Market Structure and Price Responses to Seasonal Demand Changes*

by

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Abstract

The demand for gasoline follows a seasonal cycle in Sweden. The paper investigates the response in prices and profits over the cycle. In contrast to what has been found for the gasoline market in the United States I find no support for seasonal price changes compatible with the recently developed theories for cyclical variations of intensity of competition. Some possible explanations for this difference between Sweden and the United States are discussed.

Key words: Seasonal cycles; gasoline market.

JEL classification: E320; L130; L710

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1 Introduction

A large theoretical and empirical literature has studied the relationship between cyclical demand and prices or margins. The most important reason for studying the cyclical properties of prices is the possible link between cyclical pricing and the business cycle. Prices will tend to be counter-cyclical if increasing volumes have a negative effect on prices. This will then magnify fluctuations in output. Many theoretical motivations for cyclical changes in prices have been proposed. One family of models has studied the relation between cyclical demand changes and the intensity of competition. In this paper I test one of these models, Haltiwanger and Harrington's (1991) model for pricing over a deterministic cycle. The Swedish gasoline retail market is well suited for testing the theory, since variations of demand follows a deterministic seasonal cycle over the year. Borenstein and Shepard (1996) have tested Haltiwanger and Harrington's model on the American gasoline retail market and found support for the theory. I do not find support for theory for Swedish data. One reason may be that the market structure differs between Sweden and the United States. A question of interest is therefore if the difference in market structure affects the cyclical properties of prices. Although I in this paper only test one specific model for a seasonal cycle, this may be viewed also as a test of the more general idea that changes in demand may affect the intensity of competition. In this way the test is also relevant for the question of pricing over the business cycle.

The outline of the paper is as follows. Section 2 gives the background to and a summary of the model tested. Some empirical research is also reviewed. Section 3 describes and explores the data. In section 4 the theory is tested. I find no support for the model in this section. The price response to large tax increases is discussed in section 5. The theory is not supported by the results in this section either. Section 6 discusses the results. It is found that a plausible explanation for the different results for the Swedish and the American market is the difference in market structure.

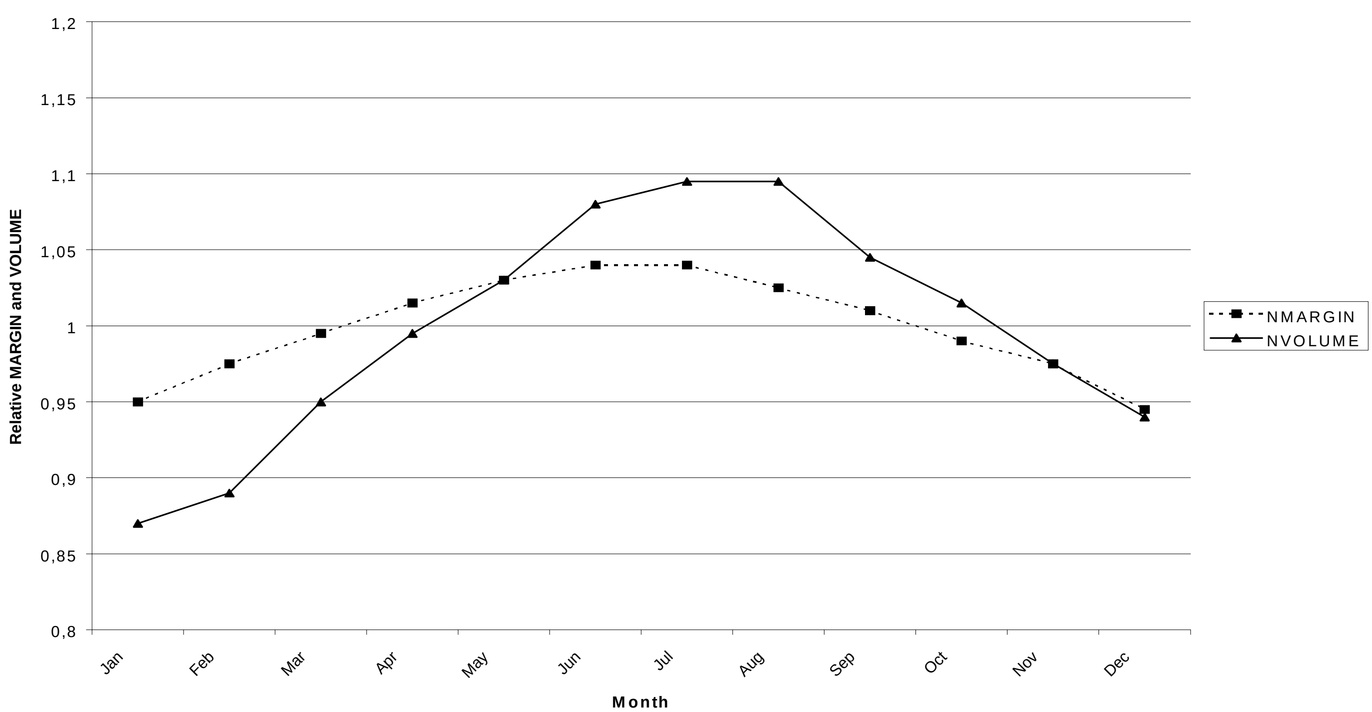
2 Literature review

Tacit collusion is often modeled as the outcome of a game in which the agents balance gains from deviating from the collusive price, thereby gaining a short run profit, against the gains from maintaining collusion in future periods. If demand fluctuates the gain from deviating is high in periods of high demand. Collusion may still be sustainable if the collusive price is allowed to vary with demand. A lower price in high demand states reduces the gains from deviating, since it reduces the gain from each unit sold in the high demand states. This gives rise to a cyclical price pattern over the business or seasonal cycle. The first paper that models this idea formally is Rotemberg and Saloner (1986). They provide a formal model of collusion over varying demand states, which predicts that an increase in current demand over future demand has a negative effect on prices. The demand states are assumed to be identically and independently distributed over time, so expected future demand is equal in all periods. A realization of an unusually high demand state makes it more profitable to deviate given the price of the competitors, since current demand is higher than normal, but expected future demand is unchanged. Hence, in order to equalize the profit from deviating and the profit from sticking to the implicit agreement, the price has to move in opposite direction to demand.

Other papers have employed the basic idea of Rotemberg and Saloner, but with different assumptions for the evolution of demand. Bagwell and Staiger (1997) assume that changes in demand are serially correlated which leads to fast and slow growth phases of demand. The demand for gasoline in Sweden follows a similar pattern for all years in the period studied. This is not consistent with the assumptions in Rotemberg and Saloner or Bagwell and Staiger. Haltiwanger and Harrington provide a model for a deterministic demand cycle, which is more appropriate for the Swedish gasoline market. The model is quite different from Rotemberg and Saloner, but both models build on the idea that the collusive price depends on the relation between current and future demand. The demand is assumed to rise each period until the peak level, after the peak it falls each period to the lowest level of demand. This is the only restriction Haltiwanger and Harrington impose on the demand cycle. There are no other restrictions on the speed or duration of the demand changes over the cycle. The model gives different predictions for different discount factors. Firms will collude at the monopoly price level in all periods if the discount factor is sufficiently high and price at the marginal cost level in all periods if the discount factor is sufficiently low. The most interesting analysis is in intermediate case. Firms will then collude, but the sustainable collusive price will vary over the cycle, with prices below the monopoly price in at least one period and above the marginal cost in at least one period.

Haltiwanger and Harrington's model provide two testable predictions. If the discount factor is high enough, so that prices are above marginal costs, profits will weakly lead the cycle. The second prediction is that, controlling for the level of demand, prices will be higher when demand is increasing than when demand is decreasing.

Diagram 1: Developement of normalized margin and volume in the United States



There is a relatively large literature studying the price setting on the gasoline market. Two papers are of particular interest. Borenstein and Shepard (1996) studies the response in prices to seasonal demand changes in the United States, i. e. the same issue as I study for Sweden. They have a panel consisting of 43 markets over 6 years. The chain between the international market and the gasoline retail market consists of several links in the United States. Cost changes are gradually passed through from the international to the regional and local markets and hence expected marginal cost changes have to be included in the estimation of the margin. A large fraction of gasoline sales is unbranded and sold by independent retailers.

Diagram 1 shows the evolution of normalized margin and normalized volume In the United States. (Source: Borenstein and Shepard 1996.) The effects of different short run dynamics in e. g. the pass-through of costs to prices are removed in the measure of margin. The pattern is consistent with the predictions offered by Haltiwanger and Harrington. Volumes lead margins. The margin is higher in periods when the demand is expected to increase than in periods when the demand is expected to decrease, for periods of approximately the same demand. Borenstein and Shepard's econometric investigation also support the theory.

The short run price dynamics of the Swedish gasoline retail market has been studied by Asplund, Eriksson and Friberg (1999). The main results were that cost changes were gradually passed through and that the price adjustment to cost increases and cost decreases was asymmetric in the short run, but symmetric in the long run. However, the price response to seasonal demand changes is not studied.

3 Data description

I study the seasonal pattern of margins for the Swedish gasoline chains for the period 1980-1996. Demand for gasoline is increasing in the spring, peaks in the summer, declines during the autumn and passes a trough in the winter. Sales are on average 42% higher in July than in January. The seven largest firms have a total market share of 95%, but no single firm has a market share in excess of 25%. The total value of gasoline sales is about 3% of GNP in Sweden. Taxes account for a large fraction of the price of gasoline. During the period it constitutes on average about 55% of the retail price of gasoline, varying from 40% to 71%.

The gasoline price used in this paper is the VAT-excluded list price for premium leaded gasoline. The price is usually the same for all firms, and large dispersion in prices is very uncommon. I use the price for one of the firms, Shell, which will be refereed to as the firm below. The results are not sensitive to which firm's price that is chosen. Gasoline is, at least physically, a relatively undifferentiated good. The consumers have a low inventory capacity, which put a limit on how much sales can increase when the price is unusually low, e. g. before a tax increase or during a price war.

The chain between the international spot market price and the retail price is simpler in Sweden than in the United States. In Sweden the retail price is directly linked to the Rotterdam spot market price. Some firms buy gasoline at the Rotterdam spot market, whereas the firms who have their own gasoline production use the Rotterdam spot price as transfer price. The firms either own the gasoline retail stations or set the price for their franchisees.

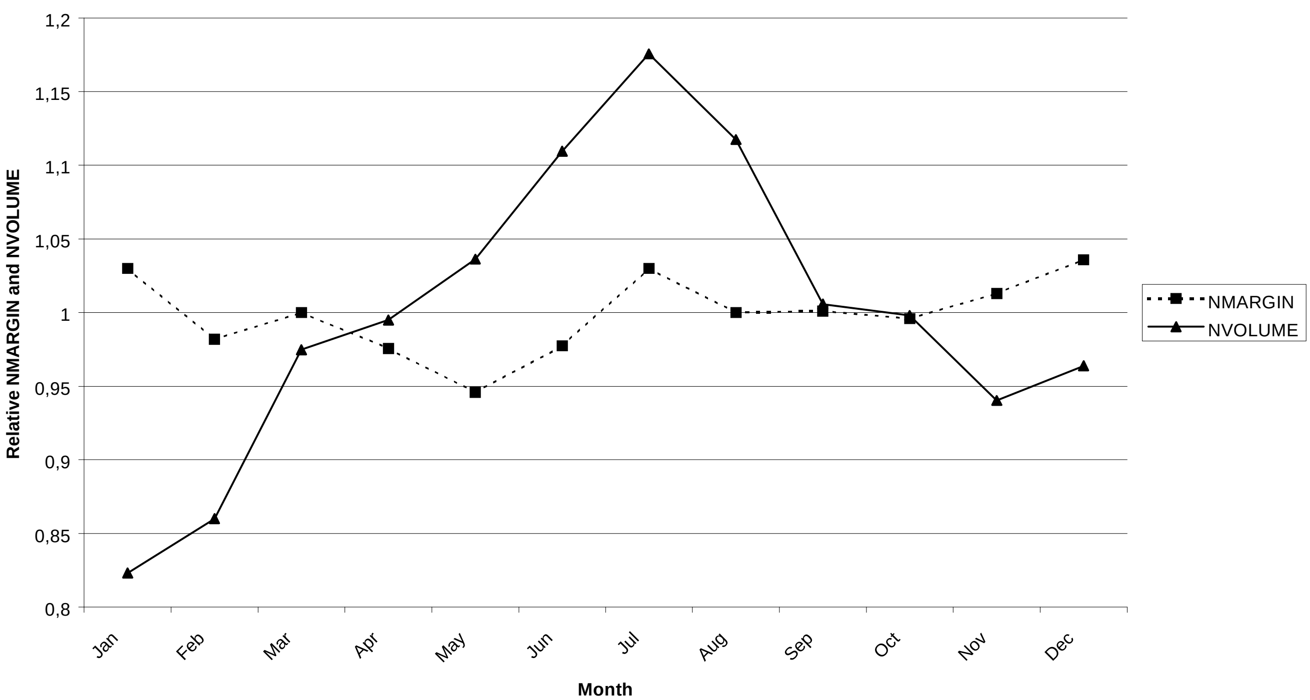
The margin, *MARGIN*, is defined as the retail price, *RP*, minus the per liter tax, *TAX*, and the cost for buying gasoline at the Rotterdam spot market, *MC*. (Note that *MARGIN* is measured in SEK*100, not as the percent mark-up.) The Rotterdam gasoline price is denoted in USD. This price is multiplied by the SEK/USD exchange rate in order to obtain *MC* in SEK*100. The retail price, *RP*, the Rotterdam gasoline price and the SEK/USD exchange rate are available on a daily basis. *MONTHVOL* and *YEARVOL* are monthly and yearly volumes sold. I use price and cost data as of the 15:th day of each month in the regressions, since I only have access to monthly data on quantities. Table 1 displays the descriptive statistics for the variables.

Table 1: Descriptive statistics

	Mean	*Std dev*	*Skewness*	*Kurtosis*	*Min*	*Max*	*N*
MARGIN	87.30	29.40	-0.11	2.43	7.32	147.76	204
MC	119.95	34.65	0.73	2.22	66.98	197.30	204
TAX	281.56	97.46	0.27	1.81	139.2	442	204
RP	488.81	105.69	0.14	2.00	276	672.8	204
MONTHVOL	448.45	60.16	-0.23	2.39	303	561	204
YEARVOL	5381.18	427.85	-0.48	1.64	4679	5910	204

MARGIN, *MC*, *TAX* and *RP* are measured in nominal SEK*100 and *MONTHVOL* and *YEARVOL* in 1000 m^3. *TAX* and sold volumes are reported in the annual reports from the Swedish Petroleum Institute. The source for *MC* is Platt's, a firm who collect prices in the oil market. There is a positive trend in *MARGIN*, *TAX* and *RP* for the period studied, which is expected since these variables are nominal, but there is no trend in *MC* due to falling real prices on oil. The variance in *YEARVOL* is rather low. The highest yearly volumes are from the end of the eighties. Most of the variation in *MONTHVOL* is explained by seasonal variation. There is no systematic seasonal variation in the use of rebates. There are some seasonal variation in transportation costs to the northern parts of Sweden, which is not accounted for in the measure of *MC*. According to the firm, this variation is not passed through to the prices and hence not to *MARGIN*. These cost changes is below 1 SEK*100. The results in the next section are not sensitive to this

Diagram 2: Developement of average normalized margin and volume



measurement error. The results are almost unchanged if *MARGIN* is decreased with 1 SEK*100 during the winter months.

Diagram 2 shows the development of average normalized margin and average *MONTHVOL*. Both *MONTHVOL* and profits (measured as *MARGIN*MONTHVOL*) peaks in July, which is consistent with Haltiwanger and Harringtons prediction that profits weakly leads demand. However, the prediction that prices, for a given demand, should be higher then demand is expected to increase finds no support in the diagram. If anything, the opposite seems to be the case. The development of normalized margin is quite different from Borenstein and Shepard's data for the gasoline market in the United States. The most important difference is that normalized margin, for a given level of demand, tends to be high when demand is expected to increase. The demand in, for example, May and September is approximately of the same magnitude, but the margin is much lower in May.

4 Econometric Analysis

Already by looking at Diagram 1 one may suspect that it will be hard to find support for Haltiwanger and Harrington's model in the data. In this section I will present the results from some econometric specifications which formally test the theory. None of them support the theory.

Part I

The first regressions follow Borenstein and Shepard's approach as closely as possible in order to facilitate comparisons with their results for the gasoline market in the United States.

RP, *MC* and *TAX* are cointegrated. The null hypothesis of unit root can not be rejected at the 10 percent level for any of the variables. A Johansen cointegration test including a constant and a linear trend rejects the null hypothesis of no cointegration at the 5 percent level. The inclusion of the constant and the linear trend lowers the Akaike information criterion, hence they are included in the cointegrating relationship.

The cointegrating relationship:

$$RP = \alpha + \beta_1 TIME + \beta_2 MC + \beta_3 TAX \quad (1)$$

I specify an error correction model in which deviations from the cointegration relationship as well as a number of variables that are important for the short run dynamics are included. I distinguish between positive and negative changes in MC, since the response in prices in previous studies of the gasoline often has been shown to be asymmetric. See Bacon (1991) for British data, Borenstein, Shepard and Cameron (1997) for American data and Asplund, Eriksson and Friberg (1999) for Swedish data. The last four variables are the error correction term. The constant in the cointegrating relationship is implicitly included in α.

$$RP - RP_{-1} = \alpha + \beta_1 MONTHVOL + \beta_2 \mathrm{E}(MONTHVOL) + \beta_3(\Delta MC|\Delta MC>0) + \beta_4(\Delta MC|\Delta MC>0)_{-1} + \beta_5(\Delta MC|\Delta MC<0) + \beta_6(\Delta MC|\Delta MC<0)_{-1} + \beta_7\Delta TAX + \beta_8\Delta TAX_{-1} + \beta_9(\Delta RP|\Delta RP>0)_{-1} + \beta_{10}(\Delta RP|\Delta RP<0)_{-1} + \beta_{11}TIME + \beta_{12}RP_{-1} + \beta_{13}MC_{-1} + \beta_{14}TAX_{-1} \qquad (2)$$

By rewriting equation 2 I get an expression for *MARGIN*, which is the variable of interest.

$$MARGIN = \alpha + \beta_1 MONTHVOL + \beta_2 \mathrm{E}(MONTHVOL) + \beta_3(\Delta MC|\Delta MC>0) + \beta_4(\Delta MC|\Delta MC>0)_{-1} + \beta_5(\Delta MC|\Delta MC<0) + \beta_6(\Delta MC|\Delta MC<0)_{-1} + \beta_7\Delta TAX + \beta_8\Delta TAX_{-1} + \beta_9(\Delta RP|\Delta RP>0)_{-1} + \beta_{10}(\Delta RP|\Delta RP<0)_{-1} + \beta_{11}TIME + (\beta_{12}+1)RP_{-1} + (\beta_{13}-1)MC_{-1} + (\beta_{14}-1)TAX_{-1} \qquad (3)$$

The only forward looking variables in the regression are the expected changes in volume of sales. The marginal cost is a random walk, so we do not need to include any measure of expected change in marginal cost.

I use expected instead of actual volume of sales to circumvent the potential simultaneity problem caused by both *MARGIN* and actual sales being dependent on the price. This may not be a very serious problem since the short run demand elasticity is known to be very low.

Table 2: Estimation of expected volumes sold

Variable	
CONSTANT	-74.6***
	(20.1)
FEB	11.8
	(7.29)
MAR	60.0***
	(7.31)
APR	74.5***
	(7.23)
MAY	91.1***
	(7.27)
JUN	119.6***
	(7.31)
JUL	154.4***
	(7.23512)
AUG	126.5***
	(7.27)
SEP	72.6***
	(7.31)
OCT	76.5***
	(7.23)
NOV	43.9***
	(7.29)
DEC	55.6***
	(7.43)
GDP	0.000329***
	(0.00000142)
$TAXINC_{t-1}$	7.14
	(8.92)
TAXINC	-38.8***
	(8.93)
$TAXINC_{t+1}$	68.0***
	(8.94)
Adj R^2	0.8790
D-W	2.10
N of obs	203

Variables starred *, ** and *** indicates significance at the 10% 5% and 1% level, respectively. Standard errors in parenthesis.

The regression for estimating expected volumes sold, E(*MONTHVOL*), is shown in Table 2. An R^2 of 0.86 indicates that most of the variation in sold volumes is due to changes in demand. The price changes in response to tax changes are known in advance and often of a larger magnitude than other price changes. The tax changes therefore affect demand in the period they occur and in the periods immediately before and after the tax change. (See the next section for further discussion.) A dummy for tax changes larger than 15 SEK*100 is included in the regression. Smaller tax changes do not affect the demand, see Table 7 in section 5. An alternative would be to include the magnitude of tax changes or include all tax changes. The results are not sensitive to which of these specifications that is chosen. A linear trend has been included in preliminary regressions, but was insignificant and did not affect any results.

Table 3: Dependent variable *MARGIN*

	OLS	*2SLS*
CONSTANT	50.3***	48.4***
	(10.8)	(10.7)
TIME	0.0112***	0.0109***
	(0.00257)	(0.00258)
RP_{-1}	0.654***	0.661***
	(0.0601)	(0.0599)
MC_{-1}	-0.699***	-0.703***
	(0.0594)	(0.0598)
TAX_{-1}	-0.779***	-0.782***
	(0.0450)	(0.0449)
MONTHVOL	-0.0162	-0.0115
	(0.0160)	(0.0181)
E*(MONTHVOL)*	-0.0172	-0.0199
	(0.0167)	(0.0175)
$(\Delta MC \mid \Delta MC>0)$	-0.315***	-0.308***
	(0.101)	(0.101)
$(\Delta MC \mid \Delta MC>0)_{-1}$	0.103	0.103
	(0.116)	(0.116)
$(\Delta MC \mid \Delta MC<0)$	-0.560***	-0.559***
	(0.0958)	(0.0959)
$(\Delta MC \mid \Delta MC<0)_{-1}$	0.210*	0.211*
	(0.125)	(0.127)
ΔTAX	-0.263***	0.0945
	(0.0634)	(0.0987)
ΔTAX_{-1}	-0.154	-0.173
	(0.0950)	(0.123)
$(\Delta RP \mid \Delta RP>0)_{-1}$	0.0950	-0.256***
	(0.0985)	(0.0633)
$(\Delta RP \mid \Delta RP<0)_{-1}$	-0.167	-0.154
	(0.123)	(0.0952)
Adj R^2	0.9104	0.9101
N of obs	200	200

Variables starred *, ** and *** indicates significance at the 10% 5% and 1% level, respectively. Standard errors in parenthesis.

The results for the regression of equation (3) are displayed in Table 3. The first column shows the OLS regression with *MONTHVOL* among the independent variables. In the second column is the 2SLS regression displayed, there *MONTHVOL* is replaced with expected monthly volumes obtained from the regression in Table 2. The signs on the estimated coefficients of *RP*, *MC* and *TAX* are the same as in Borenstein and Shepard and the magnitude of the estimates are almost the same, but slightly higher in Sweden. *TIME* is not included in Borenstein and Shepard's regressions since they have a panel with a dummy for each period.

The estimate of ΔMC_{t-1} is significantly negative for both positive and negative changes in *MC* and the estimate of ΔMC_{t-1} significantly positive for negative changes in *MC*. Asplund, Eriksson and Friberg (1997) find that part of the price adjustment occurs the period after the change in *MC*. A cost increase will lead to a falling margin in the current month, since only a part of the adjustment takes place immediately. In the following month the margin will increase as some of the price adjustment take place in this month. This explains the positive sign on ΔMC_{t-1}. The pattern of the response to marginal cost changes is the same in the United States. An augmented Dickey – Fuller test strongly rejects the null hypothesis of a unit root in the residuals.

The variable of interest for testing Haltiwanger and Harrington's model is E(*MONTHVOL*) The punishment of a price war after deviating from an implicit collusive agreement is harder then E(*MONTHVOL*) is high. A hard punishment facilitates implicit collusion, i. e. a high price. The theory would be supported by a significant positive estimate of the effect of E(*MONTHVOL*) on *MARGIN*, but as seen in Table 3, this is not the case.

Part II

The regression in the previous subsection was made to be as comparable as possible to Borenstein and Shepard's investigation of the American market. One possible explanation for the lack of support for the theory might be that the model is not appropriate for the Swedish market. Asplund, Eriksson and Friberg (1999) have investigated the Swedish retail gasoline market. In the next regressions I follow the specification chosen in that paper, but extend short run adjustment regression with E(*ΔMONTHVOL*), as estimated in Table 2, among the independent variables in order to capture the possible effects of expected demand changes on the price. Haltiwanger and Harrington´s theory is supported if the expected change in volumes has a positive effect on the price.

The Engle – Granger two-step estimation technique is utilized. In the long run regression *RP* is estimated as a function of *TAX*, *MC* and *WAGE*. *WAGE* is an index of nominal hourly wages in the manufacturing sector in Sweden and is included in order to capture cost changes apart from changes in *TAX* and *MC*.

Table 4: Long run relationship: Dependent variable *RP*

VARIABLE	
CONSTANT	24.0***
	(6.25)
MC	0.888***
	(0.0307)
TAX	0.662***
	(0.0354)
WAGE	2.00***
	(0.128)
Adj R^2	0.9854
D-W	0.71
N of obs	204

Variables starred *, ** and *** indicates significance at the 10% 5% and 1% level, respectively. Standard errors in parenthesis.

In the short run regression *ΔRP* is estimated as a function of cost changes, deviations from the long run equilibrium, $\hat{u}$, and E(*ΔMONTHVOL*), where the last variable is the one of prime interest. The results are given in Table 5.

Table 5: Short run relationship: Dependent variable *ΔRP*

VARIABLE	
CONSTANT	0.823
	(0.658)
$\hat{u}$	-0.316***
	(0.0625)
ΔTAX	0.770***
	(0.116)
ΔTAX_{-1}	-0.0770*
	(0.0407)
$\Delta WAGE$	0.545
	(0.478)
ΔMC	0.550***
	(0.0705)
ΔMC_{-1}	0.110*
	(0.0567)
ΔMC_{-2}	0.0585
	(0.0486)
E*(ΔMONTHVOL)*	-0.00511
	(0.0135)
Adj.R^2	0.633
D-W	2.05
N of obs	199

Heteroscedasticity consistent standard errors. Variables starred *, ** and *** indicates significance at the 10% 5% and 1% level, respectively. Standard errors in parenthesis.

The results are very much alike those in Asplund, Eriksson and Friberg. An increase in *MC* leads to an increase in *RP*, partly in the current period, partly with a lag and the response to changes in TAX is immediate. The negative sign on $\hat{u}$ implies that RP is adjusted towards the long run equilibrium as estimated in Table 4. An augmented Dickey – Fuller test strongly rejects the null hypothesis of a unit root in the residuals. However, the model of Haltiwanger and Harrington is not supported for this specification, since the model predicts a significant positive sign on E*(ΔMONTHVOL)*. Some other, here unreported, specifications have been estimated. One of these specifications allows for asymmetric responses to positive and negative changes in *MC*. A regression on real variables has also been estimated. None of the alternative specifications supports the model.

5 Some evidence concerning quantities and margins before and after tax increases

Tax increases induce demand fluctuations since consumers buy more gasoline before and less immediately after a tax increase. These demand changes in connection with tax increases give us another opportunity to study price responses to demand changes. Table 6 displays deviations from expected sales for periods around tax increases. Expected sales are obtained from a regression with season and GDP as independent variables (the same regression as in Table 4 but without *TAXINC* among the independent variables). Tax changes always occur on the first day of the month. Period t is the first month after a tax increase. After a tax increase sold quantities fall on average 44000 m^3, or about 10% the month, below what would be expected if there were no tax increase. After the largest tax increases is the fall about 25%. In the period preceding (t-1) and the second period following a tax increase (t+1) sales are on average increased. There is no clear pattern for more distant periods. The increase in sold volumes the period preceding the tax increase is what we expect, since the consumers buy more gasoline before the tax increase. The increase in the second period after the tax increase may be explained by the inventory technology (e. g. it might take on average a bit more than a month until the consumers have to buy gasoline for the first time after a tax increase).

Table 6: Deviations from expected volume of sales 1000 m^3

Date	*Taxchange*	*t-2*	*t-1*	*t*	*t+1*	*t+2*
930115	112,4	-6	76	-133	52	16
841215	50	37	53	-143	94	-33
900115	38	15	5	-60	70	-96
801015	25,1	1	62	-113	1	38
880415	25	2	71	-118	72	-6
870715	24	-60	77	-36	-29	-11
960115	15	-2	-16	22	31	-58
960915	11	30	0	-18	28	-17
820415	7,1	-1	34	-33	-10	42
840115	6	27	-7	-7	24	
840515	6		34	-21	8	26
910715	4	3	-55	42	-7	-5
940115	3	22	-2	-17	0	37
860115	2	-39	10	18	-8	-36
Average		2	24	-44	23	-8

The price is always increased by the same amount as the tax increase at the date the tax change occurs, so there is no change in margin the day the tax increase occur. Hence, any change in margin in response to the demand changes surrounding the tax increase must come through price adjustments before and after the price change. The margin is measured the 15:th day of each month. The change in margin as displayed in Table 7 is the difference in margin between the 15:th day of the present month and 15:th day of the preceding month.

Table 7: Changes in *MARGIN*

Date	*Taxchange*	*t-2*	*t-1*	*t*	*t+1*	*t+2*
930115	112,4	-4,9	6,0	-10,9	-12,5	-3,5
841215	50	-3,0	-4,6	-7,4	-8,5	5,0
900115	38	1,2	-1,6	10,2	2,4	1,2
801015	25,1	14,1	-0,5	-9,4	-9,4	7,9
880415	25	-5,6	1,7	-26,5	8,3	5,8
870715	24	-0,9	-0,6	-9,1	1,0	23,8
960115	15	5,5	-7,9	-0,8	2,1	-3,3
960915	11	5,2	-3,6	0,2	-10,4	4,3
820415	7,1	1,5	20,4	-19,2	-20,7	0,4
840115	6	-4,4	6,7	4,3	-39,8	
840515	6		-2,0	-1,3	-4,7	1,9
910715	4	7,2	-4,3	-8,5	1,1	-0,1
940115	3	24,6	0,4	-7,6	4,0	6,3
860115	2	15,2	24,5	2,8	16,3	0,1
Average		4,3	2,4	-5,9	-5,0	3,8

One problem with the interpretation of the changes in margin is that very large tax increases may change the optimal margin if for example the demand elasticity changes. This is probably a minor problem for smaller tax changes. Another problem is that the number of observations is small.

This said, we can compare the responses of margins with the predictions from the theory. In period t-1 the demand will be high during the remaining 15 days of the month. The demand falls the month of a tax increase. The prediction of the theory is that it would be tempting to cut prices and get a short run profit since the short run profit is higher than usual in the current period and the punishment is less severe as demand is low during the punishment phase. According to the theory the margins must fall in t-1, thereby decreasing the profits from deviating, for collusion to remain sustainable. The theory predicts an increase of margins in period t by analogous reasoning. As seen in Table 7 these predictions are not supported by the data. If anything, the opposite seems to be the case.

6 Conclusions

From the regressions in Table 3 and Table 5 we found no support for the model of Haltiwanger and Harrington. Expected increases in demand did not have a significant positive effect on current margins. Nor did the changes in demand in periods close to tax increases follow the predicted pattern. The question is now: can this lack of support for the theory in the Swedish market be explained by some difference between the Swedish and the American gasoline market?

The Swedish and the American market are alike in many aspects. The demand follows a similar pattern and the features of the product are in most aspects the same. (E. g. physically relatively undifferentiated between brands and low inventory capacity among consumers.) However, there are some differences that may explain the different price pattern over the seasonal cycle. In Sweden 95% of the gasoline are sold by the seven largest firms. In the United States the market is much less concentrated with a large fraction of the sales supplied by independently operated stations. The firms in Sweden try to induce consumer brand loyalty with advertisement and rebates. If consumers have a higher brand loyalty in Sweden, which is reasonable to assume but hard to prove, the short run gain in sales after a price decrease will be lower in Sweden than in the United States. Another explanation may be that the market concentration is lower in the United States, at least for consumers that can choose between different sub-markets in different cities, for example long distance travelers. In Sweden it is much more common that the same competitors are present in all sub-markets, which lowers the number of competitors for consumers present in several sub-markets. This gives rise to two effects which lower the short run gain for a firm from lowering its price. There will be fewer competitors for customers who are present in many sub-markets, which lowers the number of customer one firm can get by lowering its price. It also decreases the costs of monitoring the prices of the competitors. It is reasonable that a firm will know the price of those competitors who are located closely to that firm. This is always the case in the Swedish market where all major firms compete with each other in many sub-markets, although of course not in all sub-markets. In the United States the firms may have high costs for monitoring the price of competitors in other sub-markets. Hence, it is reasonable to assume that deviation period, when the deviating firm makes a higher profit, is shorter in Sweden than in the United States.

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