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Experimental Research of the Rockets and Feathers Phenomenon in Gas Markets

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Introduction

Rockets and feathers ("R&F") is a well-documented phenomenon in the academic literature of price theory. According to which, prices rise faster than they fall in response to market shocks. This phenomenon contradicts the traditional pricing theory, which states that prices should respond symmetrically to changes in costs. The term R&F is used interchangeably with the term "asymmetric pricing".

The R&F phenomenon can be observed in different markets. In food markets, for example, a rise in the cost of ingredients required to manufacture a certain product, would most likely lead to an almost immediate price rise. When the ingredients' price decreases, however, the products' price usually decreases much slower than during the price rise. In the automobile market, the rise of steel prices leads to an industry-wide car price rise while the decrease of steel prices is usually accommodated much slower.

However, the most common reference to the phenomenon refers to the gasoline market. In gasoline markets the phenomenon is expressed in a following manner: prices shown by gas stations depend on the input wholesale price, which is the price of gasoline quoted to them by the refineries. When a positive wholesale price shock appears (as a response to an oil crisis, for example), the station owners tend to respond rather quickly to it and adjust the prices accordingly. On the other hand, when a negative wholesale price shock appears, the price adjustment is much slower than after a positive shock.

Usually, in R&F studies, the approach is empirical in nature and focuses on price tendencies and existing market data research, rather than on consumers' behavior and its effect on prices (e.g. Peltzman (2000), Borenstein et. al. (1997)). A behavioral approach can provide some insight on consumers' choices and can assist with understanding the existence of this asymmetry. There is an obvious difficulty in observing real behavior and actions of individual consumers in different markets and particularly in a gasoline market. There is almost no existing data regarding individual behavior in real-world market transactions. The experimental approach, therefore, might be an appropriate methodology to explore the R&F phenomenon from the perspective of consumer or seller behavior. In the experimental lab, consumers' and sellers' behavior can be studied in a controlled environment, where it is possible to collect variables that are not observable in

the field (e.g. beliefs, foregone choices etc.). We can focus on certain, specifically chosen variables and collect them in a controlled environment.

There are a few experimental studies on the R&F phenomenon, some of them are conducted to study gas prices. However, these previous research either study different market levels (Deck and Wilson, 2008) or use experimental design that contains some characteristics that are significantly different from the way gas markets operate (Bayer and Ke, 2011). Accordingly, there are three main objectives to this proposed research. The first is to confirm the existence of the R&F phenomenon in the laboratory. While several previous research study the effect in experimental labs, it is important to see whether or not the R&F phenomenon is present when a retail gas market is simulated. The existence of this phenomenon in the lab is a necessary condition to the success of this research. The second objective is to understand the buyers-sellers relations in the retail gas market by observing the participants' decisions and the way they react to exogenous shocks. The third objective is to study the variables that have an effect on the R&F phenomenon. In particular, I investigate the effect of two variables. The first is the availability of retail prices to buyers, and the second is the information asymmetry, or the cases where information that affect prices is obtained by sellers only.

Literature Review

The price behavior defined as R&F is documented in several markets by Peltzman (2000), who conducts a comprehensive study of 77 consumer goods and 165 intermediate goods. Findings show that on average, the immediate response to a positive cost shock is at least twice as the response to a negative shock, and that difference is sustained for at least five to eight months.

In fact, a growing empirical literature documents asymmetric price adjustment in various markets, including gasoline, fruits and vegetables, beef and pork, and banking (Yang and Ye, 2008). Nevertheless, the phenomenon is recognized the most with retail gas prices (Lewis,2011, Verlinda, 2008, Tappata, 2009 and Borenstein et. al., 1997) and their response to crude oil price changes. The phenomenon is not country-specific and is documented in the UK (Bacon, 1991), US (most of the studies) and other countries.

Several explanations of the R&F phenomenon are offered in the literature. Borenstein et. al. (1997), for instance, propose three hypotheses. The first states that prices are sticky downward because when input prices fall, existing output price offers a natural focal point for oligopolistic sellers. Firms might choose to maintain a prior price until demand conditions force a change. According to the second hypothesis, negative supply shocks are accommodated faster than positive shocks because of production lags and finite gasoline inventories (i.e. if half of all the world's oil reserves suddenly disappeared, the long-run competitive price of gasoline would increase greatly, and consumption would decrease greatly. In contrast, if world oil reserves doubled overnight, the short-run response in the gasoline market would be limited by the available supply of processed or refined gasoline). According to the third hypothesis, volatile crude oil prices create a signal-extraction problem for consumers that lower the expected payoff from search. As a result, retailers become less competitive and prices fall slowly in response to negative cost shocks. When a consumer is aware of the volatility of either crude oil prices or retail gasoline prices, she may be more likely to believe that an increase in one station's retail price reflects crude oil price changes, rather than a change in the station's relative price in the retail market. Thus, the expected gain from search in reaction to a retail price increase may be smaller when crude oil prices are known to be volatile than when they are fairly stable.

Tappata (2009) suggests that consumers' search decisions affect the elasticity of the expected demand faced by firms and are therefore the reason for the price asymmetry. Specifically, if current price is high, consumers expect it to remain high, therefore expecting little price dispersion and, as a response, search very little. If in fact the unexpected occurs and gasoline cost drops, firms have little incentives to lower their prices because consumers' search is relatively small. On the other hand, if gasoline price is currently low, it is likely to stay low. For this reason, next period price dispersion is expected to be high, which intensifies consumers search. As a result, the response by firms to a positive cost shock is to raise prices significantly.

Peltzman (2000) confirms that high price volatility is associated with low price-asymmetry in most of the markets studied. However, there is no clear evidence that inventory level or an imperfect competition has an impact on price asymmetry.

Lewis (2011) develops a reference price search model of asymmetric prices, which predicts that consumers search less when prices are falling, resulting in higher profit margins and very little price response to changes in marginal cost. This model highlights an important inefficiency in this market: incorrect consumer expectations can lead to periods in which prices are well above their full information competitive level. If all consumers were informed about market prices and conducting price search, the reduction in equilibrium prices would be larger than the sum of consumers' search costs. However, provided that consumers have limited information, all firms charge higher prices and consumers cannot significantly gain by searching to acquire price information. Data reveals the presence of this inefficiency. Even when retail prices are well above wholesale costs, there is little variation in prices across stations. Therefore, one consumer would not gain much by choosing to search, even though firms would significantly lower their prices if all consumers were searching.

A few laboratory studies of the R&F phenomenon are documented. These studies focus mostly on the retailers-refiners relations (Deck and Wilson 2008) and buyers-sellers relations (Bayer and Ke, 2011). Deck and Wilson conduct a laboratory experiment to investigate the competitive effects of zone pricing on consumers, retail stations, and refiners. They construct a gasoline market with several refiners, gas stations and buyers. Buyers and gas stations are situated on the experimental map in different clusters. The researchers find that station prices in the clustered areas adjust relatively fast and asymmetrically to changes in oil costs. Station prices in isolated areas, on the other hand, adjust more slowly, but symmetrically to changes in costs.

Bayer and Ke (2011) conduct a fairly simple experiment with two sellers and one buyer, designed such that none of the typically important ingredients used to explain asymmetric price adjustment is present (so cost shocks should have no influence and no price adjustment after a shock should occur at all). Results show persistent deviations from equilibrium and asymmetric price adjustments are observed. An analysis of individual behavior suggests that bounded rationality (mainly in the absence of perfect information) is an important factor in asymmetric price adjustment. Evidence also shows that, as suggested by theory, asymmetric price adjustment is driven by buyers' asymmetric learning process of the true retailer's cost following a wholesale cost shock.

Adaptive expectations of the buyers drive the asymmetry: after a positive shock consumer search spikes (since prices have increased) and updating is immediate, while the lower prices after a negative shock reduce the search intensity. Sluggish updating allows the sellers to reduce the prices only gradually.

Experimental Design and Procedures

Nine laboratory experiments were conducted with nine participants in each session. Subjects were undergraduate students from Ben-Gurion University of the Negev, recruited from various disciplines. Each session consisted of 33 periods. In each session, a gasoline market is constructed and participants were randomly divided into two categories: three sellers and six buyers.

Each buyer has a "home" location and a "work" location. Each seller has a "gas station" somewhere between “home” and “work”. The distance from “home” to "work" is three kilometers for all buyers. In each period, a buyer is required to arrive to “work” from “home” using his “car”, which runs on gas. A “car” consumes one liter of gas for each kilometer. If the buyer has enough gas, he can drive straight to work using three liters of gas. If the buyer does not have enough gas (or if, for some reason, the buyer wishes to buy gas) he can drive to “work” via one of the three gas stations owned by the sellers. For each buyer, one station is on his way to “work”, one prolongs his driving distance by one kilometer and one prolongs his driving distance by two kilometers. The market is designed such that each station is on the way to the “work” of two different buyers, one kilometer away from “work” of two other buyers and two kilometers away from “work” of the remaining two buyers.

Each buyer’s car has a gas tank with a maximum capacity of 15 liters. If the buyer does not have enough gas and does not wish to buy gas (or cannot buy it due to insufficient funds), then the period is considered a “day-off” and he does not receive the periodic paycheck (the day – or period – is considered a day-off without pay). The salary is paid at the end of each period for buyers who manage to arrive to “work”.

Sellers, on the other hand, can buy unlimited supply of gas from the experimenter, paying for each litter a price specified by the experimenter at the beginning of each period. Sellers do not carry inventory and receive from the experimenter any amount

purchased by buyers at the specified unit price. The lack of sellers' inventory constraints resembles real-life conditions and environment, as stations do not hold gasoline for more than a few days, and can always replenish their inventory within hours, so in fact, gasoline inventory does not play a significant role at the stations level. At the end of each period, buyers receive information on their current balance, gasoline inventory and the amount of gasoline bought during the period. Sellers receive information on the amount of gasoline purchased from them over all, and also their periodic profit (as the multiplication of amount purchased from them and the difference between the sell and buy prices). Experiment instructions are provided in Appendix 2, screenshots are provided in Appendix 1.

Several treatments were conducted in this research. In the control, each period is conducted as follows: at the beginning, sellers observe the gas purchase price on their monitors ("wholesale price"). This wholesale price is provided by the experimenter and is revealed to sellers only. It is stochastic and drawn from a uniform distribution unknown to participants. Then, they need to determine the selling price, which is the price they receive from buyers for every liter they sell. Once decided, the buyers observe all gas prices offered by station and decide whether or not to purchase gas, and from what station. Then, at the end of the period, sellers observe the amount of liters they sold and the profits they made, and buyers observe the amount they earned by subtracting gas expenses from the periodic paycheck.

In order to study the effect of significant shocks, two price shocks are introduced in every session, one on period 11 and one on period 24. The two shocks are in opposite directions. In some sessions, the first shock is positive and the second is negative (these sessions are referred to as "regular" in terms of shocks in Table 1). Accordingly, for the first and last 10 periods, wholesale prices are uniformly distributed between 45 and 55 francs (the experimental currency), and between periods 11 and 23, wholesale prices are uniformly distributed 63 and 77 francs (10 percent deviation from 50 and 70 francs respectively). In other sessions, the first shock is negative and the second is positive (the prices in these sessions are distributed uniformly between 63 and 77 in the first and last 10 periods, and between 45 and 55 in periods 11 to 23. These sessions are referred to

"opposite" in terms of shocks in Table 1). The reason for applying this treatment is to study the effect of the price shock direction on the price asymmetry.

In the "search" treatment, buyers are required to pay a fee in order to see the prices charged by sellers ahead of time. Borenstein et. al. (1997), Bayer and Ke (2011) and Tappata (2009) suggest that buyers' search decisions are affected by the price shocks and vice versa. By applying the "search" treatment, the effect of buyers' search decisions on the price asymmetry can be observed and studied.

In the "competition" treatment, the distances to the gas stations were shortened compared to the control to 0.3, 0.6 and 0.9 kilometers for the first, second and third stations respectively. The purpose of this treatment is to observe the effect of competition on the price asymmetry.

In 7 out of 9 sessions sellers and buyers receive an announcement five periods before each price shock, stating that wholesale price (the cost of gas to the sellers) is about to change (either rise or fall accordingly) significantly within five periods at most. In the remaining two sessions, the announcement is shown only to sellers right before the price change. The purpose of the announcement is to test the effect of asymmetric information on price asymmetry.

The market is computerized using the Ztree software (Fischbacher (2007)) . Participants could not have negative earnings at the end of the experiment. It was not possible to buy on credit and the participants could buy gas up to their current amount of earnings. The experiment players (students) were rewarded for their participation according to the sum of end of period balances as follows: buyers' balance at the end of each period equals their endowment of cash at the beginning of the period plus earnings from work minus the expenditures on gas. Sellers' balance at the end of each period equals their initial endowment of cash plus the amount of gas sold multiplied by the markup (difference between selling and buying price).

Table 1 describes the experiments conducted for this research. Explanation on treatments follows.

Table 1: A description of the sessions conducted.

Session	Name	Extreme Shocks	Competition	Search	Asymmetric information
1	Control 1	Regular	No	No	No
2	Control 2	Regular	No	No	Yes
3	Control 3	Opposite	No	No	Yes
4	Control 4	Opposite	No	No	No
5	Competition 1	Regular	Yes	No	No
6	Competition 2	Regular	Yes	No	No
7	Competition 3	Opposite	Yes	No	No
8	Competition 4	Opposite	Yes	No	No
9	Search 1	Regular	No	Yes	No

Hypothesis Testing

The first test concerns the existence of the R&F phenomenon in experimental setup. In fact, the existence of this phenomenon is necessary to the validity of this research. We search for asymmetry of price change. Accordingly, we test the following first hypothesis:

H1: Price changes exhibit asymmetry. The relationship between a percentage change in retail price and a percentage change in wholesale price is positive but different depending on direction of the change in wholesale price.

The second test involves the influence of competition on the R&F phenomenon. Deck and Wilson (2008) suggest that in an environment with an increased competition,

the price asymmetry is more evident. This might be regarded as counterintuitive. As competition increases, the ability of buyers to search for alternatives is higher, which should drive prices down faster after a negative price shock. Therefore, the second hypothesis states that an increase in the level of competition (introduced in sessions as lower distance between stations and therefore lower cost of fueling in stations that are not on the way to "work") decreases the R&F phenomenon:

H2: When retail gas markets are more competitive, the asymmetry in price change diminishes.

The third test involves search costs. As mentioned above (Borenstein et. al, 1997, Bayer and Ke, 2011 and Tappata, 2009), when buyers face search costs, they tend to avoid the search. Therefore, a price increase is conceived more as a result of an increase in wholesale price rather than a local change (geographically). In this case, buyers tend to stick to the closest station. Accordingly:

H3: when buyers are required to pay for information on retail prices, the R&F phenomenon is expected to increase, as buyers tend to stick to the closest station and as a result, sellers tend less to reduce prices after a negative shock in wholesale price.

An additional test involves the R&F phenomenon in times of rare events with significant impact on prices. In each session, there are two types of price shock. The first is the more common, periodic shock. It is a stochastic shock that participants (both buyers and seller) cannot anticipate. The second shock occurs twice during the session in opposite directions. While the common price changes are stochastic and drawn from the same distribution, extreme shocks change the distribution itself. As a result, sellers (and therefore buyers) observe a significant shift (either up or down) of the average prices. In most sessions, these extreme shocks are announced five periods in advance. Buyers are expected to increase their demand before a positive extreme shock if announced to them. On the other hand, when a negative extreme shock is announced, competition grows as buyers are fully informed and expect prices to drop. This should drive prices down faster as well. When buyers are not informed of these extreme shocks, they cannot react to

them. The fourth hypothesis states that these extreme shocks have an effect on the R&F phenomenon as follows:

H4: Extreme shocks that are publically announced have an effect on the R&F phenomenon.

The last hypothesis involves the effect of information asymmetry. In two of the sessions, the extreme shocks are not publically informed. Instead, only sellers receive information about the price shocks at the beginning of the period where they occur. Accordingly, hypothesis 5 states the following:

H5: When only sellers are informed about the occurrence of an extreme shock, the R&F phenomenon should increase. While an increase in wholesale price justifies an immediate increase in retail price, sellers do not rush to decrease retail prices following a negative extreme shock, knowing that buyers do not expect such act.

The above hypotheses are tested and results are shown in the next section. Unless otherwise mentioned, statistical tests are conducted with 5% level of confidence. In addition, when statistical values are presented, the following applies: '*' represent 10% significance level, '**' represents 5% significance level and '***' represent 1% significance level.

Data Analysis and Results

The data analysis relied mostly on hypothesis testing. The data used for this research is the periodic costs and prices and the amount of gas sold and bought in each period. Hypothesis testing is conducted mainly using a regression analyses and a t-test to measure the effect of expectations on the chosen variable (amount of gas bought). The same tests are used to test the hypotheses above.

After carrying out all the sessions, the results are arranged and summarized as follows:

1. Descriptive statistics of the data.

2. A preliminary analysis of the existence of the R&F phenomenon shows that it does exist in experimental settings. A regression analysis shows that sellers change their prices more rapidly after a price increase.

3. A linear regression analysis shows that the R&F phenomenon increases significantly when competition intensifies.

4. T-tests applied on the amount of gasoline bought for testing the effect of expectations on the variable show that expectations drive buyers to buy significantly more gas in the periods between the announcement about an increase in wholesale price and the actual increase.

Descriptive statistics

Mean and standard error of periodic gasoline purchase (by buyers), profit and gas balance for each session type are shown in table 2.

Table 2: Descriptive statistics of gas purchases, profits and gas stock.

	Sessions 1, 4	Sessions 2, 3	Sessions 1-4	Sessions 5-8	Total
Buyers' Periodic Gas Purchase	2.9 (2.23)	3.0 (2.69)	2.9 (2.47)	2.9 (2.57)	2.9 (2.49)
Buyers' Periodic Profit	305 (146.15)	291 (185.79)	298 (167.29)	319 (159.26)	297 (172.21)
Buyers' Periodic Gas Stock	4.2 (4.07)	3.9 (3.64)	4.1 (3.86)	5.1 (4.06)	4.5 (3.90)

As can be depicted from Table 2, buyers purchased on average a bit less than three liters of gas every period. The periodic profit of sellers is around 300 franks and the stock of gas in buyers' gas tank averaged 4.5 liters. These figures are relatively stable across sessions, with the exception of the gas stock. It appears that when market is competitive, the stock of gas in buyers' gas tank is higher.

In addition to Table 2, Table 3 summarizes the number of buyers' working days which included passing through any of the gas stations.

Table 3: Average workdays with refueling per session.

Session	1	2	3	4	5	6	7	8	9
Average working days with refueling	25	20	26	26	25	22	23	24	26

According to Table 3, the average number of workdays with refueling for the average buyer across all treatments is 24 (out of 33, approximately 73% of total workdays). This means that buyers chose not to refuel almost 27% of periods on average. In addition, with an exception of one buyer in one particular period, buyers always drove to work and never missed a workday.

Hypotheses testing

A weighted average of the prices offered by the sellers in each period for each session is shown in Figures 1-9. Each observed value is standardized to one of the two possible values: 50 or 70, depending on the period. The standardization is calculated as the observed price from a specific seller plus the average price (of the actual uniform distribution – either 50 or 70) minus the wholesale price.. Each figure corresponds to the type of experiment in Table 1.

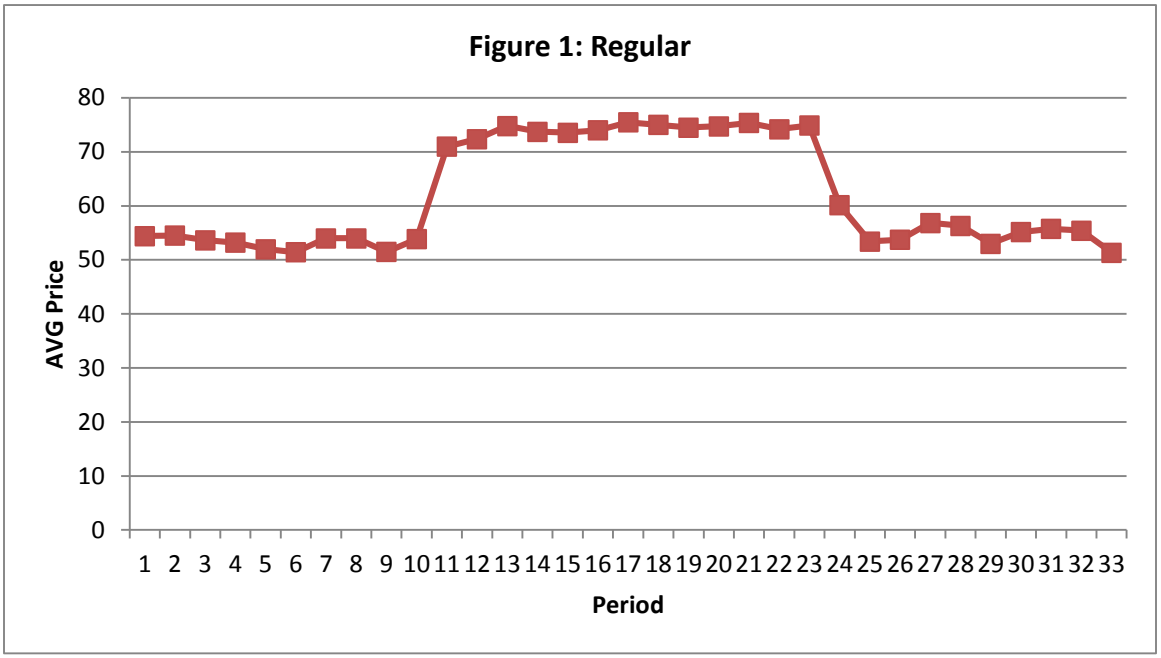
Figure 1: Regular
AVG Price
80
70
60
50
40
30
20
10
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33
Period

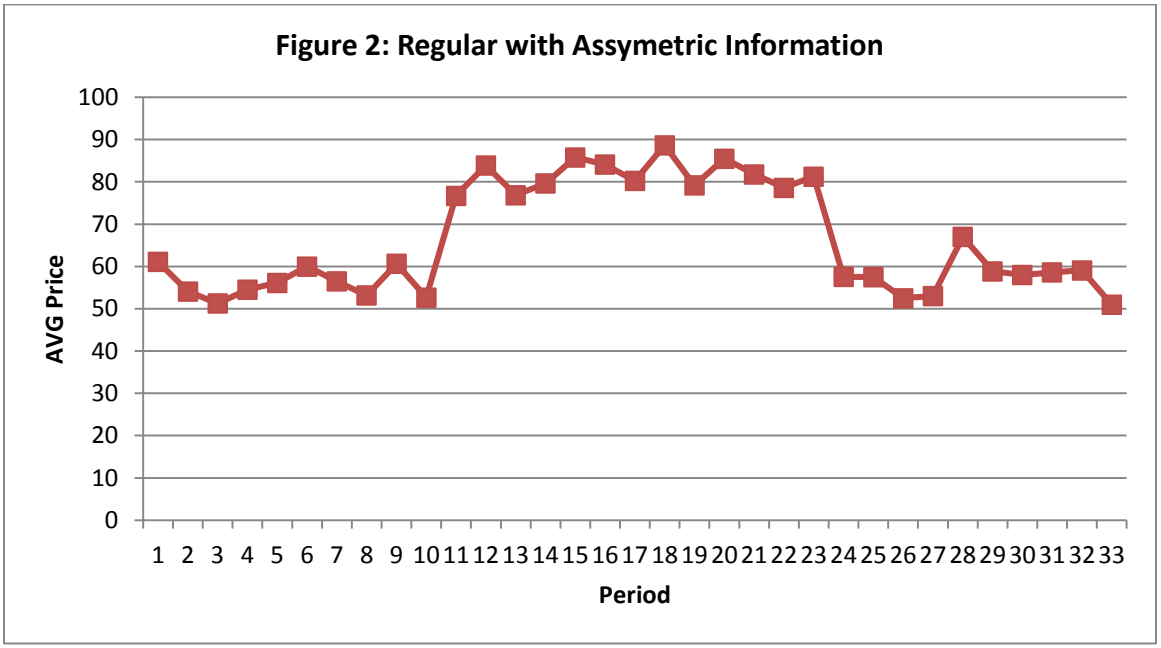
Figure 2: Regular with Assymetric Information
AVG Price
100
90
80
70
60
50
40
30
20
10
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33
Period

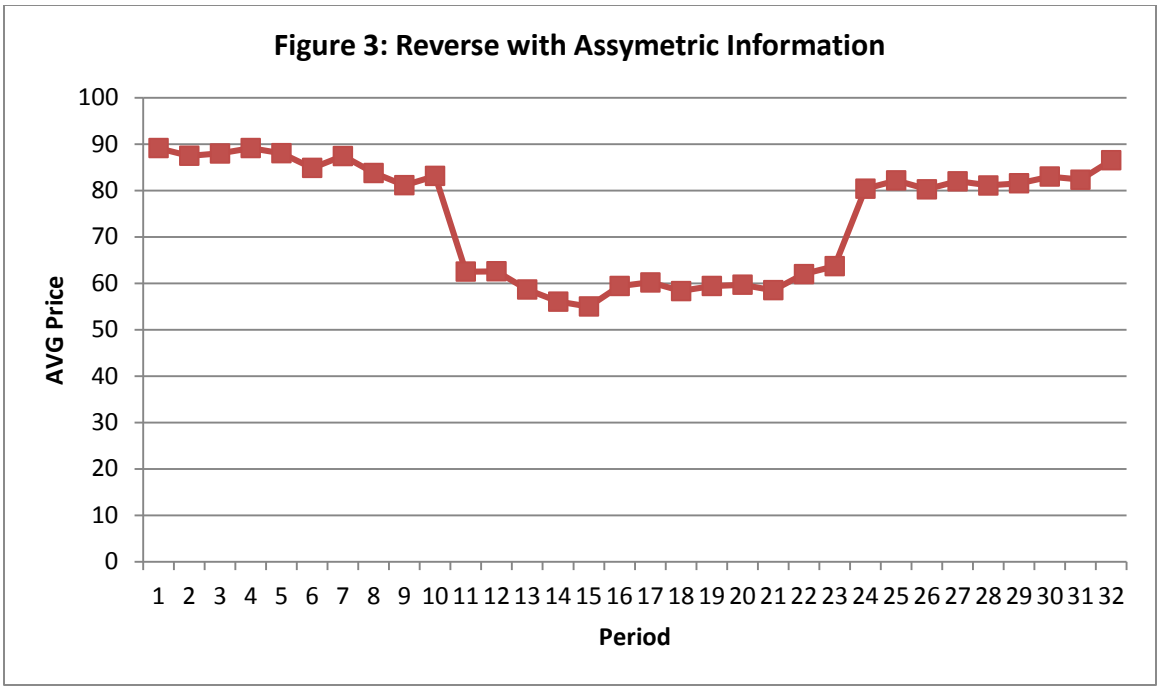
Figure 3: Reverse with Assymetric Information
AVG Price
100
90
80
70
60
50
40
30
20
10
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32
Period

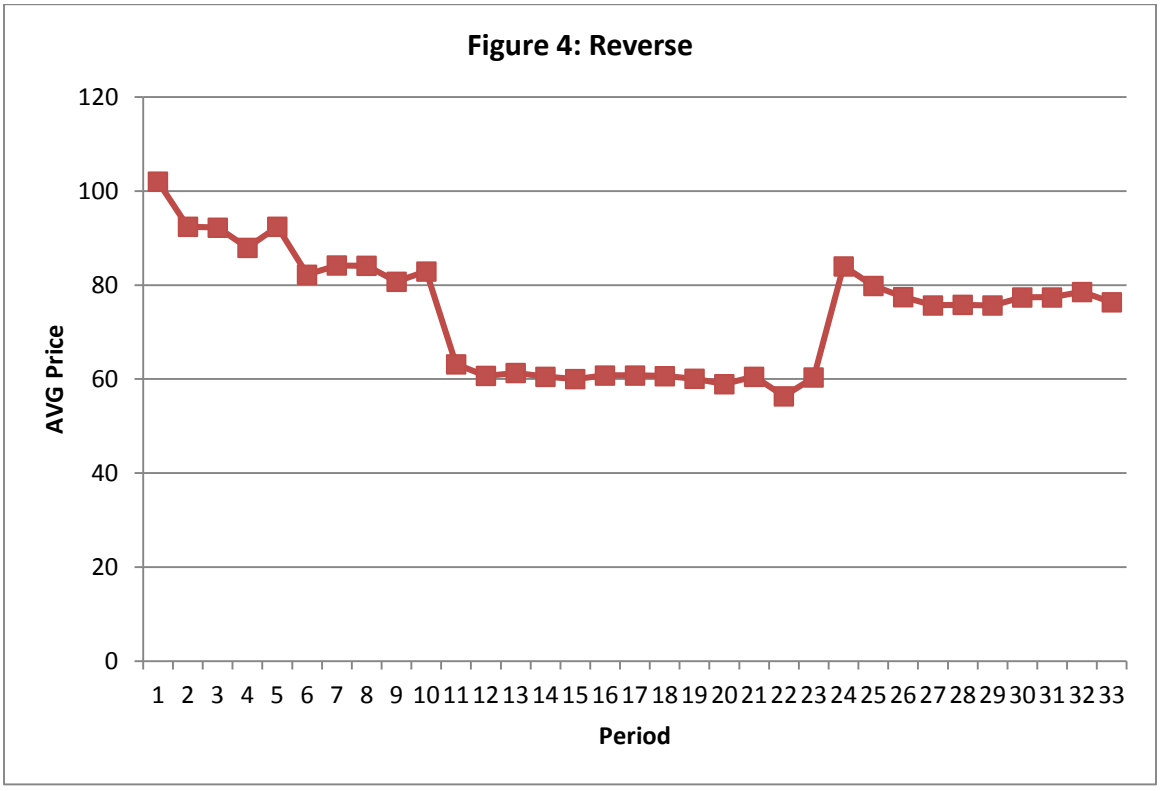
Figure 4: Reverse
AVG Price
120
100
80
60
40
20
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33
Period

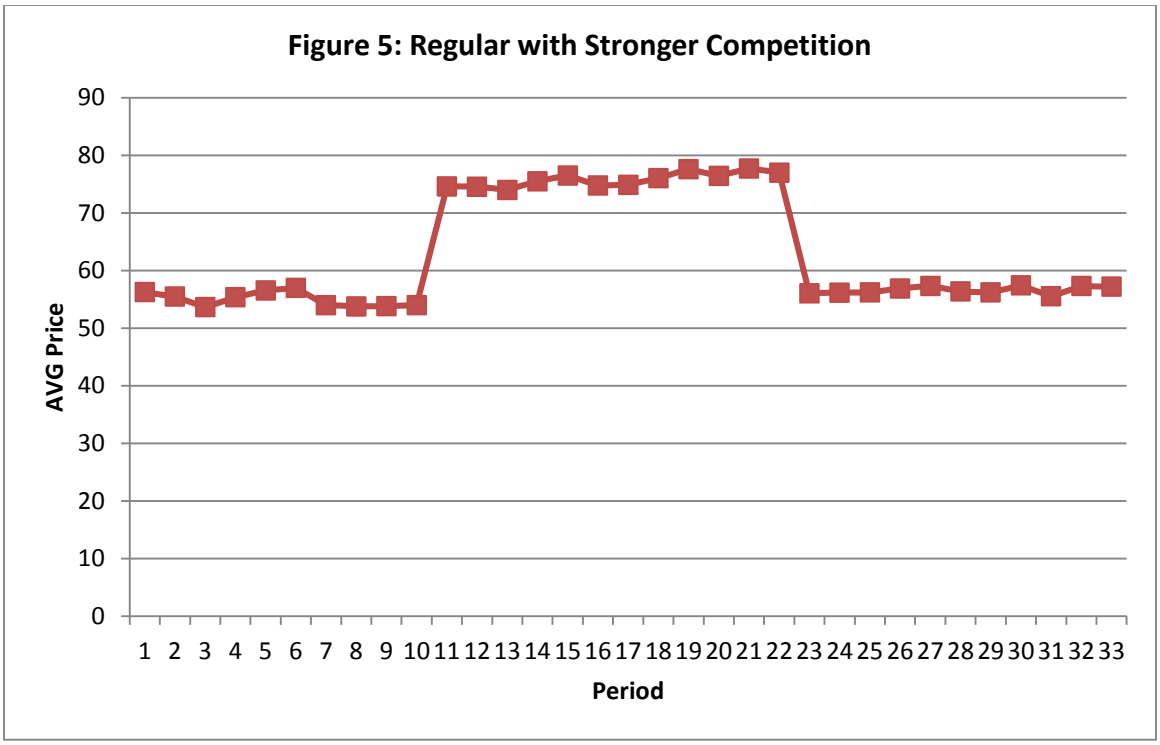
Figure 5: Regular with Stronger Competition
AVG Price
90
80
70
60
50
40
30
20
10
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33
Period

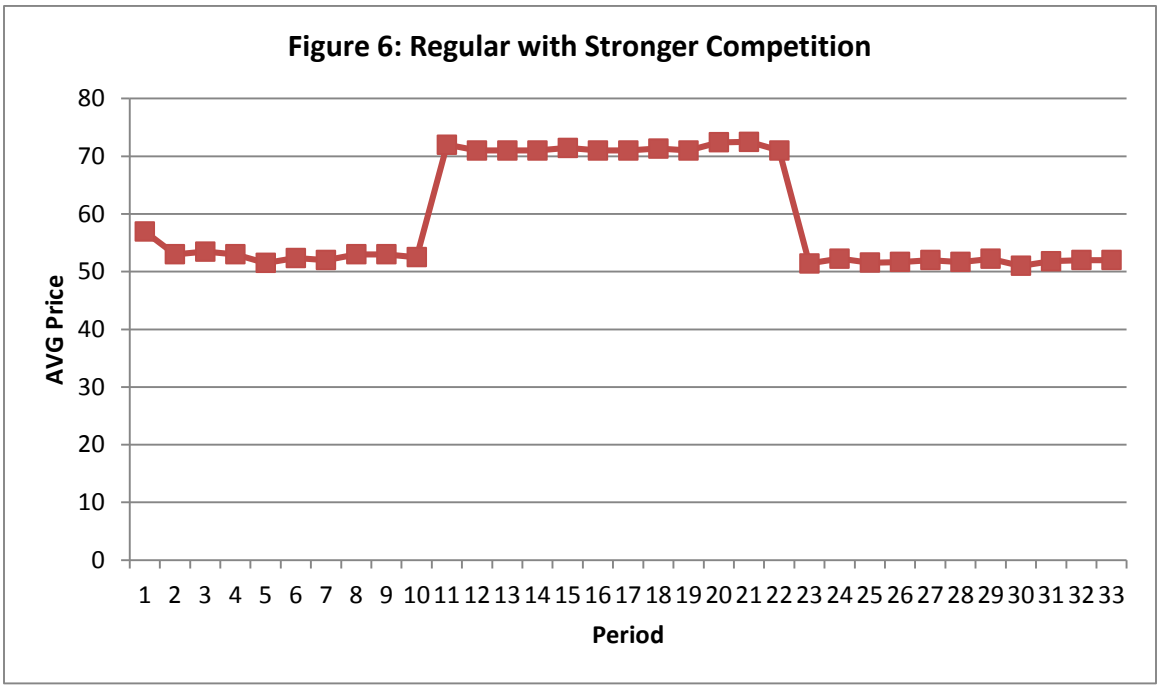
Figure 6: Regular with Stronger Competition
AVG Price
80
70
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Period

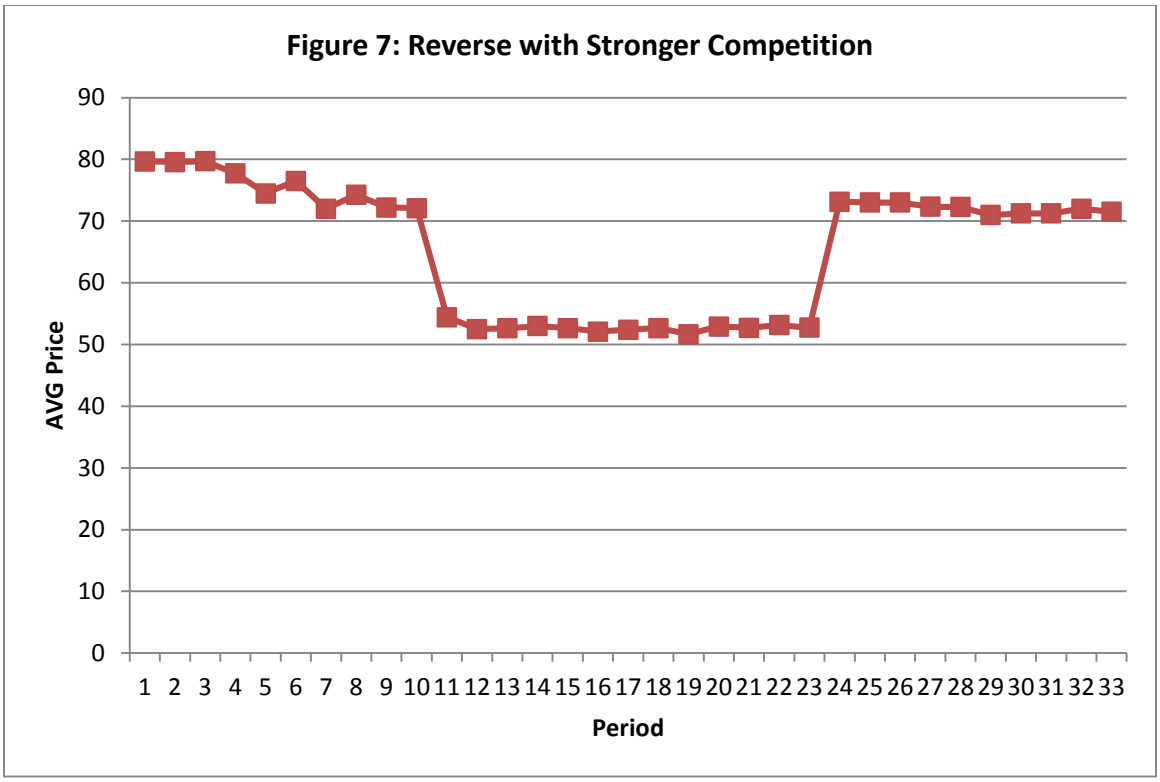
Figure 7: Reverse with Stronger Competition
AVG Price
90
80
70
60
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20
10
0
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Period

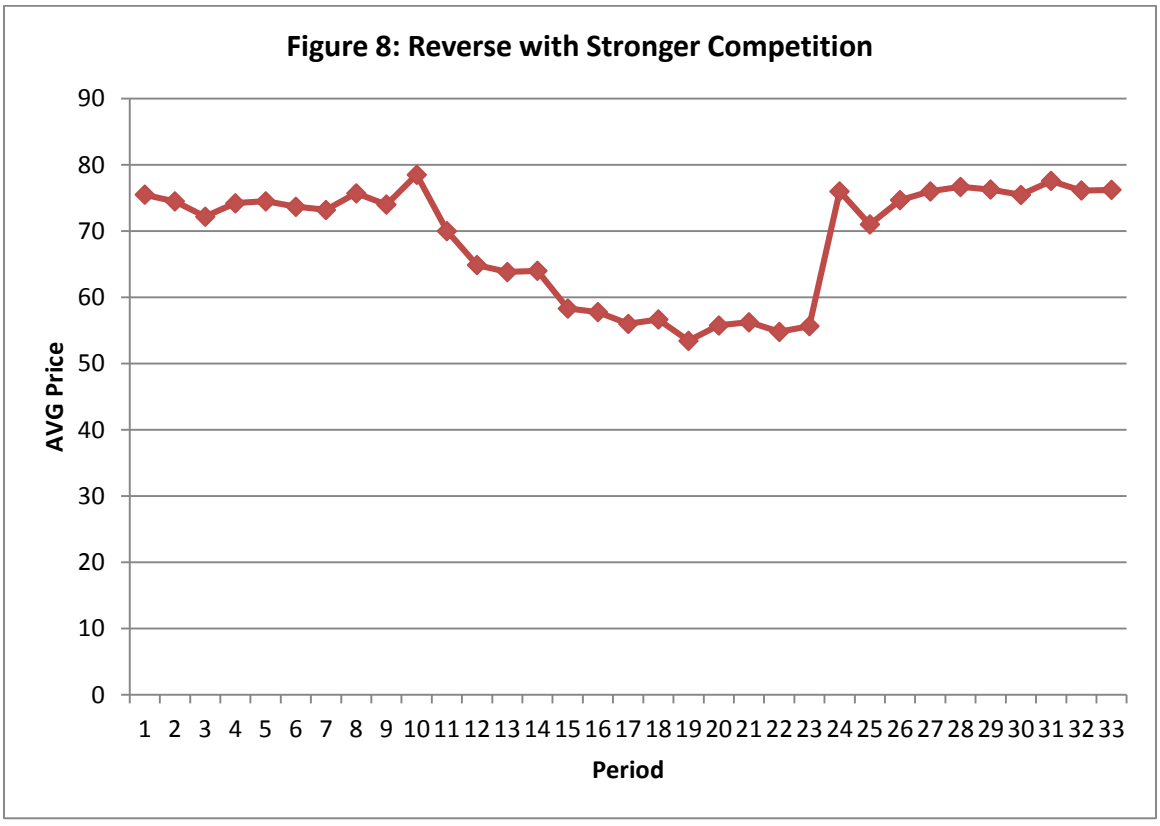
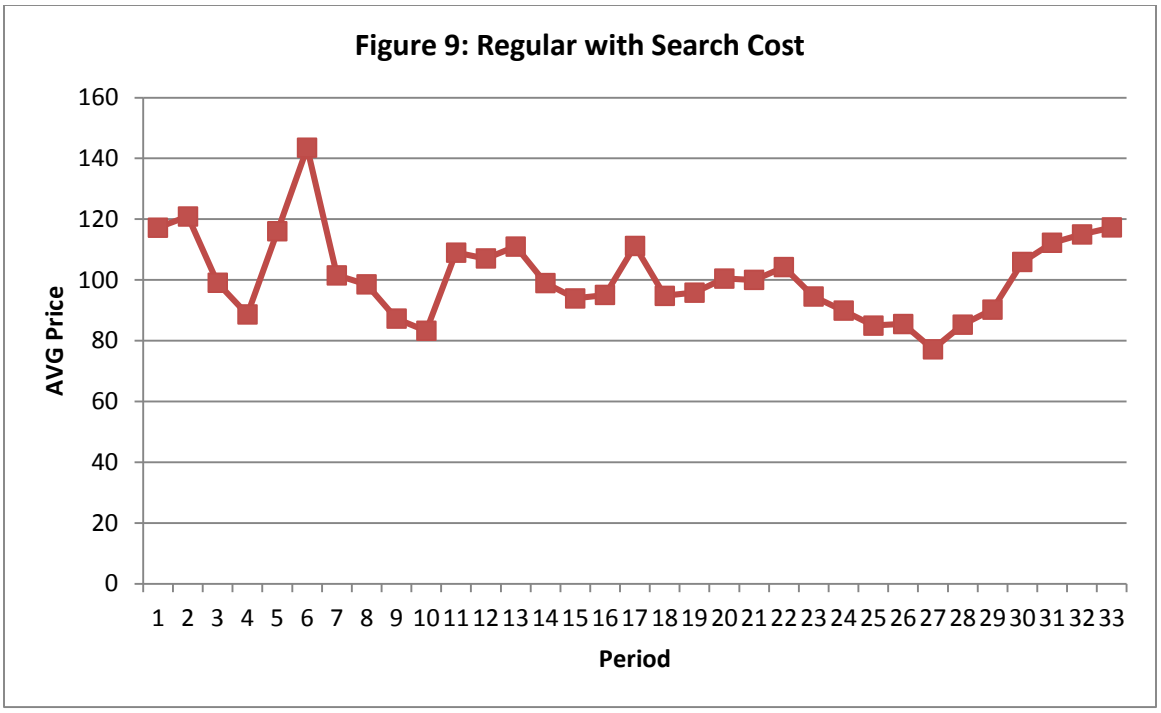


Figure 8: Reverse with Stronger Competition
AVG Price
90
80
70
60
50
40
30
20
10
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33
Period



We elaborate on these figures below. We use the following equation to test hypothesis H1:

$$(1) \qquad \Delta P_t^i = \alpha_i + \beta_1 * \Delta P_t^w + \beta_2 * D + \beta_3 * (D * \Delta P_t^w) + e_t$$

where ΔP_t^w is the percentage change in wholesale prices between two consecutive periods, ΔP_t^i is the corresponding percentage change in the retail price offered by seller i, D is a dummy variable that receive the value "*1*" if $\Delta P_t^w \geq 0$ and "*0*" otherwise, α_i is a vector for seller-specific intercepts and e_t is the model residual.

In general, we expect β_1 to be positive, because sellers are expected to increase prices when wholesale prices increase in order to preserve their margins. Additionally, we expect sellers to lower prices when wholesale prices decrease due to competition (at least to some extent). Price asymmetry is present if $\beta_3 \neq 0$. Furthermore, the presence of the R&F phenomenon should be concluded if $\beta_3 > 0$.

To start, Equation 1 was used with the entire database. Results are shown in column 1 of Table 4 (the numbers in brackets are standard errors). As can be seen, β_1 is positive and significant. In addition, β_3 is also positive and significant. Intuitively, the

increase of retail prices following a given increase in wholesale prices is more than 30% higher than a decrease in retail prices following the same given decrease in wholesale prices.

Table 4: parameters values.

Coefficient	Entire data (col. 1)	Sessions 1-4 (col.2)	Sessions 5-8 (col.3)	Session 9 (col.4)
N	864	384	384	96
R^2	0.54	0.66	0.82	0.12
β_1	0.643^{***}	0.664^{***}	0.812^{***}	-0.162
	(0.069)	(0.085)	(0.053)	(0.491)
β_2	0.003	0.005	-0.004	0.025
	(0.010)	(0.012)	(0.008)	(0.073)
β_3	0.209^{**}	0.136	0.116^{*}	1.063^{*}
	(0.083)	(0.098)	(0.067)	(0.605)

Column 2 of Table 4 provides results from the same Equation 1 with data from the four control sessions. As can be seen, both β_1 and β_3 are positive. The value of β_1 is expected while β_3 is not significant. The price symmetry therefore cannot be rejected in the control experiments.

Moving on to hypothesis *H2*, the next step is to search for the existence of the R&F phenomenon in more competitive markets and test the hypothesis that the R&F phenomenon is lower when markets are more competitive. As mentioned, experiments 5-8 are designed to be more competitive by lowering the distance between stations. In these experiments, the distance between two stations is 0.3 kilometers, instead of 1 kilometer in the control. Column 3 of Table 4 contains the results of estimating the parameters of

Equation 1 using data from experiments 5-8. This column should be compared to the third column from the left, which contains parameters values using data from experiments 1-4 (control). Results show that when markets are more competitive, the value of parameter β_3 is significant, which implies that the existence of the R&F phenomenon in these competitive markets is accepted.

To test hypothesis *H3*, a special session was conducted with search costs (the "search 1" session in Table 1). In this session, retail prices at the beginning of each period were not revealed to buyers. Instead, buyers could obtain this information for a fee. The purpose of this treatment is to imitate real conditions where the representative driver does not have information on gas prices in every station within a short driving distance. In real conditions, "gas shopping" implies driving around to observe prices, which means spending time and fuel. These are represented in the "search 1" experiment as search costs.

Results for the search treatment are described in column 4 of Table 4. Accordingly, the parameter β_3 is positive and significant (although at the 10% level of significance only), while the parameter β_1 is insignificant, which suggests that retail prices do not normally respond to changes in wholesale prices. This means that sellers tend to increase retail prices when wholesale prices go up, but tend to keep them high when wholesale prices go down. In addition, Figure 9 shows that the average retail price in this experiment is relatively higher (around 100) compared to the rest.

For testing the effects of extreme positive and negative shocks (hypothesis *H4*), initial conclusions should be drawn from Figures 1-9. Figures 2-7 clearly show that after wholesale price rises, the average retail price rises within one period. The same happens when the wholesale price falls – the average retail price falls within one period. The slope of the graphs during these changes in wholesale price seem almost identical in all six figures. In Figure 1, after the decrease in the wholesale price, it takes two periods for the average prices to settle in a fairly constant level and only one period for the price to settle after an increase in wholesale price. In figure 3 it takes 3-4 periods after the decrease in wholesale price for the average prices to settle in a fairly constant level and only one period after the price rise for the same to happen. These price patterns are also observed

in sessions 2 and 3 where information is asymmetric and buyers are not informed on changes in wholesale price. Interestingly, when search cost is present (Figure 9), retail prices do not respond to extreme changes in wholesale price as in experiments without search cost. On the other hand – as mentioned – retail prices are significantly high to begin with. Sellers in this session seem almost unaffected by the shocks.

It can be seen, therefore, that there is no clear evidence of price asymmetry in most sessions. In fact, in only two out of nine sessions some asymmetry exists. In six sessions no asymmetry is observed and in one session (session 9) no clear response to cost shocks is shown.

The lack of asymmetry following a wholesale price change is shown across all treatments except the "search cost" treatment. The sessions that show some asymmetry (Figures 1 and 8) belong to different treatments: one is "regular" and the other is "reverse with competition".

To test the asymmetry in prices following an announcement on extreme shocks (hypothesis *H5)*, we use the following regression equations:

(2) $$\Delta P_t^i = \alpha_i + \beta_1 * \Delta P_t^w + \beta_2 * D + \beta_3 * (D * \Delta P_t^w) + \beta_4 * (\Delta P_t^w * CngP) + \beta_5 * (D * \Delta P_t^w * CngP) + e_t$$

(3) $$\Delta P_t^i = \alpha_i + \beta_1 * \Delta P_t^w + \beta_2 * D + \beta_3 * (D * \Delta P_t^w) + \beta_4 * (\Delta P_t^w * CngN) + \beta_5 * (D * \Delta P_t^w * CngN) + e_t$$

where *CngP* and *CngN* are dummy variables set to 1 in each of the five periods prior to the extreme positive and negative change respectively. The parameters of Equations 2 and 3 were estimated four times each: first, for sessions 1 and 4, to test the effect of extreme shocks announcements in monopolistic competition and symmetric information. Second, for sessions 2 and 3, to test the effect of extreme shock announced to sellers only on the R&F phenomenon in monopolistic competition. Thirds, for session 5-8 to test the effect of extreme shocks announcements on competitive markets. Finally, for all sessions where extreme shocks were announced (namely sessions 1, 4-9).

Table 5: Regression results for Equations 2 and 3.

Sessions	1, 4	2, 3	5-8	1-4, 9	1, 4	2, 3	5-8	1-4, 9
Shock Type	Negative	Negative	Negative	Negative	Positive	Positive	Positive	Positive
N	162	162	324	486	162	162	324	486
R^2	0.76	0.69	0.86	0.81	0.67	0.71	0.84	0.77
β_1	0.547***	0.848***	0.815***	0.731***	0.540***	0.391***	0.804***	0.719***
	(0.099)	(0.146)	(0.054)	(0.050)	(0.121)	(0.079)	(0.055)	(0.055)
β_2	-0.001	0.014	-0.003	-0.001	0.003	0.004	-0.001	0.002
	(0.015)	(0.019)	(0.008)	(0.008)	(0.018)	(0.018)	(0.009)	(0.008)
β_3	0.072	-0.028	-0.157	-0.089	-0.140	-0.301	-0.248	-0.252*
	(0.172)	(0.208)	(0.123)	(0.101)	(0.216)	(0.242)	(0.183)	(0.133)
β_4	0.315*	-0.051	0.127**	0.169**	0.309**	-0.139	0.138***	0.173**
	(0.115)	(0.165)	(0.067)	(0.060)	(0.169)	(0.157)	(0.069)	(0.066)
β_5	-0.280	-0.095	0.235	0.071	-0.193	-0.141	0.037	-0.013
	(0.236)	(0.294)	(0.151)	(0.130)	(0.296)	(0.343)	(0.214)	(0.169)

Table 5 shows that the relationship between changes in wholesale and retail prices is positive and significant in all treatments. Moreover, the value of the parameter β_4 show that in most sessions, the relationship between changes in wholesale and retail prices is significantly higher. In fact, this relationship is not significantly higher only when announcement is given to sellers only. However, focusing on the R&F phenomenon during extreme shocks, we concentrate on the values of the parameter β_5. Results show no evidence of the R&F phenomenon in periods following announcements on extreme

shocks across sessions. It is left to accept the null hypothesis that announcements (or lack of announcements) regarding extreme shocks have no effect on the R&F phenomenon.

After failing to find evidence of the R&F phenomenon during periods with extreme shock anticipation, we test the difference (if exist) in the amount of gas purchased between routine periods (periods under no announcement) and periods under announcement (the five period interval starting from the period of announcing the extreme positive or negative shock and ending at the period of the shock). While prices do not react asymmetrically during periods following price shock announcements, it is possible that buyers do behave differently during these periods. The purpose of the following test is therefore to see if demand is influenced by extreme shock announcements. A two-sample, two-tailed t-test assuming unequal variances is conducted on gas purchases. Intuitively, we expect to see an increase in purchases following the announcement on a price increase, because buyers would prefer to fill their gas tanks as much as they can and pay low price. Conversely, we expect to observe a decrease in purchases following the announcement on a price decrease, because when buyers are informed about a price decrease in the near future, they should lower purchases in the present in order to avoid paying higher prices. If this would have been the case, then we should observe some sort of price symmetry. The increase in demand during anticipation of a price increase should drive prices up, while the decrease in demand during anticipation of a price decrease should drive prices down. An effect of extreme shock announcements on demand is important because the experimental design may not incentivize sellers to respond to demand changes. A price reaction in the field does exist.

The sessions are divided as follows: sessions 1, 4 (with announcement and low competition), sessions 2, 3 (no announcement and low competition), sessions 5-8 (with announcements and with competition), and session 9 (with search cost). The results are shown in Table 6. Full results are provided in Appendix 3.

Table 6: T-test results.

	Price increase			**Price decrease**		
	Five periods mean	Other periods mean	**p-value**	Five periods mean	Other periods mean	**p-value**
Sessions 1,4	3.533	2.764	0.047	3.000	2.764	0.429
Sessions 2,3	2.683	3.027	0.333	3.167	3.027	0.734
Sessions 5-8	3.662	2.833	0.003	2.432	2.833	0.071
Session 9	2.567	2.812	0.464	4.000	2.812	0.017

As can be seen from Table 6, the average amount of gas purchased is significantly higher during the five periods following the announcement on a price increase compared to routine periods in sessions where announcement is made to all participants and no search cost are present. This finding is expected: buyers increase their purchases when expecting a price increase in the near future. Actual change in price in sessions where announcement was actually made (namely sessions1 and 4 with significance level of 0.047, and sessions 5-8 with significance level of 0.003). When buyers do not expect such change (because they are not informed about it, in sessions 2, 3), they do not increase their purchases. As can be seen, the amount purchased in these two sessions is not significantly different from purchases during routine periods. The announcement effect on gas purchases is clear and significant when wholesale price increases. But when wholesale price decreases, there is no significant difference in the amount of gas purchased across all sessions, with the exception of session 9. It should be also noted that in the competition sessions (sessions 5-8), buyers do purchase less gas when expecting prices to fall in the near future. This difference is significant, however, in the 10% level only. This finding adds some insight to the earlier noted observation that R&F phenomenon is evident in more competitive markets.

Using Table 6, we explain how buyers' expectations affect (or even generate) the R&F phenomenon during extreme shocks. The price asymmetry stems from asymmetry in demand response to announcements. Expecting a price increase, buyers rush to

purchase gas before prices rise. On the other hand, expecting gas prices to decrease, demand does not fall as buyers do not change the amount of gas they purchase.

Because of the relatively small sample size, we also conducted a non-parametric Mann-Whitney U test for the medians of gas purchases in addition to the t-tests provided in Table 6. As the test is non-parametric, it does not assume a normal distribution of the data (as opposed to the t-test). The results are shown in Table 7.

Table 7: Mann-Whitney U test results..

	Price increase p-value	**Price decrease p-value**
Sessions 1,4	0.056	0.418
Sessions 2,3	0.428	0.729
Sessions 5-8	0.003	0.164
Session 9	0.766	0.01

The results of the Mann-Whitney U test are consistent with the t-test results in Table 6. Almost all significant differences in Table 6 are also significant in Table 7, with the exception of price increase in sessions 1, 4 (0.056 vs. 0.047) and price decrease in sessions 1-5 (0.164 vs. 0.071). These values, however, are very close and can be considered identical.

In sum, we show that the R&F phenomenon exists (when examining periodic prices) in general and is intensified in sessions with competition. Extreme wholesale cost shocks have no significant effect on price asymmetry. Information regarding cost shocks leads to a higher demand before expected wholesale cost increase but does not lead to a lower demand before expected wholesale cost decrease.

Conclusion

Price asymmetry in gasoline markets, i.e. the Rockets and Feathers phenomenon, is studied extensively in the economic literature. Naturally, empirical studies are the most common, because market prices are usually publically available. However, empirical studies based on market prices cannot reveal agents' behavior effects on the phenomenon and how market structure (like competition or search cost) is related to it. The best methodology to test individual behavior on the R&F phenomenon is the experimental

approach, because this way, researchers have the ability to elicit real time decisions, choices and outcome. Experimental studies of the R&F are, to the best of my knowledge, quite scarce.

In this work, a laboratory experiment of the R&F phenomenon is conducted. This study involves nine experiments with nine participants in each session, divided into three sellers and six buyers. Each session consists of 33 periods. In all sessions, a wholesale price shock occurs after the first ten periods, lasting thirteen periods. Then, another shock occurs, with the opposite direction. Sessions differed in treatments (each session could include more than one treatment). Sessions differed according to the following characteristics:

1. The direction of the extreme shocks was reversed.
2. Asymmetric data (in these sessions buyers were not informed about the upcoming price shocks, while sellers were informed close to the period of the shock).
3. A search cost, in which buyers had to pay to see the prices of all stations (as opposed to seeing only the closest station price).
4. Enhanced competition, in which buyers had shorter driving distances to stations.

Testing the effect of extreme shocks on the price asymmetry reveals that the effect is insignificant. However, in general, price asymmetry does exist. A regression analysis on periodic retail price reaction to periodic changes in wholesale prices show that price asymmetry exists under certain conditions. In all sessions where some monopolistic power is given to stations, no significant price asymmetry is observed. In sessions with higher level of competition, on the other hand, a significant price asymmetry is observed. Based on these findings, we conclude that competition is a driver for price asymmetry whereas lower competition reduces it. This finding contradicts the expected outcome of stronger price asymmetry in sessions with monopolistic competition. However, the same pattern was observed by Deck and Wilson (2008). One possible explanation could be that in competitive markets, sellers' profits are smaller than in a monopolistic environment. Sellers therefore respond more carefully to changes in inputs that may have an effect on their profit margin. While this explanation is only a mere suggestion, a further research is encouraged to explore this counterintuitive finding.

Testing the effect of information on the R&F phenomenon, different approaches are taken. A regression analysis of price changes during the periods between an announcement and the actual change reveals no significant difference. Investigating the demand side (the amount of gasoline purchased) during these periods reveals a different picture. Expecting a price increase, buyers rush to purchase gas before prices rise in all sessions with an announcement. On the other hand, expecting gas prices to decrease, demand does not fall as buyers do not change significantly the amount of gas they purchase after the announcement. There are two exception, however. The first is in buyers' response to an announcement in the competitive sessions, and the other during the "search cost" session. The average amount of gas purchased during periods following an announcement on a price decrease was smaller than the amount purchased in other periods in competitive markets (p-value is 7%). The "search cost" analysis shows an opposite picture: the amount of gas purchased between the announcement on the price decrease and actual price change is significantly higher than the amount purchased during routine periods.

When no announcement is made, there was no significant difference (in both means and medians) between the periods following announcements and routine periods. Thus, it is reasonable to conclude that information regarding extreme price shocks reduces price asymmetry via demand response to the announcements.

In sessions with search cost, surprisingly, no response to extreme shocks in wholesale prices is shown. Looking at periodic changes, however, price asymmetry still exists with the presence of search cost. The price asymmetry is stronger compared to sessions without search cost. This finding is consistent with the intuition that since search cost reduces competition, price asymmetry should be observed. However, these findings contradicts the previous notion that competition increases price asymmetry.

Any experimental study done in a particular environment applies only to the environment that it simulates. The physical environment in the lab could have an effect on participants' decisions and thus the results and conclusion. In the field, decisions taken by individuals could be different because the field is different (e.g. buyers can be fired if

they do not arrive to work, some price discrimination in the wholesale level may exist from refineries etc.).

This study is limited to the retail market and does not cover the wholesale market, where gas stations interact with refineries. Some previous studies that cover this market level point at the wholesale market as a possible contributor to price asymmetry. Also, it does not cover the effect of tacit collusion and the effect of wholesalers' inventory levels on R&F. We do leave these to future research.

I would suggest that future research should concentrate on the effect of search cost on the R&F phenomenon. In this study, results regarding search cost are inconclusive. In addition, I believe that the effect of asymmetric information on price should be studied more thoroughly and under different conditions.

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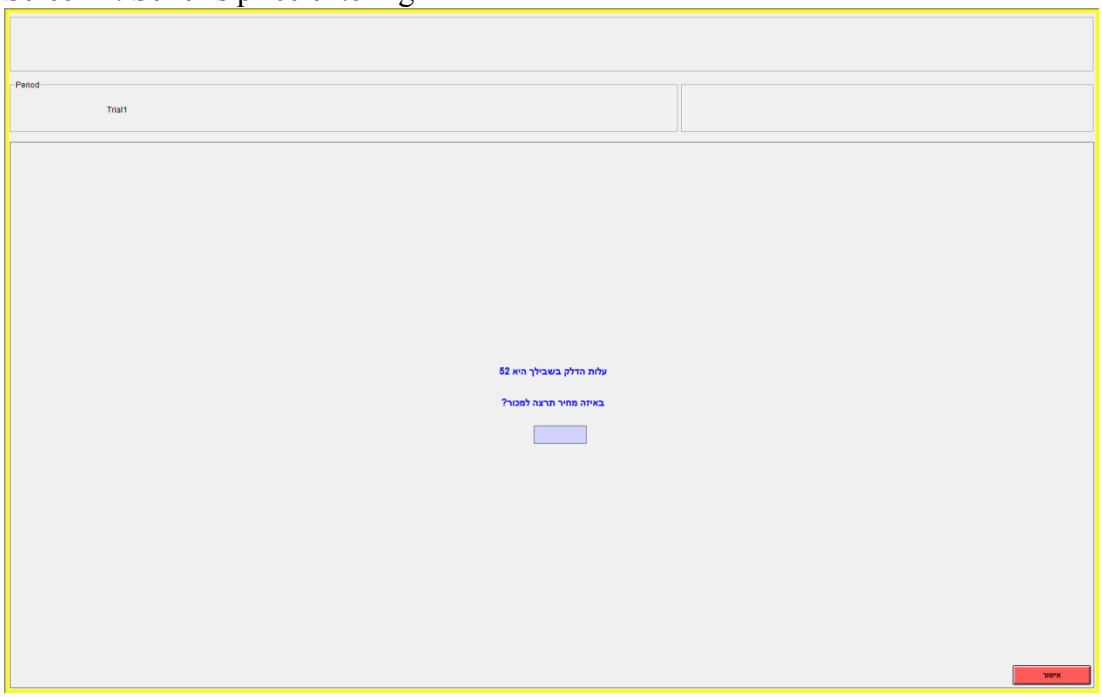
Appendix

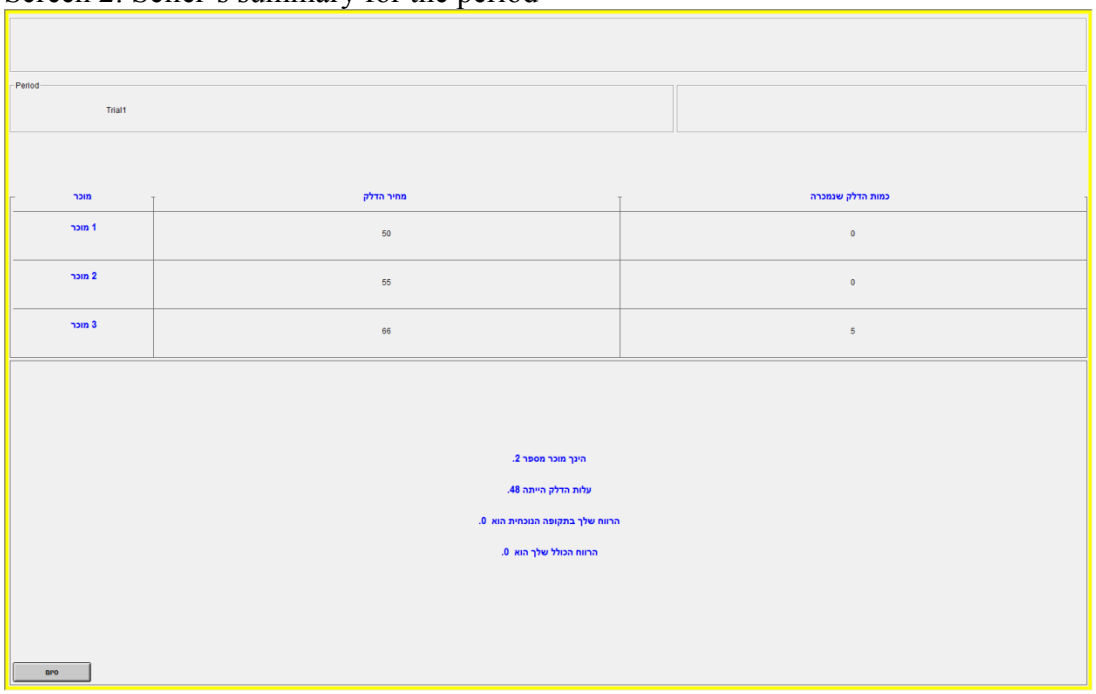
Appendix 1 – Sellers' and Buyers' Ztree screens

Sellers' screens

Screen 1: Seller's price entering

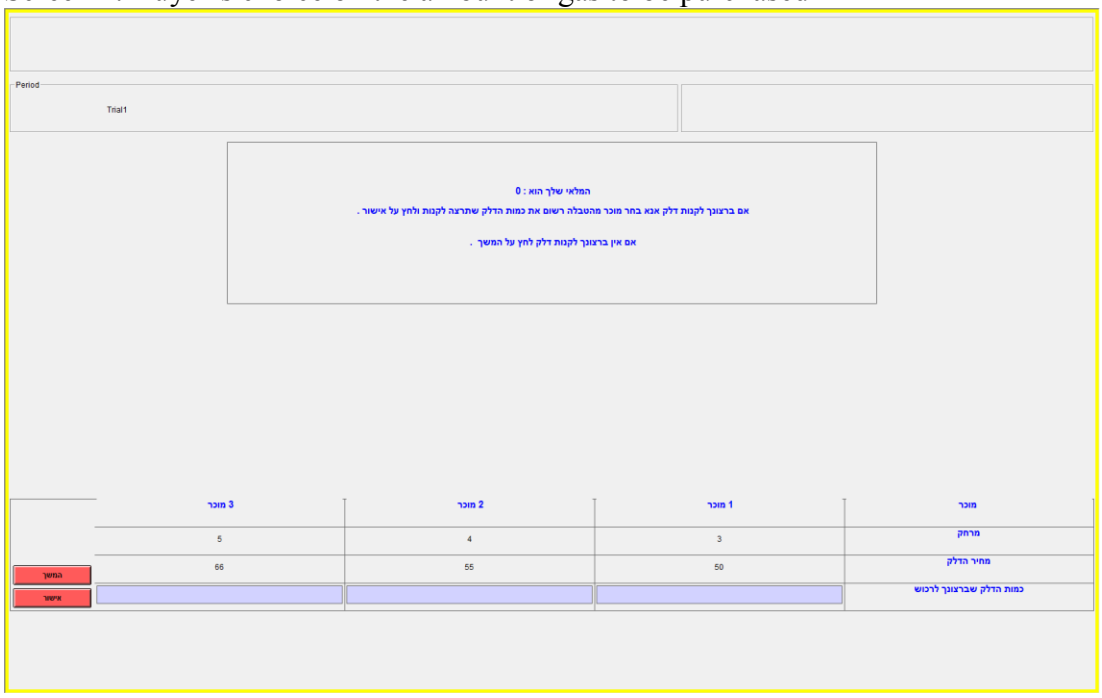


Screen 2: Seller's summary for the period

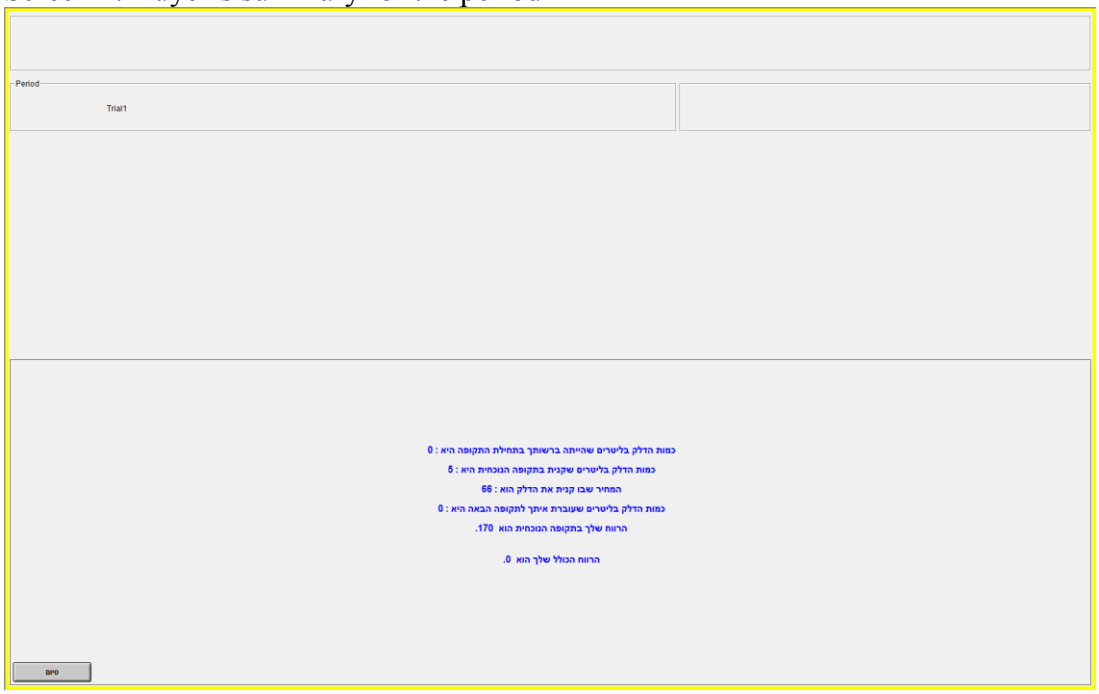


Buyers' screens

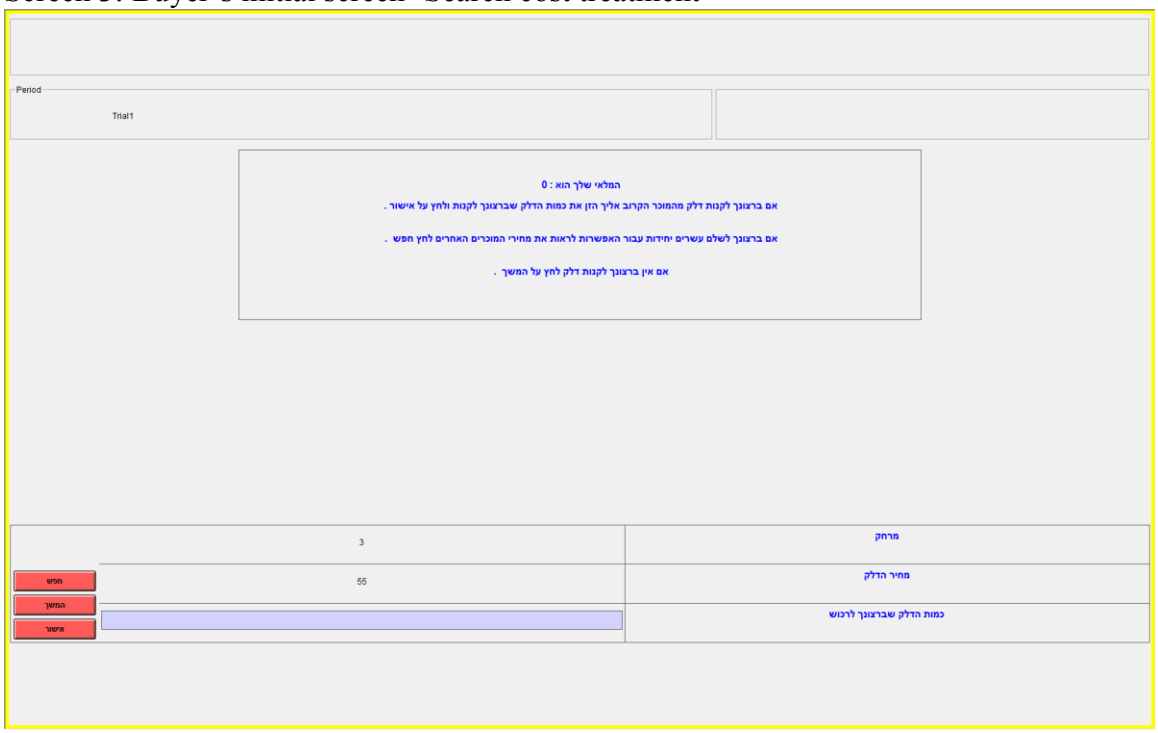
Screen 1: Buyer's choice on the amount of gas to be purchased



Screen 2: Buyer's summary for the period



Screen 3: Buyer's initial screen- Search cost treatment



Appendix 2 – Experiment instructions given to participants

מטעמי נוחות הפנייה בהוראות הניסוי היא בלשון זכר בלבד אך הכוונה היא לנשים וגברים כאחד.
אתם עומדים להשתתף בניסוי בקבלת החלטות. בניסוי זה אין החלטות נכונות או לא נכונות אולם ההחלטות שאתם והמשתתפים האחרים יקבלו במהלך הניסוי ישפיעו על הסכום שאותו תקבלו בסוף הניסוי. לכן תשתדלו לבצע את הבחירות שנראות בעיניכם לנכונות ביותר.
תוצאות הניסוי ישמשו למטרות המחקר בלבד וישמרו בסודיות מוחלטת. לאחר תום הניסוי אף אחד לא יוכל לגלות אילו החלטות קיבלתם ואילו סכומים הרווחתם.
הדרך היחידה להשתתף בניסוי היא דרך המחשב שלפניכם. אין מחשבים נוספים המשתתפים בניסוי זה מלבד המחשבים שנמצאים בחדר זה. אין מניפולציות שמבוצעות ממחשבים אחרים-הינכם היחידים שמפעילים את התוכנה ואין אף אחד אחר שמתערב במהלך הניסוי.
בניסוי זה משתתפים תשעה אנשים שחולקו באופן רנדומלי לשתי קבוצות. קבוצה קטנה בת שלושה אנשים וקבוצה גדולה בת שישה אנשים. עם תחילת הניסוי כל משתתף ידע באיזו קבוצה הוא נמצא ויישאר באותה הקבוצה עד תום הניסוי.
הקבוצה הגדולה מורכבת מאנשים רגילים (קונים) שאמורים כל בוקר לנסוע עם רכבם לעבודה. כל תקופה במשחק מדמה יום. בכל יום תצטרכו להגיע לעבודה. ניתן להגיע לעבודה אם יש ברכבכם מספיק דלק.
בתחילת כל יום אתם תראו כמה דלק יש ברשותכם וכן תדעו כמה דלק אתם צריכים בשביל להגיע לעבודה.
יש שלוש תחנות דלק שאפשר לתדלק בהן. התחנות נמצאות במרחק שונה בדרך בינכם לבין העבודה. יש תחנה אחת שאם תתדלקו דרכה, תיסעו שלושה קילומטרים כדי להגיע לעבודה, תחנה אחת שדרכה תיסעו ארבעה קילומטרים כדי להגיע לעבודה ותחנה אחת שדרכה תיסעו חמישה קילומטרים כדי להגיע לעבודה.
כלומר ככל שהתחנה רחוקה יותר, כך תבזבזו יותר דלק כדי להגיע לעבודה דרכה. המרחקים מפוזרים בצורה סימטרית בין כל ששת המשתתפים.
לצורך הפישוט רכבכם צורך ליטר לכל קילומטר.
המרחק ביניכם לבין מקום עבודתכם הוא שלושה קילומטרים כלומר כדי להגיע לעבודה תצטרכו שלושה ליטרים של דלק. כמו שניתן לראות מכך, ישנה תחנת דלק אחת שנמצאת בדרך לעבודתכם, אחת שמאריכה את דרככם בקילומטר ואחת שמאריכה את הדרך בשני קילומטרים. כלומר, לכל תחנת דלק ישנם שני אנשים שהתחנה נמצאת בדרכם לעבודה, שני אנשים שההגעה לתחנה מאריכה את דרכם בקילומטר ושני אנשים שההגעה לתחנה מאריכה את דרכם בשני קילומטרים.
המרחק לעבודה כולל גם את החזרה מהעבודה. כלומר שלושה, ארבעה וחמישה קילומטרים הם המרחקים לשני הכיוונים יחד ולא לכיוון אחד.
אם אין ברשותכם או לא קניתם מספיק דלק כדי להגיע לעבודה, לא תוכלו להגיע לעבודה ולכן לא תקבלו כסף על יום עבודה זה.
על כל יום עבודה מקבלים 500 נק'. אם תדלקתם בדרך לעבודה, מ 500 הנק' האלה נחסיר את כמות הדלק שתדלקתם כפול המחיר לליטר בתחנה שבה תדלקתם. אם יש לכם מספיק דלק, אתם לא חייבים לתדלק בדרך לעבודה. תוכלו להגיע לעבודה ולקבל את מלוא 500 הנקודות על יום העבודה. מיכל הדלק שלכם מכיל 15 ליטרים. כלומר לא חייבים לתדלק בכל תקופה. כמות הדלק שנשארה במיכל בסוף כל יום עוברת אתכם ליום הבא.
הקבוצה הקטנה יותר מורכבת משלושה משתתפים והם בעלי תחנות הדלק שמהם שאר המשתתפים קונים את הדלק. בתחילת כל תקופה, לפני שהקבוצה הגדולה מתעוררת בבוקר, כל מתדלק מקבל מידע על המחיר שבו הוא קונה ליטר דלק מהמחשב בתקופה הנוכחית. המחשב קובע את המחיר לליטר דלק לבעלי התחנות באופן רנדומלי. המחיר זהה לכל שלושת בעלי התחנות. לאחר הצגת המחיר, בעלי התחנות יצטרכו להקליד בתא המיועד את המחיר לליטר שבו ברצונם למכור את הדלק למשתתפי הקבוצה הגדולה. מחיר המכירה לא יכול להיות נמוך מהמחיר לליטר שנקבע על ידי המחשב. לבעלי התחנות אין מלאי. כמות הדלק שהקונים יקנו מהם בכל תקופה היא הכמות שאותה הם יקנו מהמחשב בתקופה זו.
לאחר קביעת מחיר המכירה ולחיצה על כפתור האישור, המוכרים עוברים למסך המתנה. לאחר ששלושת המוכרים יקבעו את המחירים, לקונים יוצג מסך שבו מופיעה טבלה עם מחירי הדלק בכל שלושת התחנות והמרחק לעבודה דרך כל תחנה. הקונים יצטרכו לבחור את התחנה שבה הם רוצים לקנות את הדלק ולהזין את

כמות הדלק בליטרים שברצונם לקנות מתחנה זו. לא ניתן לקנות כמות הגדולה מגודל המיכל (15 ליטר) פחות כמות הדלק שנשארה במיכל. להזכירכם, אם יש ברשותכם מספיק דלק כדי להגיע לעבודה אתם לא חייבים לקנות דלק כלל. במקרה זה עליכם ללחוץ על כפתור ההמשך ולא על כפתור האישור.
האינטרס של הקונים לקנות דלק מתחנות שמאריכות את דרכם לעבודה יכול לנבוע מהמחיר הנמוך יותר בתחנה כזו. כמו כן, האינטרס שלכם לא לתדלק יכול לנבוע מכך שיש ברשותכם מספיק דלק ומחירי הדלק בכל שלושת התחנות נראים לכם גבוהים מדי. לדוגמא, אם אין לכם מספיק דלק במיכל כדי להגיע לעבודה (פחות משלושה ליטרים) ואם המחיר הנמוך ביותר לליטר הוא 200 נקודות והתחנה נמצאת בדרך לעבודה, תצטרכו לשלם 600 נקודות על הדלק אך תקבלו רק 500 נקודות על יום העבודה. ניתן לראות שבמקרה כזה אין טעם להגיע לעבודה ועדיף לפספס יום זה. כלומר קיים חסם עליון למחיר הדלק שמעליו אין הגיון כלכלי לקונים לקנות את הדלק.
הרווח של בעלי התחנות בכל תקופה מורכב מכמות הדלק מכמות הליטרים שקנו מהם כפול ההפרש שבין מחיר המכירה למחיר שבו הם קנו את הדלק מהמחשב.
הרווח של הקונים בכל תקופה תלוי בהגעתם לעבודה. אם הגיעו והיו צריכים לתדלק בדרך, הרווח לתקופה הוא 500 פחות מספר הליטרים שקנו כפול המחיר לליטר. אם הגיעו ולא היו צריכים לתדלק, הרווח הוא 500. אם לא הגיעו לעבודה, הרווח הוא 0.
הערות כלליות:
מספר התקופות בניסוי לא ידוע למשתתפים.
ייתכן שבתקופות מסוימות יופיעו לפניכם הודעות שיעזרו לכם לקבל החלטות .
כל קונה בתחילת הניסוי יקבל שישה ליטרים של דלק, כלומר לא חייבים לתדלק במשך שתי תקופות.
בסוף הניסוי, סך כל הנקודות שצבר כל משתתף יוכפל בפקטור מסוים. בממוצע, כל משתתף יקבל 35 שקלים לשעה. כמובן שחלקיכם יקבלו יותר וחלקיכם פחות.
משך הניסוי הוא כשעה-שעה וחצי.

בהצלחה.

Appendix 3- T-test results

t-Test: Sessions 2,3 Price increase		
	Variable 1	*Variable 2*
Mean	2.683	3.027
Variance	6.118	7.477
Observations	60.000	336.000
Hypothesized Mean Difference	0.000	
df	87.000	
t Stat	-0.974	
P(T<=t) one-tail	0.166	
t Critical one-tail	1.663	
P(T<=t) two-tail	0.333	
t Critical two-tail	1.988	

t-Test: Sessions 1,4 Price increase		
	Variable 1	*Variable 2*
Mean	3.533	2.764
Variance	7.745	4.450
Observations	60.000	276.000
Hypothesized Mean Difference	0.000	
df	74.000	
t Stat	2.018	
P(T<=t) one-tail	0.024	
t Critical one-tail	1.666	
P(T<=t) two-tail	0.047	
t Critical two-tail	1.993	

t-Test: Sessions 5-8 Price increase		
	Variable 1	*Variable 2*
Mean	3.662	2.833
Variance	7.627	6.736
Observations	120.000	552.000
Hypothesized Mean Difference	0.000	
df	168.000	
t Stat	3.012	
P(T<=t) one-tail	0.001	
t Critical one-tail	1.654	
P(T<=t) two-tail	0.003	
t Critical two-tail	1.974	

t-Test: Session 9 Price increase		
	Variable 1	*Variable 2*
Mean	2.567	2.812
Variance	2.254	4.840
Observations	30.000	138.000
Hypothesized Mean Difference	0.000	
df	60.000	
t Stat	-0.738	
P(T<=t) one-tail	0.232	
t Critical one-tail	1.671	
P(T<=t) two-tail	0.464	
t Critical two-tail	2.000	

t-Test: Sessions 2,3 Price decrease		
	Variable 1	*Variable 2*
Mean	3.167	3.027
Variance	8.785	7.477
Observations	60.000	336.000
Hypothesized Mean Difference	0.000	
df	78.000	
t Stat	0.341	
P(T<=t) one-tail	0.367	
t Critical one-tail	1.665	
P(T<=t) two-tail	0.734	
t Critical two-tail	1.991	

t-Test: Sessions 1,4 Price decrease		
	Variable 1	*Variable 2*
Mean	3.000	2.764
Variance	4.305	4.450
Observations	60.000	276.000
Hypothesized Mean Difference	0.000	
df	88.000	
t Stat	0.794	
P(T<=t) one-tail	0.215	
t Critical one-tail	1.662	
P(T<=t) two-tail	0.429	
t Critical two-tail	1.987	

t-Test: Sessions 5-8 Price decrease		
	Variable 1	*Variable 2*
Mean	2.432	2.833
Variance	4.384	6.736
Observations	120.000	552.000
Hypothesized Mean Difference	0.000	
df	207.000	
t Stat	-1.816	
P(T<=t) one-tail	0.035	
t Critical one-tail	1.652	
P(T<=t) two-tail	0.071	
t Critical two-tail	1.971	

t-Test: Session 9 Price increase		
	Variable 1	*Variable 2*
Mean	4.000	2.812
Variance	5.724	4.840
Observations	30.000	138.000
Hypothesized Mean Difference	0.000	
df	40.000	
t Stat	2.501	
P(T<=t) one-tail	0.008	
t Critical one-tail	1.684	
P(T<=t) two-tail	0.017	
t Critical two-tail	2.021	