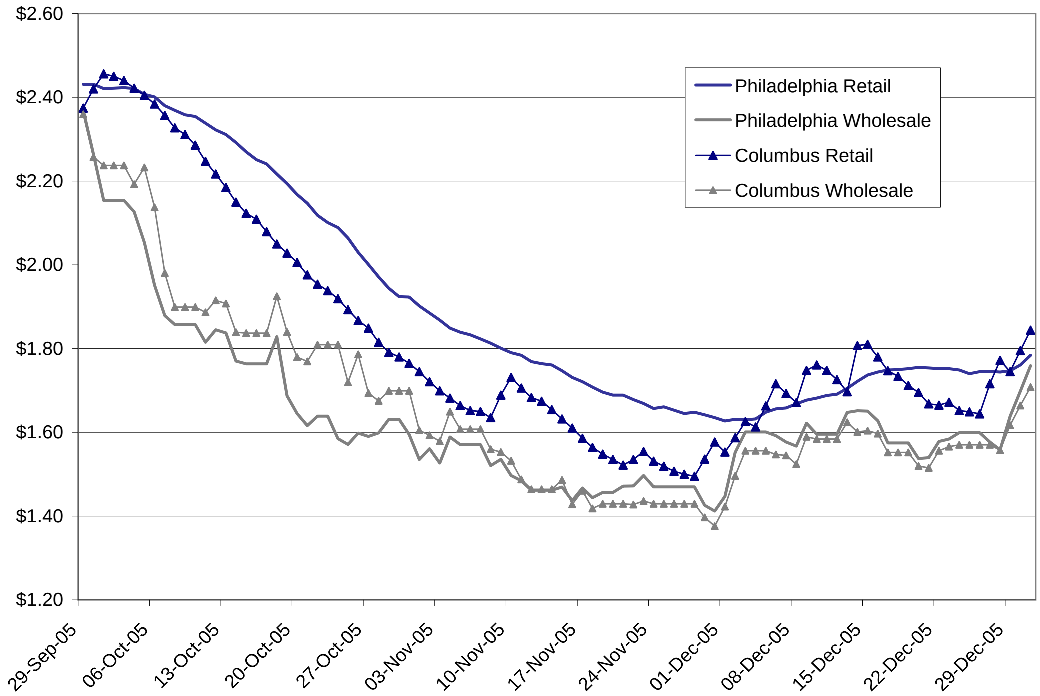
Figure 3: Typical Gasoline Prices in Columbus and Pittsburgh.



fairly stable margins over wholesale price. These pricing patterns are usually referred to as Edgeworth Cycles in reference to the competitive equilibrium modeled by Maskin and Tirole (1988). Cyclical equilibria are characterized by retail prices that are much more volatile than the wholesale price. Even with constant wholesale prices, retail prices tend to decrease frequently in small increments over time as stations continuously try to undercut each other until the retail margin has nearly disappeared. Then prices jump quickly with one or two large positive price movements until margins are large and the slow undercutting process begins again. Each price cycle can take anywhere from a few days to a few weeks depending on the location and whether there are movements in the wholesale cost level.

Some cities in my sample clearly exhibit such Edgeworth Price Cycles while other have a much more constant retail margin over time. These two different types of retail pricing behavior can be observed in Figure 3, which shows typical gasoline price movements in Pittsburgh, PA and Columbus, OH. Though several previous studies have also documented

Figure 4: Prices in Philadelphia and Columbus After Hurricane Rita.



these cycles in specific retail gasoline markets, what influences their existence and what competitive effects they have on the market are not well understood.[7] Local market structure or the degree of competition may influence their existence, though I do not observe large differences in long run average retail margins between cities exhibiting these two types of equilibria.[8] I do show, however, that the presence of such retail price cycles significantly impacts how quickly high retail margins were dissipated following Hurricane Rita.

One explanation is that gas stations in cities with Edgeworth Price Cycles are accustomed to decreasing their price more frequently than stations in other cities. When wholesale costs declined quickly after the Hurricane Rita price spike, average retail prices in Edgeworth Cycle cities decreased more quickly towards wholesale cost while other cities' prices were more resistant to fall. Compare the behavior of prices in Figure 4 for Columbus,

[7]See Eckert and West (2004) and Eckert (2003) for a discussion of the sources of different competitive equilibria.

[8]Any correlation between city size or market size and the presence of retail cycles is not statistically significant.

OH and Philadelphia, PA. Both cities faced similar wholesale price spikes after Hurricane Rita, but Columbus typically exhibits price cycles while Philadelphia does not. It is clear that retail prices in Columbus approach wholesale prices much more quickly than those in Philadelphia. If price margins systematically dissipate more quickly in cities with cycles after large supply shocks, this may also represent a major source of geographic retail price dispersion during such periods.

Empirical Analysis

A casual analysis of prices after the hurricanes suggests that the severity of the local wholesale price spike and the tendency for frequent retail price cycles to occur in a particular city had a significant influence the size and persistence of unusually high retail margins in subsequent months. Using the full panel dataset of prices I can more systematically identify the effects that a larger local wholesale price spike and the existence of retail price cycles had on retail prices in each city. I do this by modeling local retail prices over the months following the hurricanes as a function of: current wholesale costs, the local peak of wholesale costs after Hurricane Rita, and an indicator for the existence of price cycles. To account for possible regional differences in demand or retail competition I also control for variation across cities in the (long run) average level of retail margins. I estimate the following specification of the retail price (p_i) in city (i) for each day (t) after the hurricane:

$$p_{it} = \alpha_t + \beta_t^1 c_{it} + \beta_t^2 \; City\ Margin_i + \beta_t^3 \; Cycle_i + \beta_t^4 \; Peak\ c_i + \epsilon_{it} \tag{1}$$

where $c_i f$ is the local wholesale price, $City\ Margin_i$ is the average of $(p_{it} - c_{it})$ over the period from January 2004 to June 2005, $Cycle_i$ is an indicator for whether retail price cycles are common in city i, and $Peak\ c_i$ is the highest local wholesale price observed immediately following Hurricane Rita. The preliminary evidence suggested that a higher wholesale price spike associated with Hurricane Rita should have a positive effect on the local retail price in the days following the hurricane, and the presence of retail price cycles in a city should have a negative effect. (ie. $\beta_t^4 > 0$ & $\beta_t^3 < 0$). Notice that $c_i t$ accounts for the contemporaneous effect of the current wholesale price on the current retail price, so that the coefficient on $Peak\ c_i$ describes the additional influence that past wholesale price levels can have on retail prices after controlling for current wholesale conditions.

In order to estimate Equation 1 we need to define an indicator, $Cycle_i$, for the presence of retail price cycles in a city. In some cases it is obvious whether prices in a city exhibit cycles or not (as for the cities in Figure 3). For other cities making such a designation may not be so clear. However, the nature of Edgeworth Cycle equilibria suggests a simple and straightforward measure that should be highly correlated with the extent of price cycles. Prices in an Edgeworth Cycle equilibrium should be much more volatile from day to day, and more importantly, should exhibit frequent (small) negative price changes and relatively infrequent (but large) positive price changes. In contrast, average prices in non-cycle cities should be predominantly dictated by wholesale cost changes, and in the long run should exhibit a more even distribution of negative and positive changes. Following this logic, an appropriate proxy for the extent of price cycles in a city is the median daily change in the city average price.[9] Cities with cycles should have many more decreases than increases, so the median change in the city average price should be negative. In cities with more stable prices, the median change in the average price should be much closer to zero. As suspected, the data reveal two types of cities: those with median price changes massed around zero and those with negative and sizable median price changes. More specifically, 45% of observed cities have a median price change between -.1 and .1 cents/gal (the maximum for the sample), while 55% have median price changes from -.1 to -1.5 cents/gallon. Appendix Figure A1 shows a kernel density plot of the distribution of median price changes for the cities observed.

I define the indicator ($Cycle_i$) to be 1 if the median change in average price for the city is less than -.1, suggesting the presence of price cycles. Though this is somewhat arbitrary, altering the definition of the cycle indicator or using a continuous measure of price cycle activity (which will be discussed below) has very little effect on the coefficient

[9]The median of daily price changes is calculated over the period from January 2004 to June 2005.

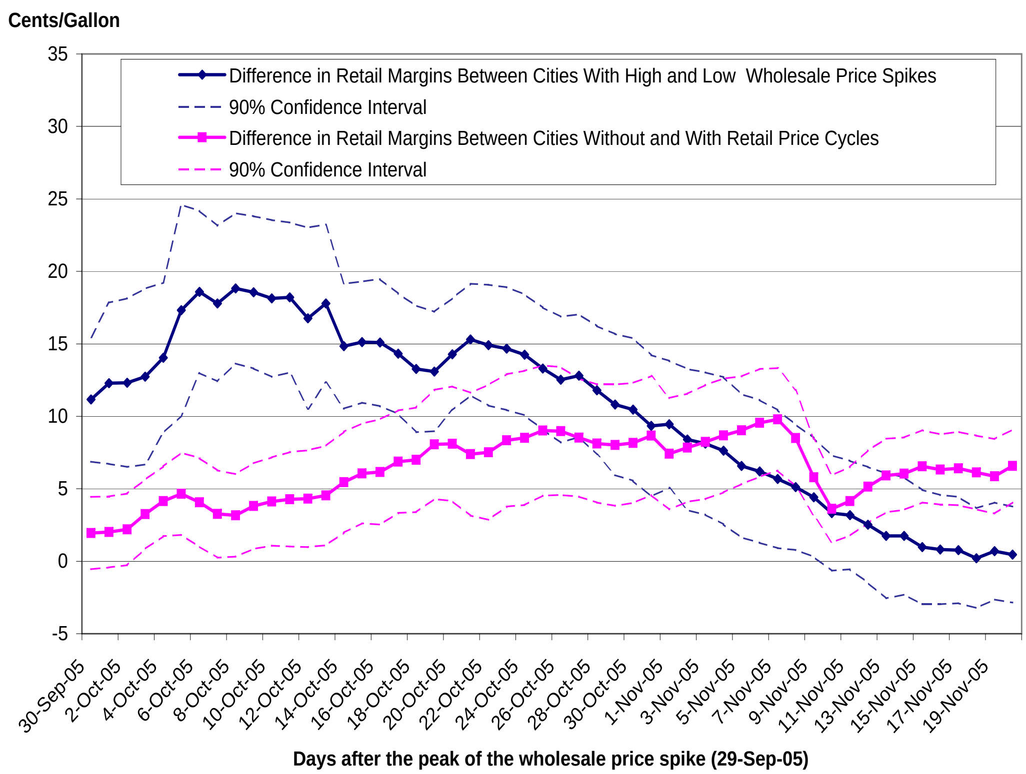
estimates. Equation 1 is estimated separately for each day using the 85 observed cities. Independent estimation of the daily regressions ensures that heteroscedasticity and serial correlation in errors over time do not bias the standard error estimates.

The regression results are reported in Table 1 and are consistent with the preliminary analysis. The coefficient estimates on $Peak\ c_i$ are positive and significant for more than a month after the price spike, with the largest values of just over .5 coming around 10 days after the spike. This coefficient value reveals how many cents/gallon higher the daily retail price would be, all else equal, if the peak of the wholesale price spike in the city would have been one cent higher. The regression controls for the current wholesale price in each city, so this effect of $Peak\ c_i$ can be interpreted to describe differences in retail margins across cities after the hurricane. Given that the standard deviation of wholesale prices during the spike was roughly 16 cents/gallon, the implied differences in retail margins can be sizable. The dark solid line in Figure 5 reports the daily predicted difference in retail margins between a city with a peak wholesale cost one standard deviation above the average and an otherwise identical city (with the same current wholesale cost) whose peak cost was one standard deviation below the average. The largest predicted retail price differences approach 20 cents/gallon.[10]

The coefficient on the retail price cycle indicator variable is negative and highly significant. Being in a city with where retail price cycles are common results in lower retail prices in the period after a large spike. Unlike the effect of a higher local price spike, the effect of being in a city with cycles increases slowly in magnitude for over a month after the spike. Price margins in cities with cycles appear to have fallen at a faster rate causing the price difference from non-cycling cities to grow over time. The lighter solid line in Figure 5 reports the difference in predicted retail margins following the spike for cities with and without retail cycles. At its peak, the predicted difference in margins between the two city types reaches nearly 10 cents/gallon. This difference drops suddenly about 40 days after the spike, around the time when most cities with cycles experience their first cyclical price

[10]This estimate seems reasonable given the overall level of geographic retail price dispersion during this period which exhibits a standard deviation of around 12 cents/gallon.

Figure 5: Differences in Retail Margins Between Cities After Hurricane Rita



increase following the spike.

The $Cycle_i$ indicator is used because many cities either clearly display cycling behavior or display no cycling behavior. However, price cycling behavior in some cities is *weaker* than in others. Therefore, I also estimate Equation 1 using a continuous measure of the extent of price cycles, the median daily change in each city's average price. This measure is increasingly negative for cities with strong price cycles and is close to zero in the absence of price cycles, and has a standard deviation of around .43. The regression results are reported in Table 2 and are very similar to those in Table 1. The model has a bit more explanatory power with the continuous measure, and the predicted retail price difference between cities with median daily price change measures 2 standard deviations apart reaches just over 10 cents/gallon.

In all of the daily regressions the coefficients on $City\ Margin_i$ remain close to 1, suggesting that long run locational differences in retail margins tend to persist during after the price spike. One might also expect that the coefficient on the current wholesale cost, c_{it}, should remain close to 1, but this is not the case. In fact, both the Edgeworth Cycle theory and observed patterns in gasoline markets with cycles suggest that once retail prices are falling, they continue to fall at a fairly consistent rate until they approach the wholesale price level. Movements in wholesale cost during this falling price phase do not have large effects on retail prices unless they increase enough to *reset* the cycle. Therefore, the current wholesale price should not have a significant effect on retail prices in cycling cities as prices fall after the hurricane. Possibly to a lesser extent, this behavior also occurs in non-cycling cities during periods of falling prices (and high margins). Lewis (2005) presents a model of consumer search which predicts that retail prices will be less responsive to cost changes when margins are high, and reports empirical evidence from a non-cycling market that supports this prediction. Consistent with both the theory and past empirical evidence, the results in Table 1 show that the coefficient on c_it is insignificant in the initial period after the price spike, and only slowly increases toward 1 in the following months.

Impact on Consumers

Consumers paid higher retail prices following the hurricanes, not only because higher wholesale costs were passed through, but because retail margins increased. This appears to have been more extreme in cities with larger wholesale price spikes. The estimation results imply that, over the six weeks following Hurricane Rita, a city in which the wholesale price spiked 16 cents higher (2 standard deviations) would have paid retail margins of 12.6 cents/gallon more on average than in an otherwise identical city. In addition to higher wholesale costs being passed through, the higher retail margins alone would have caused a 15 gallon-per-week consumer to pay $11.33 (or over 6%) more for gasoline in this city over this period. Following the price spike, consumers in cities without retail price cycles also paid higher retail margins than consumers in otherwise identical cities with retail cycles. Over the eight weeks following Hurricane Rita, consumers paid an average of 6.2 cents/gallon more in cities without retail price cycles, costing a 15 gallon-per-week consumer an additional $7.37 over this period.

Conclusions

Cities with larger wholesale price spikes and cities that generally do not exhibit retail price cycles both had significantly higher retail prices relative to other cities after Hurricane Rita. Even lower priced cities had historically high retail price margins during this period due the general tenancy for retail prices to fall more slowly than wholesale prices. Therefore, these two additional factors simply exacerbated the already high retail margins faced by consumers in certain cities. High retail margins are not only harmful to consumers, but most likely result in economic inefficiency as the prices faced by consumers are much higher than the true opportunity cost of the gasoline. The results of this paper highlight the large geographic differences in the extent of these inefficiencies that can result from temporary wholesale cost differences or differences in the nature of the local competitive equilibrium.

These results may also have interesting implications regarding the ability and/or incentive for large refining companies to exercise market power during periods when refining capacity is tight. It has been argued that the incentives for refiners to exercise market power in the wholesale gasoline market increase when capacity is scarce and prices are already high (see Borenstein, Bushnell and Lewis (2004)). Many of these large refiners also capture retail margins by selling through their own stations or by selling to their branded dealer stations at prices well above the unbranded wholesale price observed in the study. Such refiners may have even more incentive to temporarily exercise wholesale market power during price spikes if it also increases profits from future retail margins.

Table 1: Coefficient Estimates for Daily Price Regressions

(Standard errors in parenthesis)

Date	*Wholesale Cost*	*City Margin*	*Peak c* [1]	$Cycle_i$	*constant*	R-squared
9/30/2005	0.241 (0.063)	1.003 (0.164)	0.319 (0.065)	-1.95 (1.47)	97.1 (11.2)	0.66
10/1/2005	0.142 (0.092)	1.047 (0.193)	0.351 (0.083)	-2.02 (1.44)	113.7 (13.2)	0.64
10/2/2005	0.160 (0.093)	1.032 (0.188)	0.352 (0.086)	-2.19 (1.43)	108.8 (12.8)	0.65
10/3/2005	0.142 (0.096)	0.954 (0.175)	0.364 (0.086)	-3.24 (1.37)	110.8 (13.2)	0.68
10/4/2005	0.082 (0.094)	0.853 (0.183)	0.401 (0.069)	-4.14 (1.27)	116.7 (15.6)	0.67
10/5/2005	-0.078 (0.129)	0.799 (0.168)	0.495 (0.094)	-4.65 (1.40)	129.1 (15.5)	0.68
10/6/2005	-0.085 (0.101)	0.803 (0.155)	0.531 (0.077)	-4.06 (1.56)	118.1 (14.0)	0.72
10/7/2005	-0.004 (0.126)	0.912 (0.166)	0.508 (0.077)	-3.26 (1.59)	101.9 (17.9)	0.68
10/8/2005	-0.011 (0.179)	1.056 (0.163)	0.538 (0.074)	-3.17 (1.46)	91.0 (25.6)	0.70
10/9/2005	0.039 (0.181)	1.153 (0.167)	0.530 (0.074)	-3.80 (1.51)	81.1 (26.8)	0.69
10/10/2005	0.111 (0.184)	0.997 (0.179)	0.518 (0.075)	-4.12 (1.53)	70.8 (26.6)	0.69
10/11/2005	0.176 (0.174)	1.030 (0.184)	0.520 (0.072)	-4.27 (1.60)	55.0 (26.5)	0.70
10/12/2005	0.209 (0.185)	0.985 (0.202)	0.479 (0.088)	-4.32 (1.68)	55.7 (24.6)	0.68
10/13/2005	0.227 (0.156)	0.966 (0.212)	0.508 (0.076)	-4.53 (1.69)	43.5 (24.1)	0.68
10/14/2005	0.423 (0.150)	1.000 (0.236)	0.424 (0.059)	-5.45 (1.78)	27.2 (22.6)	0.68
10/15/2005	0.450 (0.155)	1.081 (0.254)	0.432 (0.058)	-6.06 (1.80)	16.7 (23.4)	0.67
10/16/2005	0.430 (0.160)	1.187 (0.276)	0.431 (0.061)	-6.16 (1.87)	17.9 (24.1)	0.66
10/17/2005	0.471 (0.150)	1.108 (0.267)	0.409 (0.056)	-6.87 (1.81)	16.0 (22.0)	0.67
10/18/2005	0.454 (0.144)	1.147 (0.272)	0.379 (0.059)	-7.00 (1.84)	20.8 (21.2)	0.68
10/19/2005	0.428 (0.129)	1.136 (0.273)	0.374 (0.052)	-8.06 (1.97)	30.1 (18.3)	0.67
10/20/2005	0.341 (0.129)	1.172 (0.279)	0.408 (0.051)	-8.10 (2.09)	36.3 (19.2)	0.65
10/21/2005	0.253 (0.129)	1.128 (0.289)	0.437 (0.050)	-7.38 (2.28)	42.8 (21.4)	0.60
10/22/2005	0.287 (0.139)	1.280 (0.290)	0.426 (0.057)	-7.51 (2.48)	34.5 (22.5)	0.59
10/23/2005	0.327 (0.135)	1.264 (0.300)	0.419 (0.057)	-8.34 (2.44)	28.6 (21.9)	0.60
10/24/2005	0.314 (0.132)	1.157 (0.307)	0.407 (0.056)	-8.52 (2.48)	33.8 (20.7)	0.59
10/25/2005	0.326 (0.130)	1.196 (0.306)	0.380 (0.057)	-9.02 (2.40)	37.4 (20.8)	0.59
10/26/2005	0.375 (0.144)	1.177 (0.312)	0.358 (0.059)	-8.98 (2.34)	31.0 (22.5)	0.58
10/27/2005	0.342 (0.137)	1.128 (0.303)	0.366 (0.056)	-8.52 (2.19)	36.1 (22.6)	0.57
10/28/2005	0.434 (0.168)	1.105 (0.342)	0.337 (0.059)	-8.12 (2.19)	25.7 (25.7)	0.55
10/29/2005	0.443 (0.195)	1.225 (0.351)	0.309 (0.066)	-8.01 (2.25)	26.4 (28.0)	0.53
10/30/2005	0.440 (0.193)	1.243 (0.351)	0.299 (0.067)	-8.16 (2.22)	28.2 (27.7)	0.53
10/31/2005	0.445 (0.179)	1.244 (0.349)	0.267 (0.066)	-8.67 (2.19)	34.7 (25.0)	0.52
11/1/2005	0.304 (0.176)	1.236 (0.350)	0.270 (0.060)	-7.42 (2.09)	58.1 (24.7)	0.48
11/2/2005	0.502 (0.198)	1.201 (0.348)	0.240 (0.065)	-7.83 (1.98)	32.0 (26.5)	0.49
11/3/2005	0.455 (0.191)	1.268 (0.363)	0.232 (0.066)	-8.22 (2.04)	40.1 (24.3)	0.48
11/4/2005	0.447 (0.201)	1.317 (0.354)	0.218 (0.067)	-8.68 (1.98)	39.8 (27.9)	0.47
11/5/2005	0.576 (0.204)	1.347 (0.353)	0.188 (0.063)	-9.04 (1.91)	25.4 (29.8)	0.49
11/6/2005	0.598 (0.203)	1.413 (0.354)	0.177 (0.062)	-9.55 (1.90)	23.6 (29.8)	0.51
11/7/2005	0.601 (0.196)	1.345 (0.342)	0.162 (0.060)	-9.79 (1.82)	27.3 (27.9)	0.52
11/8/2005	0.544 (0.180)	1.335 (0.333)	0.146 (0.055)	-8.50 (1.70)	41.6 (25.0)	0.50
11/9/2005	0.515 (0.158)	1.483 (0.267)	0.126 (0.053)	-5.79 (1.39)	47.7 (22.3)	0.55
11/10/2005	0.529 (0.166)	1.524 (0.219)	0.095 (0.053)	-3.61 (1.25)	52.3 (24.2)	0.58
11/11/2005	0.486 (0.162)	1.453 (0.225)	0.091 (0.048)	-4.14 (1.24)	61.7 (24.5)	0.56
11/12/2005	0.513 (0.162)	1.407 (0.236)	0.072 (0.051)	-5.15 (1.33)	62.2 (24.0)	0.54
11/13/2005	0.563 (0.158)	1.407 (0.241)	0.050 (0.054)	-5.91 (1.33)	59.5 (23.2)	0.55
11/14/2005	0.573 (0.168)	1.274 (0.250)	0.050 (0.051)	-6.04 (1.31)	58.5 (25.2)	0.53
11/15/2005	0.669 (0.194)	1.184 (0.250)	0.028 (0.050)	-6.54 (1.30)	49.1 (28.7)	0.53
11/16/2005	0.717 (0.213)	1.218 (0.246)	0.023 (0.048)	-6.33 (1.25)	44.5 (32.0)	0.55
11/17/2005	0.799 (0.245)	1.031 (0.259)	0.022 (0.048)	-6.40 (1.28)	32.3 (37.5)	0.52
11/18/2005	0.854 (0.209)	0.950 (0.262)	0.006 (0.045)	-6.12 (1.29)	29.3 (31.7)	0.53
11/19/2005	0.931 (0.207)	0.984 (0.268)	0.020 (0.045)	-5.86 (1.33)	12.1 (31.8)	0.53
11/20/2005	0.919 (0.203)	0.989 (0.271)	0.013 (0.043)	-6.58 (1.32)	15.5 (30.8)	0.56
11/21/2005	0.931 (0.200)	0.932 (0.278)	0.009 (0.042)	-6.89 (1.31)	14.6 (30.7)	0.56
11/22/2005	0.820 (0.192)	0.945 (0.261)	0.002 (0.039)	-4.76 (1.24)	31.5 (29.7)	0.52
11/23/2005	0.661 (0.162)	1.021 (0.245)	-0.035 (0.041)	-3.12 (1.23)	60.4 (24.2)	0.48
11/24/2005	0.768 (0.189)	1.003 (0.234)	-0.058 (0.043)	-3.45 (1.24)	51.1 (27.5)	0.51
11/25/2005	0.831 (0.192)	0.974 (0.239)	-0.064 (0.038)	-3.68 (1.20)	43.4 (28.5)	0.54
11/26/2005	0.872 (0.186)	0.889 (0.221)	-0.069 (0.037)	-4.15 (1.17)	38.9 (27.9)	0.56
11/27/2005	0.899 (0.191)	0.920 (0.241)	-0.073 (0.038)	-4.38 (1.19)	35.3 (28.6)	0.57
11/28/2005	0.931 (0.188)	0.890 (0.224)	-0.068 (0.036)	-4.67 (1.15)	29.5 (28.2)	0.59
11/29/2005	0.986 (0.128)	1.114 (0.173)	-0.036 (0.029)	-3.21 (0.95)	13.9 (17.2)	0.67
11/30/2005	0.937 (0.140)	1.128 (0.153)	-0.013 (0.030)	-1.25 (0.96)	16.6 (20.6)	0.63

[1] Peak wholesale prices following Hurricane Rita occurred on September 29^{th}, 2005.

Table 2: Coefficient Estimates for Alternate Daily Price Regressions

(Standard errors in parenthesis)

Date	*Wholesale Cost*	*City Margin*	*Peak c* [1]	*Median* Δp_i	*constant*	R-squared
9/30/2005	0.246 (0.056)	1.074 (0.177)	0.315 (0.062)	2.21 (1.26)	95.8 (11.5)	0.67
10/1/2005	0.165 (0.086)	1.120 (0.199)	0.337 (0.081)	1.42 (1.24)	110.4 (12.9)	0.64
10/2/2005	0.181 (0.089)	1.115 (0.194)	0.339 (0.085)	1.94 (1.24)	105.8 (12.8)	0.65
10/3/2005	0.180 (0.089)	1.084 (0.181)	0.341 (0.086)	3.26 (1.28)	105.8 (12.8)	0.67
10/4/2005	0.106 (0.093)	1.008 (0.196)	0.388 (0.075)	4.33 (1.21)	112.0 (14.9)	0.67
10/5/2005	-0.026 (0.123)	0.970 (0.187)	0.461 (0.099)	5.20 (1.32)	123.2 (15.0)	0.67
10/6/2005	-0.066 (0.096)	0.947 (0.173)	0.517 (0.081)	4.58 (1.53)	115.1 (14.2)	0.71
10/7/2005	0.017 (0.121)	1.028 (0.170)	0.496 (0.078)	3.84 (1.40)	99.0 (18.6)	0.68
10/8/2005	-0.014 (0.179)	1.166 (0.165)	0.537 (0.076)	3.50 (1.33)	90.1 (26.3)	0.70
10/9/2005	0.021 (0.187)	1.278 (0.166)	0.534 (0.077)	3.64 (1.41)	81.5 (28.3)	0.68
10/10/2005	0.089 (0.189)	1.131 (0.178)	0.522 (0.079)	3.88 (1.42)	71.4 (27.8)	0.68
10/11/2005	0.149 (0.182)	1.173 (0.179)	0.525 (0.076)	4.38 (1.50)	56.5 (28.2)	0.69
10/12/2005	0.198 (0.198)	1.136 (0.185)	0.480 (0.094)	4.68 (1.70)	55.0 (26.8)	0.68
10/13/2005	0.223 (0.176)	1.121 (0.203)	0.505 (0.083)	4.86 (1.82)	42.1 (27.1)	0.67
10/14/2005	0.418 (0.150)	1.186 (0.223)	0.421 (0.063)	5.83 (1.71)	25.7 (24.2)	0.67
10/15/2005	0.380 (0.158)	1.276 (0.234)	0.446 (0.060)	5.61 (1.66)	22.4 (26.1)	0.66
10/16/2005	0.361 (0.163)	1.385 (0.254)	0.444 (0.063)	5.77 (1.69)	23.4 (27.1)	0.65
10/17/2005	0.407 (0.150)	1.334 (0.246)	0.420 (0.059)	6.78 (1.67)	20.8 (24.7)	0.66
10/18/2005	0.441 (0.139)	1.390 (0.242)	0.377 (0.062)	7.79 (1.60)	19.7 (23.4)	0.68
10/19/2005	0.387 (0.118)	1.409 (0.244)	0.379 (0.058)	8.59 (1.63)	31.6 (19.6)	0.66
10/20/2005	0.284 (0.111)	1.444 (0.246)	0.414 (0.055)	8.57 (1.67)	40.1 (20.7)	0.64
10/21/2005	0.241 (0.108)	1.388 (0.257)	0.433 (0.055)	8.48 (1.72)	41.7 (22.0)	0.61
10/22/2005	0.277 (0.116)	1.547 (0.258)	0.422 (0.059)	8.83 (1.81)	33.0 (23.2)	0.60
10/23/2005	0.304 (0.115)	1.553 (0.265)	0.417 (0.060)	9.45 (1.80)	28.4 (23.1)	0.60
10/24/2005	0.298 (0.109)	1.457 (0.275)	0.404 (0.059)	9.90 (1.83)	32.5 (21.8)	0.60
10/25/2005	0.287 (0.107)	1.503 (0.282)	0.382 (0.059)	10.22 (1.74)	38.5 (21.3)	0.60
10/26/2005	0.333 (0.118)	1.485 (0.286)	0.359 (0.061)	10.29 (1.71)	32.9 (23.0)	0.59
10/27/2005	0.308 (0.115)	1.427 (0.277)	0.364 (0.061)	9.94 (1.68)	37.5 (22.5)	0.59
10/28/2005	0.378 (0.136)	1.395 (0.308)	0.339 (0.061)	9.60 (1.59)	30.0 (24.5)	0.58
10/29/2005	0.391 (0.161)	1.511 (0.319)	0.311 (0.068)	9.39 (1.66)	30.1 (26.0)	0.55
10/30/2005	0.390 (0.160)	1.536 (0.321)	0.300 (0.068)	9.66 (1.62)	31.7 (25.8)	0.55
10/31/2005	0.393 (0.149)	1.554 (0.312)	0.269 (0.068)	10.26 (1.57)	38.2 (23.8)	0.55
11/1/2005	0.250 (0.149)	1.515 (0.314)	0.271 (0.061)	9.41 (1.48)	62.1 (24.3)	0.51
11/2/2005	0.400 (0.161)	1.494 (0.310)	0.246 (0.066)	9.71 (1.42)	42.5 (23.8)	0.53
11/3/2005	0.340 (0.158)	1.577 (0.322)	0.238 (0.068)	10.11 (1.40)	52.2 (23.3)	0.53
11/4/2005	0.339 (0.169)	1.635 (0.320)	0.220 (0.070)	10.63 (1.31)	52.4 (26.5)	0.52
11/5/2005	0.425 (0.156)	1.680 (0.321)	0.195 (0.067)	11.02 (1.28)	43.6 (24.6)	0.54
11/6/2005	0.438 (0.152)	1.765 (0.319)	0.183 (0.066)	11.68 (1.26)	42.7 (24.0)	0.56
11/7/2005	0.449 (0.148)	1.709 (0.303)	0.168 (0.064)	12.00 (1.22)	45.0 (22.3)	0.58
11/8/2005	0.353 (0.136)	1.664 (0.294)	0.157 (0.057)	10.98 (1.17)	64.5 (20.4)	0.57
11/9/2005	0.362 (0.137)	1.694 (0.242)	0.135 (0.056)	6.51 (1.05)	66.5 (20.3)	0.56
11/10/2005	0.451 (0.156)	1.642 (0.197)	0.101 (0.056)	2.98 (0.97)	60.9 (23.3)	0.56
11/11/2005	0.402 (0.152)	1.594 (0.205)	0.095 (0.052)	3.96 (1.03)	70.8 (23.2)	0.54
11/12/2005	0.399 (0.144)	1.587 (0.215)	0.078 (0.056)	5.07 (1.10)	75.0 (21.3)	0.52
11/13/2005	0.431 (0.138)	1.615 (0.215)	0.057 (0.060)	5.87 (1.13)	74.1 (20.4)	0.52
11/14/2005	0.437 (0.137)	1.495 (0.219)	0.057 (0.056)	6.62 (1.04)	73.9 (20.8)	0.53
11/15/2005	0.521 (0.156)	1.427 (0.219)	0.034 (0.054)	7.57 (1.00)	66.3 (23.1)	0.55
11/16/2005	0.584 (0.172)	1.458 (0.220)	0.026 (0.051)	7.81 (0.99)	59.7 (25.5)	0.58
11/17/2005	0.650 (0.194)	1.292 (0.226)	0.024 (0.050)	8.39 (0.96)	50.5 (28.9)	0.58
11/18/2005	0.678 (0.174)	1.213 (0.235)	0.009 (0.047)	8.06 (0.99)	50.7 (25.4)	0.58
11/19/2005	0.763 (0.174)	1.244 (0.240)	0.019 (0.045)	8.17 (1.00)	33.8 (25.5)	0.60
11/20/2005	0.737 (0.170)	1.274 (0.238)	0.011 (0.045)	8.79 (0.96)	38.7 (24.2)	0.61
11/21/2005	0.734 (0.161)	1.236 (0.242)	0.008 (0.043)	9.43 (0.94)	39.9 (23.2)	0.63
11/22/2005	0.673 (0.174)	1.160 (0.239)	0.000 (0.040)	6.52 (0.99)	50.7 (25.5)	0.56
11/23/2005	0.575 (0.170)	1.150 (0.233)	-0.034 (0.042)	3.60 (1.21)	71.2 (24.4)	0.48
11/24/2005	0.672 (0.192)	1.152 (0.224)	-0.056 (0.044)	4.33 (1.28)	62.6 (26.6)	0.52
11/25/2005	0.717 (0.188)	1.139 (0.229)	-0.061 (0.039)	4.95 (1.19)	57.2 (26.5)	0.56
11/26/2005	0.732 (0.174)	1.082 (0.211)	-0.065 (0.038)	5.82 (1.11)	56.0 (24.5)	0.59
11/27/2005	0.748 (0.175)	1.126 (0.232)	-0.069 (0.038)	6.25 (1.11)	54.0 (24.5)	0.61
11/28/2005	0.760 (0.165)	1.115 (0.214)	-0.063 (0.035)	6.91 (1.03)	50.7 (23.0)	0.65
11/29/2005	0.890 (0.140)	1.243 (0.163)	-0.036 (0.030)	3.91 (0.80)	26.0 (18.1)	0.67
11/30/2005	0.965 (0.153)	1.150 (0.147)	-0.014 (0.031)	0.16 (0.85)	11.9 (21.8)	0.62

[1] Peak wholesale prices following Hurricane Rita occurred on September 29^{th}, 2005.

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