Does Price Liberalization Affect Customer Satisfaction and Future Patronage Intentions?

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Abstract:

This paper adapts a framework developed for the analysis of customer satisfaction in retailing to the case of gas stations and implements this framework with unique survey data. Our analysis generates three substantive results. First, the main determinants of customer satisfaction subject to the control of a manager are the same before and after price liberalization. Second, the link between customer satisfaction and future patronage intentions seems to breakdown for gas stations. Nevertheless, once we correct for the possible simultaneity bias in the attributes/satisfaction/performance links the existence of the link is restored. This link is the same before and after the price liberalization. Third, the uniqueness of the data allows us to address the question in the title. Increases in distribution services explain about 41% of the increase in customer satisfaction after the price liberalization; increases in customer satisfaction explain about 36% of the increase in future patronage intentions after the price liberalization. Moreover, the ability to explain these changes in customer satisfaction in terms of changes in what we can directly observe is much greater than the ability to explain these changes in future patronage intentions in terms of changes in what we directly observe.

Keywords: Retailing; Customer Satisfaction; Distribution Services; Gas Stations; Satisfaction/ Patronage Intentions Link; Price Liberalization.

JEL Code: M3; L8; M31; L81 ;M38 ; L88.

1. Introduction

Economies in transition, developing countries and even developed ones liberalizing their economies expect consumers to be among the main beneficiaries of price liberalization processes. In this paper we take advantage of a unique opportunity to provide empirical evidence on how this process actually affects consumers in terms of two important variables marketing scholars have focused on: namely, customer satisfaction and future patronage intentions. A somewhat fortuitous element providing this opportunity is a survey of consumers on their satisfaction with gas stations in Pamplona, Spain, undertaken in the Spring of 1998. The attractiveness of these data lies in the fact that the prices of gasoline at gas stations in Pamplona at that time were constant across gas stations.

The price liberalization process at the retail level is part of the evolution of the petroleum industry in Spain, for example Bello (2008). The Spanish gasoline market was highly regulated for many years. Various aspects of an opening transition process started as early as the mid 1980's and accelerated in the 1990's. Small regional differences in retail prices (less than 1% at the province level), however, only begin to appear in 1998. Yet, at this time there are no differences in gasoline retail prices at gas stations within the city of Pamplona. 1998 is the date of the price liberalization law that affects gas stations, Bello (2008). Since then noticeable differences in prices have appeared within the city. For instance, in the Spring of 2007 observed differences in prices at gas stations within Pamplona's beltway ranged from 5% for unleaded premium to 7% for diesel.

We undertook a survey of gas stations in Pamplona in the Spring of 2007 to ascertain consumer satisfaction with gas stations as well as its effect on future patronage intentions in this

new liberalized environment. This survey, in combination with the earlier one, provides a unique opportunity to ascertain the effects of price liberalization at a very disaggregated level and with respect to two outcome variables that are of interest in practical settings.

In marketing the standard framework for the analysis of customer satisfaction and its application to future patronage intentions stems from Anderson and Sullivan's (1993) frequently cited paper. This framework, which was developed for manufacturing firms, has been extended in a number of directions for applications to this type of firms, e.g., Anderson, Fornell and Mazvancheryl (2004) or Kopalle and Lehmann (2006). Contributions in the context of the service sector have proceeded by treating "…service quality and customer satisfaction almost interchangeably", Rust and Zahorik (1993, p.193), or by using attributes to identify service quality and customer satisfaction, Gomez, McLaughlin and Wittink (2004). Most recently, Betancourt, Cortiñas, Elorz and Mugica (2007) integrate the standard framework previously applied to manufacturing with characteristics of the retail sector stressed in earlier literature, e.g., Bucklin (1973), Betancourt and Gautschi (1988) and Oi (1992).

Integration of these two literatures takes place by relying on the concept of distribution services as outputs of a retail firm and as determinants of consumers' retail demand that are dual to prices, Betancourt (2004). Relaxing the assumption that the demand for these services equals the supply of these services allows application of the same conceptual approach to customer satisfaction in manufacturing to firms or establishments in the retail sector. Furthermore, under the same assumptions made in previous empirical analyses of the service and retail sector, this integration is suitable for empirical implementation with typically available data.

An additional benefit of this integration is the ability to analyze the links between distribution services, customer satisfaction and future patronage intentions in a manner analogous to the literature on manufacturing. The latter has stressed possible non-linearities in the links between attributes satisfaction and economic performance variables, for example Anderson and Mittal (2000). Incidentally, attributes can be viewed as special cases of distribution services. If the links were linear the direct impact of attributes on economic performance variables would be the same as the indirect impact of attributes through satisfaction and of satisfaction on economic performance. If the links are non-linear, however, the results can differ. An example of the direct approach is Rust and Zahorik (1993); an example of the indirect approach, or attribute/satisfaction /profitability chain, is Kamakura, et al (2002).

One of our main findings is that the main determinants of customer satisfaction with gas stations subject to managerial control have the same effect on customer satisfaction before and after the price liberalization. Moreover, increases in these determinants of customer satisfaction explain 41% of the increase in satisfaction between 1998 and 2007. The price liberalization and other changes that took place between 1998 and 2007 had other effects, of course, on customer satisfaction. Nevertheless these effects worked mainly through changes in the conditioning variables that determine satisfaction as well as in the unobservable factors that affect satisfaction rather than through changes in the relationship between satisfaction and its determinants.

Another one of our main findings is that the link between customer satisfaction and future patronage intentions appears to break down in the case of gas stations, but this is the case only if one fails to correct for simultaneity bias in estimating the relationship. Once the correction is made the main determinant of future patronage intentions subject to managerial control,

customer satisfaction, has the same effect before and after the price liberalization. Moreover, increases in satisfaction explain 36% of the increase in future patronage between 1998 and 2007. In contrast to the results for customer satisfaction, price liberalization and other changes that took place between 1998 and 2007 changed the conditioning variables and unobservable factors that affect future patronage intentions as well as the relationship between future patronage intentions and some of its important determinants. Most prominent among the latter is the extent of competition in the Pamplona market, which had no effect before the price liberalization but a substantial one after the price liberalization.

In the next section of the paper, we present the conceptual framework to be used in the analysis of gas stations. Subsequently, in Section 3, we discuss the data sets, emphasizing the nature of the survey process in each of the two years. In Section 4 we describe the measurement of distribution services relevant for gas stations and other variables used in the empirical analysis. An appendix available upon request provides additional details on the data. In Section 5 we concentrate on econometric issues especially germane to our analysis. This leads to a presentation of our results for customer satisfaction in Section 6 and for future patronage intentions in Section 7. Section 8 provides details on the implications of our results with respect to how robust they are to alternative specifications of the empirical analysis and to how they can be used by managers. We conclude with a brief summary of contributions to the literature and limitations of the analysis.

2. Modeling Framework

Following Betancourt, et al. (2007) we view customer satisfaction as inversely related to the gap between the demand for distribution services by the ith customer and the customer´s

perception of the supply of distribution services provided by the kth establishment, D^d (i) - D^s (i , k), where D is a vector of distribution services that corresponds to various attributes of the establishment or firm. These distribution services will be indexed by j. Characteristics of customers (indexed by i) and of establishments other than distribution services (indexed by k), can also affect customer satisfaction and will be captured in X (i, k). Following the empirical literature on customer satisfaction in retailing, we will assume that customers´ demand for a distribution service, j, is never satisfied and is always at its maximum, M, which is the same for all consumers.

Thus, consumer i satisfaction with a gas station, k, is given by a relation of the following form

(1) $$S_i (k) = f\{ [M - D^s (i, k)]_j, \ X(i, k)\},$$

where $S_i (k)$ is a measure of customer satisfaction, i.e., of consumer i satisfaction with station k. This satisfaction is a decreasing function, $f_j' < 0$, of the distance between each of the j distribution services actually provided by station k, $D^s (i, k)$, as perceived by the consumer and the maximum level of each of the j distribution services demanded by consumer i, M. This specification allows us to address two of our main research questions: What are the determinants of customer satisfaction with gas stations? ; Does price liberalization change the relationship between customer satisfaction and its determinants?

We also follow the literature in our specification of future patronage intentions. Just as mentioned in the introduction, the latter has taken two forms. One is a direct form in which future patronage intentions, P(i, k), by a consumer, i, with respect to an establishment, k, are determined by her perceptions of retailers´ distribution services at that establishment, $D^s (i, k)$, as well as by

characteristics of the consumer and/or the establishment, Z(i, k). Another one is an indirect form in which satisfaction is determined first, as in (1) above, and future patronage intentions are determined separately as a function of customer satisfaction, S_i (k) , and the set of controls in Z(i, k). Hence, we have two specifications for future patronage intentions below. These specifications allow us to address our two other main research questions: What determines future patronage intentions for gas stations? Does price liberalization change the nature of the relationships between future patronage intentions and its determinants in either specification?

If we follow the direct specification, we have

(2) $$P(i, k) = g\ [D^s (i, k), Z (i, k)\ ];$$

If we follow the indirect specification we have

(3) $$P(i, k) = h\ [S_i (k), Z (i, k)\ ].$$

Note that the specification in (3) together with equation (1) implements the service/ satisfaction/performance chain.

3. The data sets

Our first data set consists of surveys of customers at 7 gasoline stations in the city of Pamplona, Spain.[1] Consumers were selected for interviews upon arrival at the gas station during one week in the Spring of 1998.[2] The survey was designed over a period of a month. The interviewers were trained in one meeting; their instructions were printed in the first page of the survey; and they were asked to fill the surveys themselves. 5 interviewers were assigned to each

[1] Originally, we had data on customers surveyed at 8 stations but we had to drop one of the stations for our analysis because it went out of business by 2007.
[2] At the time of the 1998 survey the 7 surviving gas stations were 41.2 % of the universe of gas stations within Pamplona´s beltway. The smallest gas station was the one that went out of business.

station, spaced over the day, each day of the week. These surveys generated a total of 280 observations with a maximum number of 41 interviews at one station and a minimum number of 21 at another. Eliminating the station that ceased to exist by 2007 reduces the overall sample by 29 observations, leaving us with 251 observations.

Our second data set consists of surveys of customers at the 7 gasoline stations from 1998 that survived the price liberalization.[3] Consumers were selected for interviews upon arrival at the gas station during the Spring of 2007. The surveys took place during the period April 16 –29, 2007. This survey was designed as a slightly modified version of the one used in 1998.[4] Just as before, the interviewers were trained in one meeting, their instructions were printed in the first page of the survey, and they were asked to fill the surveys themselves. In contrast to the 1998 survey, however, 2 interviewers were assigned to each station and the interviews were spaced over the day but over two weeks. The interview process was designed to generate 40 interviews for each station over the two weeks period. There is a maximum number of interviews of 40 at 2 stations and a minimum number of 33 at one station.

Two factors led to differences in the interview process between the two survey years. First, in 1998 the interviewers were not asked to keep an explicit record of the response rate but to give an overall assessment. The latter were reported to be between 40% and 50%. Survey experts at our institution in Pamplona view this response rate as typical for surveys of this nature, but in 2007 we decided to try to have an explicit record. Interviewers were asked to indicate the number of refusals between interviews in order to obtain a more accurate estimate of the response

[3] In 2007 these 7 stations represented 29.2% of the universe of gas stations within Pamplona´s beltway.

rate. Out of 280 interviews over the 7 stations there were 127 refusals between interviews. The estimated response rate for 2007 was 68.8%. This is an upper bound on the response rate. It is accurate if no one refused the first interview. If in every station the first two attempts failed, for example, the response rate would be 280 out of 414 or 65.5 %.[5] Second, we also had fewer different interviewers per station than in 1998 to reduce possible variability in responses due to variations in interviewer characteristics.

In addition to the survey data we also gathered information on objective characteristics of the gas stations. One set of these measures tried to capture competitive conditions. A second set of these measures tried to capture objective conditions of the gas stations that could affect customer satisfaction and that corresponded to dimensions of the distribution services that consumers were being asked about in the surveys. They are also described in detail in the Data Appendix. The information on these variables was gathered for both 1998 and 2007 as far as possible.

4. Empirical Implementation

Distribution services can be assigned to one of the following five broad categories: accessibility of location, information, assortment (breadth or depth), assurance of product delivery (in the desired form or at the desired time), and ambiance. Attempts at measurement of these services at the level of the establishment have been undertaken for hardware stores, e.g., Barber and Tietje (2004), and for supermarkets, e.g., Betancourt, et al. (2007). Here we extend this

[4] In terms of the questionnaire: we added two entirely new questions, we split two old questions into two components and eliminated an earlier one completely. The reasons are discussed in the Data Appendix.
[5] Of course, not all interviews were equally complete. After eliminating those that failed to answer more than 3 questions we ended up with a sample of 265 observations over the 7 stations.

measurement to gas stations.

In these data sets distribution services or their dimensions are measured as attributes associated with a gas station. Consumers were asked to rate on a scale of 0-10 a number of attributes that corresponded to (or at least correspond to an explicit dimension of) the five distributions services identified above. With respect to four of them, one can credibly argue that there is a close relation between the distribution service and the measured attribute. With modifications due to the nature of the fundamental offerings of gas stations, they coincide in spirit and intent with the measures used for hardware stores and supermarkets.

Accessibility of location, $D(i, k)_1$, is measured from the answer to the question – To what extent this station´s location makes your access, including jointly distance and ease of entry and exit, convenient?[6] Information, $D(i, k)_2$, is measured from the answer to the question – To what extent the employees and the signs in this establishment facilitate your information needs with respect to gasoline, other products and services, their location in the station, prices, sales, etc.? Assortment, $D(i, k)_3$, is measured from the answer to the question – To what extent the assortment of other products and services of this station facilitates your solving other demands you usually have at this station? Finally, ambiance, $D(i, k)_5$, is measured from the answer to the question – To what extent your treatment by employees, and the cleanliness and orderliness of the station allow your purchases to be an agreeable experience?[7]

With respect to the distribution service, assurance of product delivery ($D(i, k)_4$), the

[6] In the 2007 survey we split this question into two questions, separating distance from ease of entry and exit, but we added them together with equal weights for this study in order to retain comparability between the surveys.
[7] In the 2007 survey we also split this question into two components, separating the treatment of employees from the order and cleanliness of establishments, but for comparability with the 1998 survey we also added the answers to the two questions with equal weights.

situation differs as follows. This concept has two dimensions, desired form and desired time. In the data there were three questions that picked up different aspects of assurance of product delivery at the desired time. Our approach was to use the simple average of the answers to the following three questions – To what extent is it quick and convenient to pay for your purchases at the station?; To what extent the hours and the days the station is open facilitate making your purchases when you need to do so?; To what extent access to the pumps and their utilization make the services you derive from the station quick and convenient?

Given that the maximum in the measurement scale for these services was a 10, we introduced these services in the customer satisfaction equation as $[10 - D(i, k)_j]$. Notice that an increase in $[10 - D(i, k)_j]$ implies a lowering of the level of the jth distribution service as perceived by the consumer. Hence, it should result in a lower level of customer satisfaction because the distance between the quality or level of service offered and the one expected has increased. That is, we expect a negative sign for these variables in equation (1). We introduced them directly as $D(i, k)_j$ in equation (2). Thus, we expect them to have a positive sign in this equation.

The variable, $S_i(k)$, represents consumer's i satisfaction with station k. We measured it in a form typical of the literature on customer satisfaction. That is, it was measured as the answer to the following question, also on a scale of 0-10. -- What is your degree of satisfaction with the services provided and the purchases made at this station? This was our dependent variable in equation (1) and an explanatory variable in equation (3). The dependent variable in equations (2) and (3), future patronage intentions, was measured as the answer to the following question, also on a scale 0-10, -- Will you put gas in this station in the future?

In implementing equations (1) and (2) and (3) empirically we selected a number of other variables for inclusion as explanatory variables to capture possible characteristics of consumers and/or establishments, i.e., the components of vectors X(i, k) and Z(i, k).[8] Details on the definitions of these and other variables are available in the Data Appendix.

Here we mention the main ones used in the analysis. General demographic characteristics of consumers were included, although we had no expectations as to how or if they would affect customer satisfaction or patronage intentions in terms of their signs. In particular we obtained and used information on: gender, X_7; age, X_8; position in the life cycle, X_9; and extent of work outside the home, X_{10}.

Similarly, four objective and three subjective characteristics of customers buying habits were used in various versions of the empirical analysis. The four objective ones were: the length of stay at the station, X_{11}, the size of the average purchase at the station, X_{12}, the frequency of gasoline purchases at the station, X_{13B} , and the frequency of gasoline purchases in days, X_{13A}. The three subjective ones reflect attitudes toward purchasing gasoline products. They were: preferences toward pumping your own gasoline, X_{14}; the importance of reducing time spent on this activity, X_{15}; and, inclination to search for alternative stations when making this type of purchase, X_{16}.

Finally, we gathered data on a variety of objective characteristics of gas stations that could help identify important changes between 1998 and 2007. Among the main ones relating to competitive aspects were, for example, the number of gas stations within 5 km of each of the

[8] If a variable other than distribution services was included in the customer satisfaction equation, it was labeled X; if it was included in the future patronage intentions equation, it was labeled Z. In all cases, however, the number of the

seven gas stations in the sample and the distance of the nearest gas stations within 5 km to each gas station in the sample. With respect to objective characteristics of the gas station itself we considered, for example, the length of opening hours and whether or not self-service was an option at the gas station. Other alternatives are described in the Data Appendix.

5. Estimation Strategy

For estimation purposes we want to ascertain the effects of liberalizing gasoline retail prices on the relationship between the explanatory variables (which we will label X* to encompass all the ones discussed in the previous section) and the dependent variable (which we will label Y to encompass the dependent variable in all three equations to be estimated).

We can write our basic estimation equation as

$$Y = \beta(1998)X^* + \delta DX^* + U \tag{4}$$

where Y is a column vector of all i observations on a dependent variable. Note that the 1998 ones are `stacked up´ below the 2007 ones. X* is a matrix of independent variables with K + 1 columns of explanatory variables `stacked´ up in the same fashion as Y. By convention we will assume the first column to be a vector of 1´s, which yields the standard intercept in a regression. D is a dummy variable that takes on the value of 1 if an observation belongs to the 2007 sample and zero otherwise. U is a column vector of disturbance terms associated with each observation similarly `stacked up´. Greek letters indicate parameters to be estimated. Given our formulation of the dummy variable, the standard parameters (β) correspond to 1998 where as the parameters associated with the dummy (δ) are the difference between any parameter in 2007 and 1998, i.e., δ

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variable was the same regardless of the equation in which it was included.

= β (2007) - β(1998).

In general the liberalization of gasoline retail prices can have two consequences on these relationships. It can change the nature of the relationship by changing the values of the parameters or it can change the value of the conditioning variables. Both impacts of the price liberalization are captured in the differences between the conditional means of the dependent variables: Namely,

(15) $$E(Y/ X^*(2007), D =1) – E(Y/ X^*(1998), D = 0).$$

Note that X*(2007) is the value of the conditioning variables after the liberalization and X*(1998) is the value of these variables before liberalization.

If we impose the standard assumption in regression analysis, E(U/X*) = 0, (5) can be rewritten as

(6) $$\beta(2007)E(X^*(2007), D = 1) - \beta(1998)E(X^*(1998), D = 0).$$

Adding and subtracting β(1998) E(X*(2007), D= 1), (6) can be rewritten as

(7) $$\delta E(X^*(2007), D = 1) + \beta(1998)[E(X^*(2007), D = 1)- E(X^*(1998), D = 0)].$$

Thus, the impact of the liberalization of gasoline retail prices on the average values of the variables of interest, customer satisfaction and future patronage intentions, can be interpreted as the sum of two effects: the change in the parameters multiplied by the mean of the conditioning variables in 2007; and, the change in the means of the conditioning variables between 2007 and 1998 multiplied by the value of the parameters in 1998. Hence, we need to consider both sets of changes to evaluate the impact of the price liberalization. Of course, we want to include as many conditioning variables as possible to capture any other changes between the two periods that may affect the results as well as to ensure that the standard assumption holds.

Finally, we note that all of the results presented below are based on robust standard errors that adjust for the clustering of observations by gas stations in 1998 and 2007 (14 clusters). The rationale for the correction is to adjust for the fact that the assumption of identically and independently distributed disturbance terms for observations across clusters is unlikely to hold. Intuitively, common events that affect a particular cluster (gas station in a sample year in our case) can impact all respondents in that cluster in a similar manner affecting either the variance or the correlation of the disturbance terms within the cluster. For instance, the common event may lead to responses that are not independent of each other but exhibit some correlation within the cluster.

6. Results: Price Liberalization and Customer Satisfaction

In this section we present the results of our analysis of customer satisfaction and its changes after the price liberalization. In Table 1 we present descriptive statistics on all the variables used in the analysis for both 1998 and 2007 as well as the t-ratio for testing the null hypothesis that there is a difference in means between the two years. We will refer to this table throughout our discussion of the results in this section and the next. At this point, however, the most important piece of information that it conveys is that the average level of customer satisfaction with a transaction at these gas stations increased by .61 or 8.64% between 1998 and 2007. This average increase was statistically significant at the 1% level.

<TABLE 1 GOES AROUND HERE>

Tables 2 A and B present the results of estimating equation (1) in the empirical form indicated by equation (4) for gas stations in Pamplona. If distribution services were to determine both the selection of a station as well as customer satisfaction our estimates of their impact on

customer satisfaction would be biased. One way to correct for this problem is to include a variable that would appear in a selection equation but not in the satisfaction equation, Wooldridge (2003, Ch.17: Section 2). Thus we view the second set of results in these tables as the relevant ones, because they include a variable that captures how often the participant visits the particular gas station where he was surveyed out of every ten times that he visits a gas station, (X_{13B}). In any event the results for the other variables in both regressions are basically the same. For instance, the signs of the corresponding coefficients are the same in both regressions for all variables with a t-ratio greater than unity and they are also close in magnitude. For example, 7 out 9 coefficients with a t-ratio greater than 2 in one regression also have a t-ratio greater than 2 in the other one and the two t-ratios with lower values are 1.96 and –1.98. Thus selection bias, if any, is not much of an issue.

<TABLES 2A AND 2B GO AROUND HERE>

The results in Table 2A indicate that prior to the liberalization consumer's perceptions of two distribution services had a substantial positive effect on customer satisfaction in terms of both statistical significance and magnitude of impact. That is, we are referring to assurance of product delivery at the desired time and ambiance. Among demographic characteristics of consumers and their purchase habits, two life cycle variables had a substantial positive effect, relative to single persons, on customer satisfaction in terms of magnitude of impacts that were statistically significant at the 1% level: namely, having children between 6 and 14 years old or older than 14. One age variable, those between 41 and 60, had a substantial negative effect, relative to those who were less than 25 years old, on customer satisfaction in terms of magnitude of an impact that was statistically significant at the 1% level. These results allow us to answer the question of what are

the main determinants of customer satisfaction with gas stations, at least in 1998. That is, two distribution services and three demographic characteristics of the customers.

Similarly, the results in Table 2B indicate whether or not the relationship changed after the price liberalization. First, there is no difference in the slope coefficients for any of the distribution services. Second, there are only two slope coefficients among the purely demographic variables that exhibit a statistically significant change in the magnitude of their impact at the 1% level. Those in the age group 41- 60 increase their level of satisfaction with their gas stations relative to the less than 25 group after the price liberalization; those having children older than 14 experience a decrease in customer satisfaction relative to single persons. One of the characteristics of consumers' purchasing habits exhibits a change in its effect on customer satisfaction after the price liberalization that is statistically significant at the 1% level. Those who purchase gas more frequently at the station suffer a decrease in customer satisfaction.[9] These results allow us to answer the question of whether the main determinants of customer satisfaction change after the price liberalization. Namely, two of the demographic variables change in the sign of their impact and one ceases to have an impact after the price liberalization. Finally, one of the purchase habits of customers, frequency of purchases at the gas station, becomes a determinant of satisfaction after the liberalization.

We can now ask and answer the following question. To what extent do these main determinants of customer satisfaction and their changes explain the change in the average level of customer satisfaction associated with the price liberalization? One can calculate an estimate based on the results in Tables1, 2A and 2B by using equation (7), which identifies two sources of

impact: changes in the relationship and changes in the conditioning variables. We consider only statistically significant changes, i.e., in evaluating the elements of equation (7) (δ [E(X*(2007), D = 1] or the differences in means β(1998)[E(X*(2007), D= 1)- E(X*(1998), D= 0)]) we only include statistically significant values of δ, β or [E(X*(2007), D= 1)- E(X*(1998), D= 0)].

First and foremost, changes in the average values of ambiance plus assurance, the two distribution services perceived by customers (D_i) that are statistically significant in Table 2A, explain 41% of the increase in the average value of customer satisfaction after the price liberalization.[10] While two life cycle variables have statistically significant coefficients in 1998, only one of them (those with children between 6 and 14 years old) experiences a statistically significant change in its mean value between the two years. The increase in its mean value times its coefficient leads to an 11% increase in customer satisfaction. One age variable has a statistically significant impact in 1998 but the difference in its means over the two years is not statistically significant at the 1% level. Hence, changes in the means of the conditioning variables suggested by our analysis explain 52% of the increase in customer satisfaction associated with the price liberalization.

We saw in the discussion of Table 2B that there are only two demographic variables which experiences a statistically significant change in its coefficient at the 1% level. Those in the age group 41 to 60 increase their customer satisfaction relative to those less than 25 years old by 67% of the increase in customer satisfaction after the price liberalization. Those with children

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[9] An unsurprising result since prices would be expected to be higher after the liberalization.

[10] The calculations underlying this discussion and the corresponding one in the next section were undertaken using up to three decimals for any single element in an operation and four decimals in the results of any operation. For example, 41% = ({[(10-7.70) – (10 – 7.43)*(-.42) + [(10 – 7.73) – (10 –7.43)]*(-.26)}/.61)*100. All results noted in the text are expressed as percentages and it is at this point that we round-off.

older than 14 years decrease their satisfaction relative to singles by 27% after the price liberalization. In addition, the decrease in customer satisfaction as a result of the change in slope of the selection variable was also statistically significant. Hence, this decrease explains 66% of the change in customer satisfaction after the price liberalization. Thus, a net decrease of 26% in customer satisfaction is explained by the changes in these three coefficients associated with the price liberalization. Finally, adding this decrease to the 52% increase explained by the changes in the conditioning variables, we have that 26% of the increase in average customer satisfaction associated with the price liberalization is explained by our overall analysis.

To conclude this section, we note that in arriving at these results we considered alternative specifications of the regressions. These included adding dummy variables for each gas station, adding competition variables, adding objective measures of distribution services, and the last two variants together. An F-test of the model in tables 2A and 2B against each of these four alternatives accepted the model in tables 2A and 2B as the null hypothesis against the alternative that these specifications with additional variables added any explanatory power at levels of significance well beyond the 10 % level. The main results in Tables 2A and 2B were not affected by the use of these alternative specifications. To facilitate the exposition we discuss the relevant results in Section 8.

7. Results: Price Liberalization and Future Patronage Intentions

Just as in the case of customer satisfaction, there is an increase in the average level of future patronage intentions after the price liberalization. This increase is bigger than the one for customer satisfaction, namely .82 or about 13% of the 1998 value. It is also statistically significant at the 1% level. In order to control for selection as a result of interviewing customers

at gas stations, we follow a similar procedure in this section to what we did in the previous one. Nevertheless, there are two major contrasts with the previous section. First, we now have two different specifications of the behavioural relationship; a direct one, equation (2), and an indirect one, equation (3). Second, we considered a number of variables beyond the ones generated by the surveys and they played a role in determining future patronage. These variables played no role in determining customer satisfaction. Therefore, all the results in this section include two additional variables to the ones used in the previous one: the number of competitors within 5 kms. and an indicator of whether or not self-service was available at the station in 1998 and 2007.

Tables 3A and 3B present the results of estimating equation (2) using the same general form as equation (4) for empirical purposes. Perhaps the most important aspect of these results is that the direct procedure generates inconsistent results in the following sense. Two distribution services have a positive and statistically significant impact on customer satisfaction in both 1998 and 2007. Recall that a statistically insignificant coefficient associated with the price liberalization implies no change in the coefficient between 1998 and 2007. On the other hand, only one of these variables has a positive and statistically significant coefficient in 1998 (D_4) with an implied zero change coefficient for 2007 in determining future patronage intentions in Tables 3A and 3B. The other one (D_5) generates an implied zero coefficient for 1998 and a positive and statistically significant one for 2007.

<TABLES 3A AND 3B GO AROUND HERE>

Consistency in these results requires the relation between customer satisfaction and future patronage intentions to be linear. It also requires that the multicolinearity between the other variables appearing in equation (2) and the distribution services be sufficiently weak to preserve

the results from estimating equation (1). Since the indirect approach is not affected by the first requirement and is less sensitive to the second one, we limit the discussion in the text to this approach. In addition, it is also noteworthy that this approach is the one followed by the recent literature on customer satisfaction.[11]

Tables 4A and 4B present the results of estimating equation (3) using the same general form as equation (4) for empirical purposes. Implementing this approach, however, requires addressing a new econometric problem. Namely, if the disturbances associated with equation (1) are correlated with the ones associated with equation (3), estimation of the latter equation ignoring the correlation between disturbances will in general yield biased estimates. An intuitive way of conceptualizing this issue is as follows: if the unobservables associated with equation (1) are correlated with the unobservables associated with equation (3), including observed customer satisfaction in the estimation of equation (3) leads to inconsistent estimates; since many of the same unobservable events between 1998 and 2007 would affect both customer satisfaction and future patronage intentions, this is a likely situation.

A simple solution to this problem is to use the estimated values of customer satisfaction in equation (3) rather than the observed ones. After all, the estimation procedure for implementing equation (1) implies that the estimated values will be uncorrelated with the estimated error. The first regression shown in Tables 4A and 4B implements equation (3) by including observed customer satisfaction; the second regression implements equation (3) by including instead estimated customer satisfaction. It can be seen from these tables that the correction makes a

[11] Incidentally, the consistency issue arises whether or not the two additional variables determining future patronage intentions are included in the estimation of equation (2).

substantial difference. Using the estimated value of customer satisfaction in Table 4A we find a positive and statistically significant coefficient at the 1% level that is substantial in magnitude; using the observed one we find a positive but statistically insignificant one that is also quite small in magnitude. Therefore, we focus on the results using the estimated value of customer satisfaction as the explanatory variable.

<TABLES 4A AND 4B GO AROUND HERE>

Using Table 4A we can answer the question of what are the main determinants of future patronage intentions in 1998 as follows: First, and foremost from our perspective, customer satisfaction after correcting it for simultaneity bias; second, two demographic variables; and, third, three purchase habit variables. All of them have statistically significant effects in Table 4A. Two of these determinants lower future patronage intentions: Females plan future patronage to a lesser extent than males; purchasing gas more frequently at the station surveyed decreases future patronage. Four of these determinant increase future patronage intentions: higher levels of customer satisfaction increase future patronage; those in the 25-40 age group plan future patronage to a greater extent than those in the less than 25 age group; those who purchase gas more frequently have higher future patronage intentions; and those deriving more pleasure in pumping their own increase future patronage.

Table 4B shows the changes in the relationship after the price liberalization. We can use it to answer the question of whether the main determinants of future patronage change after the price liberalization. Some important ones change; a couple of important ones remain the same. In particular there is no change with respect to the effect of customer satisfaction on future patronage intentions after the price liberalization. Aside form the pleasure in pumping your own gas,

however, the rest of the determinants of future patronage intentions change in some fashion.

Gender and the three age dummies change in their impact after the price liberalization. Two of them change from a negative effect to a positive one. That is, gender changes from females having lesser future patronage intentions than males prior to the liberalization to their having greater future patronage intentions after the price liberalization; similarly, those between 25 and 40 years of age change from lower patronage intentions than the reference youngest group to higher than this group. The two age groups older than 40 increase their future patronage intentions relative to those less than 25 after the price liberalization. Future patronage intentions for these two groups change from the same as the reference youngest group to greater than this group after the price liberalization.

Two of the purchase habit variables experience statistically significant changes with respect to their impact on patronage intentions after the price liberalization. The effect of frequency of gas purchases at the station surveyed on future purchase intentions changes from a negative impact to a positive one after the price liberalization. While the effect of frequency of gas purchases on future patronage decreases after the price liberalization, it remains positive in both 1998 and 2007. Indeed, even after the change it has a bigger impact than the frequency of gas purchases at the station. Finally, the impact of the competition variable (the number of gas stations within 5kms.. of the station) on future patronage intentions changes from no statistically significant impact on future patronage intentions in 1998 to a positive one in 2007.[12]

Just as in the previous section we can now answer the question -- To what extent the

[12] A plausible interpretation of this result is that the price liberalization generated a re-allocation of customers and gas stations within the Pamplona beltway that led to a new equilibrium with consumers more satisfied with their options.

main determinants of future patronage intentions and their changes after the price liberalization can explain the increase in future patronage intentions after the price liberalization? Again we use equation (7), with the results in Tables 1, 4A and 4B, to answer this question in terms of statistically significant changes in the relationship and in the conditioning variables.

Given our emphasis in this section, we note first an increase in future patronage intentions after the price liberalization due to the statistically significant increase in customer satisfaction after the price liberalization (.61) that explains 36% of the increase in future patronage intentions after the price liberalization.

For expositional convenience, we consider first the rest of the changes that arise through the statistically significant elements of the second term in equation (7). We can ignore the impacts of pleasure in pumping your own gas and of the age group between 25 and 40. While their coefficients in 1998 are statistically significant, neither experiences a statistically significant changes in its mean between 1998 and 2007, which can be seen from Table 1. The net effect of the three remaining statistically significant elements in the second term of (7) (gender, frequency of gas purchases, and frequency of gas purchases at the station) is to increase future patronage intentions by 221%.

We now consider the elements of the first term. There are four statistically significant negative changes in the coefficients after the price liberalization. These negative changes weighted by the mean of the variable in 2007 lead to a decrease of 584% in future patronage intentions after the price liberalization. There are three statistically significant positive changes in the coefficients after the price liberalization. These positive changes weighted by the mean of the variable in 2007 lead to an increase of 265% increase in future patronage intentions after the price

liberalization. Thus, the net change from this term is a decrease of about 320% in future patronage intentions.

Summing up, the net impacts associated with the price liberalization on average future patronage intentions explained through variables in our analysis other than customer satisfaction is a decrease of 99%! This enhances the importance of customer satisfaction in explaining future patronage intentions. Changes due to other observable variables not included in our analysis and those due to unobservables must increase future patronage intentions by 163% (100 + 99 –36) to explain the observed change in future patronage after the price liberalization.

Just a sin the previous section, we note that in arriving at these results we considered alternative specifications of the regressions. These included adding dummy variables for each gas station as well as adding competition variables and objective characteristics of gas stations besides the ones included here. The main results in this section were not affected by the use of these alternative specifications. We illustrate this point in the context of discussing the substantive implications of our results in the next section.

8. Implications

One important implication of the preceding analysis is that our main results are robust to alternative specifications of the empirical analysis. In this section we provide support for this statement with respect to both customer satisfaction and future patronage intentions. Another implication of our analysis is that it provides guidance for managerial behavior. In this section we use the results of the previous two sections to illustrate this statement.

We consider first the robustness of the main results on customer satisfaction to alternative specifications. Just as indicated at the end of Section 6, we performed four types of experiments

in selecting the preferred regression presented there[13]: a) adding establishment dummies to the variables included in Section 6; b) adding the number of gas stations within 5 kms. of each gas station in both 1998 and 2007 as a measure of competition in the market; c) adding an indicator of whether or not self-service was available in both 1998 and 2007 as a measure of objective characteristics of gas stations that could affect customer satisfaction; d) alternatives b) and c) together. The observed F- statistic and the corresponding critical value at the 1% level for each of these experiments were: a) observed F (6, 466) = .088, F*(6,466) = 2.84; b) observed F (2, 470) = 1.13, F *(2, 470) = 4.65; c) F(2, 470) = .13, F*(2, 470) = 4.65); d) F(4, 468) = .61, F* (4, 468) = 3.36.

Succinctly put, all four alternatives are soundly rejected by the data as providing any additional ability to explain customer satisfaction. Moreover, 7 of the 8 statistically significant coefficient estimates for the two distribution services that explain customer satisfaction in these four alternatives are exactly the same as the ones presented in Section 6 and the only one that is different takes on the value of .43 rather than .42! Just as in Section 6 none of the other three distribution services are statistically significant in these alternative specifications. The results with respect to the demographic and purchase habit variables are also very similar in all these alternative specifications. Furthermore, the outcome is the same if we were to substitute other measures of competition, for example distance to the nearest gas station within 5 kms., or of objective characteristics of gas stations, for example extent of opening hours or convenience (the

[13] Recall that we chose the regression including frequency of purchases at the gas station as a selection control variable as our preferred specification.

latter measured as the number of aisles times the number of pumps available at a gas station) for the ones employed in the above tests.

We consider next the robustness of our results on future patronage intentions. In contrast to the previous results for Section 6, the same variables do make a difference in explaining future patronage intentions. We performed the same four types of tests on future patronage intentions that we did on customer satisfaction on our preferred specification.[14] That is, we re-estimated the results in Section 7 without the two additional variables used in that section relative to the ones in Section 6 and did the same tests as above: a) adding establishment dummies; b) adding the number of gas stations within 5 kms. of each gas station in both 1998 and 2007 as a measure of competition in the market; c) adding an indicator of whether or not self-service was available in both 1998 and 2007 as a measure of objective characteristics of gas stations that can affect patronage intentions; d) alternatives b) and c) together. The results of the regressions for future patronage intentions without the two additional variables are presented in Tables 5A and 5B. The observed F- statistic and the corresponding critical value at the 1% level for each of these experiments for future patronage intentions were: a) observed F (6, 474) = 3.18, F*(6,474) = 2.84; b) observed F (2, 478) = 7.16, F *(2, 478) = 4.65; c) F(2, 478) = 7.26, F*(2, 478) =4.65); d) F(4, 476) = 5.66 , F* (4, 476) = 3.36.

<TABLES 5A AND 5B GO AROUND HERE>

Briefly put, in each of the four cases the null hypothesis that the additional variables don't add to the explanation of future patronage intentions is rejected by the data at levels of

[14] Recall that we chose the regression correcting for simultaneity in customer satisfaction as our preferred specification.

significance well beyond the 1%. We selected the specification including the two features of gas stations over the one including the establishment dummies for two reasons. It predicted better with fewer variables (R2 = .4466 with 4 additional variables vs. R2 = .4355 with 6 additional variables) and it provides a more intuitive interpretation of the results.[15] Moreover, a comparison between Tables 4A, and B and Tables 5A,and B shows that the main behavioral determinant of future patronage that can be influenced directly by a manager, customer satisfaction, has a very similar effect on future patronage intentions regardless of whether or not the additional two features of gas stations are included. In addition note that all variables included in both specifications that are statistically significant in Tables 4A and B are also statistically significant in Tables 5A and B and that the coefficient estimates are quite similar.

In the case of future patronage intentions the use of an alternative measure of competition, distance to the nearest gas stations within 5kms., leads to statistically insignificant results for the competition variable in every instance. Hence, we dropped this alternative measure of competition from further consideration. Given the intuitive nature of the substantive results in Section 7 using the number of gas stations within 5kms. as the measure of competition for a gas station, we conclude that this measure is the relevant one for explaining future patronage.

Finally, we constructed other variables that captured objective features of gas stations in 1998 and 2007. Two in particular were attractive conceptually and sometimes mattered statistically if included by themselves and without the competition variable. These two were the length of opening hours of the station and convenience of access measured by the number of

[15] We selected the specification with two features rather than one because in each case at least one of the coefficients was statistically significant when included by itself.

aisles times the number of pumps. Unfortunately, these two variables were highly correlated among themselves and with the competition variable.[16] Hence, we included only the self-service variable because it had the lowest correlation of the three with the number of competitors before and after the liberalization. In any event, inclusion or exclusion of these characteristics of gas stations did not affect the results for the survey based variables.

We now turn to illustrate the managerial implications of the results in Sections 6 and 7. To assess the impact of increasing a distribution service on economic performance a manager wants to know the answers to two questions. First, what is the impact on customer satisfaction of increasing the level of a distribution service per unit cost? Second, what is the impact of increasing customer satisfaction by one unit on economic performance through its effect on future patronage intentions?

We illustrate the answer to the first question by considering a one unit increase in assurance of product delivery (D_4). This distribution service had an economic and statistically significant impact on customer satisfaction that was quite robust to alternative specifications. The results in Section 6, Table 2A, showed that a one unit increase in assurance of product delivery increased customer satisfaction by .42 units. This increase could be accomplished in three ways.[17] Since these different ways were weighted the same (1/3) in the empirical analysis, the impact of anyone of them on customer satisfaction is .14. Managers should be able to estimate

[16] For instance, their correlation prior to the price liberalization was .953 and the correlation between hours and the competition variable was .905 after the price liberalization.

[17] Recall from Section 4 that this variable was constructed as a simple average of three variables that capture different dimensions of quickness and timeliness. Essentially we assumed that all three dimensions had the same impact on customer satisfaction for empirical purposes. We tested this assumption by running the regression with the three variables separately and the assumption that the three coefficients are the same can not be rejected at the 1% level. The observed F-statistic is .17 and the 1% critical value is 3.36.

directly the costs per unit of these alternative ways of increasing this distribution service: Namely, quickness and convenience of payment, lengthening the days or hours of operation, and improving access to pumps and their utilization.

We illustrate the answer to the second question with the results from Section 7. From Table 4A we know that a one unit increase in customer satisfaction increases future patronage intentions by .49. We interpret future patronage intentions as the probability of an additional future visit per month. Given the 0-10 scale of the dependent variable, a one unit increase in customer satisfaction can be interpreted to increase the probability of a future monthly visit by .10. In terms of expected revenues a future monthly visit is worth .10* average expenditure per visit. In our 2007 sample the average customer expenditure per visit was 34€. Thus, a one unit increase in customer satisfaction generates 3.4€ per customer of expected monthly revenues.

Putting together the answers to both questions, we estimate first that if a gas station in Pamplona is visited by 500 customers a month over the 12 months of a year, an increase in customer satisfaction of one unit will increase average monthly revenues by 833€ (3.4*500*.49). Second, a one unit increase in any of the three relevant dimensions of assurance of product delivery increases customer satisfaction by .14 units. Thus, its impact on expected revenues will be about 117€ per month (.14*833). If any of these three forms of providing assurance of product delivery has costs per month of increasing them by one unit of less than 117€, it will increase the profits of the gas station to undertake the activity required to increase this particular form of the distribution service. Of course, the costs of increasing any of these three dimensions can be quite different and the station manager is likely to be in the best position to determine which one is the most cost effective.

9. Concluding Remarks

In this paper we make three contributions to the marketing literature. First, we apply the attributes/ satisfaction/ performance links approach to the analysis of a specialized retail service sector, gas stations, for the first time. Second, we identify and solve a methodological problem that exists in the application of this approach. Namely, the need to account for the simultaneity in the estimation of the links when using this approach. The importance of this contribution lies in that in principle it affects every application of the approach whether it be to retail or to manufacturing. In our particular case it makes a substantial difference: the second link disappears when this problem is not addressed. Third, and perhaps most importantly, we develop and implement a procedure for evaluating the impact of a price liberalization on two outcome variables of interest to marketing scholars. While the implementation is limited to a particular sector, the procedure can be applied to any sector experiencing a price liberalization. Indeed the procedure can be applied equally well to analyze the imposition of a price regulation.

Our research also has limitations that suggest potentially fruitful areas for further research. One limitation is that the procedure used to analyze the impact of price liberalization also captures the influence of other changes occurring simultaneously. For instance, the period 1998-2007 was one of great prosperity in the Spanish economy in general as well as in the Navarra region where Pamplona is located in particular. It would be useful to separate explicitly those effects that are solely due to the price liberalization from those that occur as a result of other changes.

In this context we should note that this limitation is very asymmetric in its effects. That is, some results are very unlikely to be due to factors other than the price liberalization because it is

unlikely that all these other factors would cancel out. For instance, the findings that the impacts of the two distribution services that are determinants of customer satisfaction do not change as a result of the price liberalization or that the impact of customer satisfaction on future patronage intentions does not change as a result of the price liberalization are unlikely to be affected by this limitation. On the other hand, when changes take place it is far less likely that these other factors played no role. For instance, it is uncertain to what extent the increase in future patronage intentions as a result of the increase in competition associated with the price liberalization is solely due to the latter and not influenced by the general increase in prosperity that also took place during this period.

A more general limitation of the research is that it may be subject to what has been referred to in the psychological literature as common method bias, Podsakoff, McKenzie, Lee and Podsakoff 2003. While there are different sources of this type of bias an important one can arise in all survey research where the respondent answers questions about both the dependent variables and the ones used to explained them, which is the case here. The fact that some distribution services, measured on the same basis as customer satisfaction, matter statistically and others have no effect suggests that this problem is not a serious in our data. The possibility of this source of as well as other sources of common method bias distorting our results is also mitigated by the use of different survey sites, interviewers per site and years as well as by our use of clustering by survey site and year in all of our statistical analyses. Finally there is also recent research in the psychological literature showing that common method bias as a mechanism for inflating correlations has been substantially overstated, Spector 2006.

Finally, our analysis is able to explain a substantial part of the increase in customer satisfaction associated with the price liberalization in terms of changes in variables that can be influenced by managers (41%), but it implies a decrease of 15% in terms of other variables available in our data. Similarly, our analysis is able to explain a significant increase in future patronage intentions associated with the price liberalization in terms of changes in a single variable that can be influenced by managers (36%), but it implies a decrease of 199% in terms of other variables available in our data. This suggests improvements in the modeling of these two outcome variables as an attractive area for future research, and especially so for future patronage intentions.

Table 1. Descriptive statistics

Variable name	*Symbol*	*Min*		*Max*		*Mean*		*St.Dv.*		*Diff Mean (07-98)*	*Diff Mean (t)**
		98	07	98	07	98	07	98	07		
Customer Satisfaction	S	1.00	.00	10.00	10.00	7.06	7.67	1.80	1.71	.61	3.94
Future Patronage Intentions	FP	.00	.00	10.00	10.00	6.54	7.36	2.57	2.71	.82	3.51
Accessibility of Location	D_1	.00	1.00	10.00	10.00	6.66	7.82	2.30	1.96	1.16	6.13
Information	D_2	.00	.00	10.00	10.00	5.69	6.33	2.63	2.62	.64	2.79
Assortment	D_3	.00	.00	10.00	10.00	3.88	4.31	2.93	3.22	.43	1.58
Assurance	D_4	1.33	3.67	10.00	10.00	7.43	7.70	1.51	1.43	.27	2.10
Ambiance	D_5	.00	.00	10.00	10.00	7.23	7.73	1.92	1.68	.50	3.14
Gender 0 (male)	X_{70}	.00	.00	1.00	1.00	.73	.58	.45	.49	-.15	-3.49
Gender (female)	X_{71}	.00	.00	1.00	1.00	.27	.42	.45	.49	.15	3.49
Age 0 (less than 25 years)	X_{80}	.00	.00	1.00	1.00	.33	.20	.47	.40	-.13	-3.29
Age 1(25 – 40 years)	X_{81}	.00	.00	1.00	1.00	.41	.46	.49	.50	.05	1.06
Age 2 (41 – 60 years)	X_{82}	.00	.00	1.00	1.00	.23	.28	.42	.45	.05	1.26
Age 3 (> than 60 years)	X_{83}	.00	.00	1.00	1.00	.03	.06	.18	.25	.03	1.72
Life cycle 0 (single)	X_{90}	.00	.00	1.00	1.00	.40	.24	.49	.43	-.16	-4.06
Life cycle 1 (no child)	X_{91}	.00	.00	1.00	1.00	.20	.34	.40	.47	.14	3.64
Life cycle 2 (child < 6 yrs.)	X_{92}	.00	.00	1.00	1.00	.13	.13	.34	.34	.00	.02
Life cycle 3(6 <child age <14)	X_{93}	.00	.00	1.00	1.00	.08	.14	.27	.34	.06	2.23
Life cycle 4 (child>14 yrs.)	X_{94}	.00	.00	1.00	1.00	.19	.15	.39	.36	-.04	-1.09

* Robust Student's T-test with unequal variances

Table 1. Descriptive statistics (continued)

Variable name	*Symbol*	*Min*		*Max*		*Mean*		*St.Dv.*		*Diff Mean (07-98)*	*Diff Mean (t)**
		98	07	98	07	98	07	98	07		
Hours worked	X_{10}	.00	.00	15.00	24.00	7.18	7.10	3.39	3.31	-.08	-.27
Mean length of stay (mins.)	X_{11}	1.00	1.50	30.00	15.00	5.48	5.44	3.01	2.65	-.04	-.15
Size of purchases (24€ or more=1)	X_{12}	.00	.00	1.00	1.00	.35	.79	.48	.41	.44	11.04
Frequency of purchases of gas (how often in days)	X_{13a}	1.00	1.00	30.00	30.00	7.45	11.21	5.01	6.67	3.76	7.25
Frequency of purchases at the station (out of every ten times)	X_{13b}	.00	.00	10.00	10.00	5.47	6.67	2.99	2.77	1.20	4.73
Pleasure in pumping own gas	X_{14}	.00	.00	10.00	10.00	2.80	2.62	3.35	3.35	-.18	-.59
Importance of time	X_{15}	.00	.00	10.00	10.00	4.07	3.80	3.02	3.39	-.27	-.96
Searches for other stores	X_{16}	.00	.00	10.00	10.00	6.51	3.51	2.84	3.16	-3.00	-11.33
Self Service (Self service=1,Full service= 0)	O_1	.00	.00	1.00	1.00	.31	.27	.46	.44	-.04	.97
Nº competitors 5 kms..	O_2	3.00	3.00	12.00	18.00	9.09	13.47	2.97	4.88	4.38	-12.40

* Robust Student's T-test with unequal variances

Table 2A. Customer Satisfaction and Its Determinants: β(1998)

	Variable	*Regression Coefficient*	*T- Ratio*	*Regression Coefficient*	*T- Ratio*
Constant	Constant	9.29	14.36*	9.01	13.76*
Accessibility	$[10–D_1]$	-.04	-.79	-.06	-1.12
Information	$[10–D_2]$	-.04	-.97	-.04	-.99
Assortment	$[10–D_3]$	-.04	-.94	-.04	-1.02
Assurance	$[10–D_4]$	-.43	-5.07*	-.42	-5.14*
Ambiance	$[10–D_5]$	-.26	-3.85*	-.26	-3.98*
Gender**	X_{71}	.02	.17	-.01	-.05
Age 1**	X_{81}	-.08	-.46	-.11	-.63
Age 2**	X_{82}	-1.12	-3.84*	-1.22	-4.22*
Age 3**	X_{83}	-.83	-1.15	-1.04	-1.34
Life cycle 1**	X_{91}	.18	.62	.23	.80
Life cycle 2**	X_{92}	-.14	-.46	-.08	-.25
Life cycle 3**	X_{93}	1.10	2.99*	1.11	3.01*
Life cycle 4**	X_{94}	1.17	3.27*	1.25	3.53*
Hours worked	X_{10}	.02	.31	.02	.51
Mean length of stay	X_{11}	-.01	-.18	.00	-.16
Size of purchases **	X_{12}	-.07	-.45	-.10	-.58
Pleasure in pumping gas	X_{14}	.01	.30	.01	.27
Importance of time	X_{15}	-.03	-.85	-.02	-.59
Searches for other stores	X_{16}	-.01	-.30	-.01	-.34
Frequency of purchases of gas	X_{13A}	.04	1.65	.03	1.62
Frequency of purchases at the station	X_{13B}	-	-	.03	1.87

* t-ratio greater than 2
** see Table 1 for the reference group

Table 2B. Customer Satisfaction and Its Determinants: δ= β(2007)-β(1998)

	Variable	*Regression Coefficient*	*T- Ratio*	*Regression Coefficient*	*T- Ratio*
Dummy year	D 2007	-1.30	-1.81	-.63	-.82
Accessibility	$D[10–D_1]$	-.03	-.53	-.02	-.40
Information	$D[10–D_2]$	.03	.57	.04	.70
Assortment	$D[10–D_3]$	.07	1.48	.06	1.35
Assurance	$D[10–D_4]$	.00	.05	.01	.07
Ambiance	$D[10–D_5]$	.02	.17	.02	.24
Gender**	DX_{71}	.00	.02	.07	.42
Age 1**	DX_{81}	-.04	-.09	.05	.14
Age 2**	DX_{82}	1.29	2.94*	1.47	3.35*
Age 3**	DX_{83}	1.27	1.52	1.50	1.74
Life cycle 1**	DX_{91}	-.28	-.67	-.38	-.93
Life cycle 2**	DX_{92}	.31	.78	.26	.63
Life cycle 3**	DX_{93}	-.75	-1.53	-.82	-1.58
Life cycle 4**	DX_{94}	-.99	-1.98	-1.11	-2.23*
Hours worked	DX_{10}	.00	-.01	-.02	-.38
Mean length of stay	DX_{11}	.05	1.01	.04	.98
Size of purchases **	DX_{12}	.07	.34	.17	.68
Pleasure in pumping gas	DX_{14}	-.05	-1.22	-.04	-1.06
Importance of time	DX_{15}	.04	.93	.03	.77
Searches for other stores	DX_{16}	.07	2.07*	.06	1.96
Frequency of purchases of gas	DX_{13A}	.06	1.48	.06	1.45
Frequency of purchases at the station	DX_{13B}	-	-	-.06	-3.03*
		R^2=.4449	k = 42	R^2=.4548	k = 44

* t-ratio greater than 2
** see Table 1 for the reference group

Table 3A. Future Patronage Intentions: Direct Approach: β(1998)

	Variable	*Regression Coefficient*	*T- Ratio*	*Regression Coefficient*	*T- Ratio*
	Constant	.53	.56	.73	.73
Accessibility	D_1	.16	1.40	.15	1.27
Information	D_2	.00	.02	.00	.03
Assortment	D_3	-.02	-.50	-.02	-.52
Assurance	D_4	.31	3.70*	.32	3.92*
Ambiance	D_5	-.03	-.70	-.03	-.60
Gender**	X_{71}	-.61	-2.81*	-.59	-2.71*
Age 1**	X_{81}	.50	2.57*	.54	2.72*
Age 2**	X_{82}	.02	.06	.12	.35
Age 3**	X_{83}	-.15	-.24	.06	.10
Life cycle 1**	X_{91}	-.04	-.21	-.10	-.46
Life cycle 2**	X_{92}	-.07	-.25	-.13	-.42
Life cycle 3**	X_{93}	.39	.87	.38	.83
Life cycle 4**	X_{94}	.46	1.21	.39	1.14
Hours worked	X_{10}	.00	.11	.00	-.11
Mean length of stay	X_{11}	.04	1.01	.04	.98
Size of purchases **	X_{12}	-.14	-.54	-.11	-.42
Pleasure in pumping gas	X_{14}	.08	2.45*	.08	2.37*
Importance of time	X_{15}	-.04	-1.92	-.04	-1.96
Searches for other stores	X_{16}	-.02	-.38	-.02	-.34
Frequency of purchases of gas	X_{13A}	.51	13.47*	.51	13.92*
Frequency of purchases at the station	X_{13B}	-	-	-.03	-2.15*
Nº competitors 5 kms..	O_1	.01	.19	.02	.46
Self-service**	O_2	-.70	-2.15*	-.70	-2.15*

* t-ratio greater than 2
** see Table 1 for the reference group

Table 3B. Future Patronage Intentions: δ= β(2007)-β(1998)

	Variable	*Regression Coefficient*	*T- Ratio*	*Regression Coefficient*	*T- Ratio*
Dummy year	D 2007	3.47	1.81	3.16	1.57
Accessibility	DD_1	-.19	-1.42	-.19	-1.33
Information	DD_2	-.09	-1.09	-.09	-1.15
Assortment	DD_3	.07	.79	.07	.78
Assurance	DD_4	-.15	-1.02	-.16	-1.06
Ambiance	DD_5	.26	2.65*	.26	2.56*
Gender**	DX_{71}	.76	2.38*	.73	2.33*
Age 1**	DX_{81}	-.67	-1.92	-.72	-2.04*
Age 2**	DX_{82}	-.60	-1.28	-.73	-1.61
Age 3**	DX_{83}	-1.74	-2.59*	-1.96	-2.94*
Life cycle 1**	DX_{91}	.45	1.22	.53	1.35
Life cycle 2**	DX_{92}	-.47	-.76	-.42	-.66
Life cycle 3**	DX_{93}	.34	.56	.36	.62
Life cycle 4**	DX_{94}	.20	.33	.29	.51
Hours worked	DX_{10}	-.02	-.32	-.01	-.14
Mean length of stay	DX_{11}	-.04	-.78	-.04	-.77
Size of purchases **	DX_{12}	-.42	-1.21	-.46	-1.25
Pleasure in pumping gas	DX_{14}	-.07	-1.66	-.07	-1.64
Importance of time	DX_{15}	.00	-.02	.01	.09
Searches for other stores	DX_{16}	-.14	-1.43	-.14	-1.45
Frequency of purchases of gas	DX_{13A}	-.29	-4.26*	-.29	-4.26*
Frequency of purchases at the station	DX_{13B}	-	-	.04	1.52
Nº competitors 5 kms..	DO_1	.07	1.59	.06	1.34
Self-service**	DO_2	.07	.17	.06	.14
		R^2=.4614	K=46	R^2=.4630	K=48

* t-ratio greater than 2
** see Table 1 for the reference group

Table 4A. Future patronage Intentions: Indirect Approach: β(1998)

	Variable	*Regression Coefficient*	*T- Ratio*	*Regression Coefficient*	*T- Ratio*
	Constant	3.38	5.33*	.94	.94
Customer satisfaction	S	.09	1.58	--	--
Estimated customer satisfaction	S^	--	--	.49	3.87*
Gender**	X_{71}	-.43	-2.18*	-.56	-3.33*
Age 1**	X_{81}	.56	1.80	.70	2.62*
Age 2**	X_{82}	.11	.25	.82	1.79
Age 3**	X_{83}	-.21	-.37	.61	.92
Life cycle 1**	X_{91}	-.16	-.49	-.21	-.83
Life cycle 2**	X_{92}	-.10	-.34	-.12	-.44
Life cycle 3**	X_{93}	.40	.74	-.21	-.39
Life cycle 4**	X_{94}	.50	.97	-.22	-.43
Hours worked	X_{10}	.00	.10	-.02	-.45
Mean length of stay	X_{11}	.04	.71	.04	.82
Size of purchases **	X_{12}	-.15	-.62	-.06	-.22
Pleasure in pumping gas	X_{14}	.09	2.33*	.08	2.40*
Importance of time	X_{15}	-.08	-2.23*	-.05	-1.84
Searches for other stores	X_{16}	-.02	-.36	-.03	-.43
Frequency of purchases of gas	X_{13A}	.58	11.17*	.52	11.85*
Frequency of purchases at the station	X_{13B}	-.04	-2.55*	-.05	-3.58*
Nº competitors 5 kms..	O_1	-.04	-.91	-.01	-.43
Self-service**	O_2	-.55	-1.23	-.72	-1.90

* t-ratio greater than 2
** see Table 1 for the reference group

Table 4B. Future Patronage Intentions: Indirect Approach: $\delta = \beta(2007) - \beta(1998)$

	Variable	*Regression Coefficient*	*T- Ratio*	*Regression Coefficient*	*T-Ratio*
Dummy	D 2007	1.43	1.08	1.97	.97
Customer satisfaction	DS	.03	.26	--	--
Estimated customer satisfaction	DS^	--	--	-.05	-.19
Gender**	DX_{71}	.61	2.02*	.68	2.26*
Age 1**	DX_{81}	-.67	-1.65	-.89	-2.11*
Age 2**	DX_{82}	-.61	-1.18	-1.50	-2.62*
Age 3**	DX_{83}	-1.38	-2.26*	-2.51	-3.33*
Life cycle 1**	DX_{91}	.61	1.28	.73	1.78
Life cycle 2**	DX_{92}	-.48	-.80	-.44	-.77
Life cycle 3**	DX_{93}	.38	.56	.89	1.27
Life cycle 4**	DX_{94}	.21	.29	.80	1.11
Hours worked	DX_{10}	.00	-.01	.01	.15
Mean length of stay	DX_{11}	-.06	-.80	-.05	-.79
Size of purchases **	DX_{12}	-.47	-1.14	-.51	-1.28
Pleasure in pumping gas	DX_{14}	-.08	-1.40	-.05	-1.13
Importance of time	DX_{15}	.05	.75	.02	.40
Searches for other stores	DX_{16}	-.17	-1.62	-.17	-1.71
Frequency of purchases of gas	DX_{13A}	-.33	-4.03*	-.34	-4.67*
Frequency of purchases at the station	DX_{13B}	.05	1.89	.08	2.61*
Nº competitors 5 kms..	DO_1	.13	2.49*	.10	2.67*
Self-service**	DO_2	-.03	-.05	.16	.34
		R^2=.4268	K= 40	R^2=.4466	K= 40

* t-ratio greater than 2
** see Table 1 for the reference group

Table 5A. Future Patronage Intentions: Indirect Approach: β(1998)

	Variable	*Regression Coefficient*	*T- Ratio*	*Regression Coefficient*	*T- Ratio*
	Constant	2.74	4.68*	.58	.63
Customer satisfaction	S	.09	1.44	--	--
Estimated customer satisfaction	S^	--	--	.45	3.80*
Gender**	X_{71}	-.41	-2.22*	-.52	-3.52*
Age 1**	X_{81}	.58	2.47*	.67	3.11*
Age 2**	X_{82}	.08	.20	.67	1.66
Age 3**	X_{83}	-.26	-.46	.40	.61
Life cycle 1**	X_{91}	-.11	-.43	-.12	-.52
Life cycle 2**	X_{92}	-.11	-.39	-.14	-.56
Life cycle 3**	X_{93}	.47	.89	-.06	-.10
Life cycle 4**	X_{94}	.63	1.25	.01	.03
Hours worked	X_{10}	.00	-.04	-.02	-.55
Mean length of stay	X_{11}	.05	.84	.05	.97
Size of purchases **	X_{12}	-.15	-.63	-.09	-.36
Pleasure in pumping gas	X_{14}	.08	2.13*	.06	2.11*
Importance of time	X_{15}	-.08	-2.11*	-.05	-1.74
Searches for other stores	X_{16}	-.01	-.13	-.02	-.22
Frequency of purchases of gas	X_{13A}	.59	12.14*	.55	13.24*
Frequency of purchases at the station	X_{13B}	-.05	-2.55*	-.06	-2.92*

* t-ratio greater than 2
** see Table 1 for the reference group

Table 5B. Future Patronage Intentions: Indirect Approach: $\delta = \beta(2007) - \beta(1998)$

	Variable	*Regression Coefficient*	*T- Ratio*	*Regression Coefficient*	T-Ratio
Dummy	D 2007	3.02	1.87	3.01	1.49
Customer satisfaction	DS	.08	.66	--	--
Estimated customer satisfaction	DS^	--	--	.05	.22
Gender**	DX_{71}	.56	1.94	.62	2.15*
Age 1**	DX_{81}	-.73	-1.94	-.90	-2.15*
Age 2**	DX_{82}	-.39	-.77	-1.18	-2.09*
Age 3**	DX_{83}	-.84	-1.27	-1.86	-2.45*
Life cycle 1**	DX_{91}	.47	1.05	.55	1.39
Life cycle 2**	DX_{92}	-.60	-.87	-.54	-.83
Life cycle 3**	DX_{93}	.15	.23	.58	.84
Life cycle 4**	DX_{94}	-.34	-.49	.15	.23
Hours worked	DX_{10}	.01	.16	.02	.26
Mean length of stay	DX_{11}	-.08	-1.07	-.07	-1.10
Size of purchases **	DX_{12}	-.56	-1.24	-.56	-1.28
Pleasure in pumping gas	DX_{14}	-.11	-1.96	-.09	-1.76
Importance of time	DX_{15}	.05	.81	.03	.47
Searches for other stores	DX_{16}	-.16	-1.43	-.16	-1.42
Frequency of purchases of gas	DX_{13A}	-.33	-4.05*	-.36	-4.58*
Frequency of purchases at the station	DX_{13B}	.04	1.57	.07	2.22*
		R^2=.4012	K=36	R^2=.4204	K=36

* t-ratio greater than 2
** see Table 1 for the reference group

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Data Appendix Available Upon Request: Gas Stations (1998, 2007).

In this Appendix we describe in a more systematic and thorough manner the variables used in the analysis. We also provide a discussion of some differences between the two surveys that were mentioned but not described in detail in the text. Finally, we also describe here variables that we constructed to identify objective characteristics of gas stations.

In both surveys customer satisfaction (S) was measured as the answer to the same question on a scale of 0-10, -- What is your degree of satisfaction with the services provided and the purchases made at this gas station? All the distribution services were measured on the same 0-10 scale as customer satisfaction in both surveys. Furthermore, three of the five distribution services were measured in exactly the same way in both surveys. Two of them are measured as answers to a single question: information (D_2) was measured in terms of -- To what extent the employees and the signs in this establishment facilitate your information needs with respect to gasoline, other products and services, their location in the station, prices, sales, etc.? ; and assortment (D_3) was measured in terms of --To what extent the assortment of other products and services of this station facilitates your solving other demands you usually have at this station?

A third distribution service, assurance of product delivery (D_4), was measured in both surveys as the simple average of the answers to the following three questions: To what extent is it quick and convenient to pay for your purchases at the station?; To what extent the hours and the days the station is open facilitate making your purchases when you need to do so?; To what extent access to the pumps and their utilization make the services you derive from the station quick and convenient?

With respect to the other two distribution services, there was a difference between the 1998 and the 2007 survey in that the 1998 question was split in two to capture different dimensions of the service. For instance, ambiance (D_5) was measured in 1998 in terms of -- To what extent your treatment by employees, and the cleanliness and orderliness of the station allow your purchases to be an agreeable experience? In 2007 we asked two similar questions separating the treatment of employees from the cleanliness and orderliness of the station. For comparability purposes, however, we took the simple average of the answers to each question as our single measure of ambiance in 2007. Similarly, accessibility of location (D_1) was measured in 1998 in terms of --To what extent this station´s location makes your access, including jointly distance and ease of entry and exit, convenient? In 2007 we asked two similar questions separating distance from ease of entry and exit. Once again we took the simple average of the answers as our measure of accessibility in 2007.

Variables D_1 - D_5 can be characterized as eliciting consumer's perceptions of how well the station was providing a distribution service or a selected aspect or dimension of a distribution service. The information on descriptive statistics in rows 3 through 7 of Table 1 in the text shows substantial variations in the average of these perceptions across consumers between 1998 and 2007. The mean score is always higher for 2007 than for 1998 and, except for assortment, the difference in means between the two years is statistically significant at the 1% level. It can also be seen from the first row of this table that the same is true for the level of customer satisfaction and future patronage intentions.

In addition to the above variables, essential for our purposes, the two surveys gathered the same information on general characteristics of consumers, of their buying habits, as well as on attitudes toward the gas station where they were interviewed.

Variables X_7 - X_{10} measure general characteristics of consumers. X_7 identifies gender (one if the consumer is female). Age, X_8 , is captured through dummy variables where the omitted category is that the consumer is less than 25. (X_{81}) is one if the consumer is between 25 and 40 years of age. (X_{82}) is one if she is between 41 and 60. Finally (X_{83}) is one if the consumer is greater than 60 years old. Position in the life cycle, X_9, was captured in terms of dummy variables where the omitted category was single without children. (X_{91}) is one if the consumer is part of a couple without children. (X_{92}) is one if the consumer has children less than 6 years old. (X_{93}) is one if the consumer has children between 6 and 14 years old. (X_{94}) is one if the consumer has children over 14 years of age. The last of these 'demographic' variables, X_{10}, measures the average number of hours worked outside the home daily by the consumer. Table 1 in the text shows the changes in the mean of these variables between 1998 and 2007.

Among the characteristics of their buying habits consumers were asked about the following: The amount of money spent each time they put in gasoline, on average, X_{12}, which was used to construct a dummy variable indicating if the customer spent more than 24 euros on a visit; How often do you put in gas in terms of days out of the month?, X_{13A}; To what extent do you prefer pumping your own gasoline?, X_{14}; To what extent is it important for you to reduce the amount of time spent on this activity?, X_{15}; To what extent do you search for alternative establishments when doing this type of purchasing?, X_{16}. Table 1 also shows the changes in the means of these variables between 1998 and 2007.

With respect to their attitudes toward purchases at the station consumers were asked the following: average length of their stay at the gas stations in minutes, X_{11}; out of every ten times that you put in gas at a station how often do you do it at this one?, X_{13B}; To what extent do you plan to patronize this gas station in the future?, X_{20}; This last variable is our other dependent variable. The means of these variables for both years are also available in Table 1. The variables discussed, thus far, are based on the responses of consumers interviewed at the station.

In addition we gathered information on what may be described as objective characteristic of the gas stations. Objective characteristics of gas stations were used to construct two types of variables for both 1998 and 2007: competition variables and concepts representing objective, as opposed to perceived by customers, versions of the distribution services identified in the text. We constructed two sets of competition variables for each year: one set was based on features of competitors within 5kms. of a gas station; another was based on features of competitors within the branch to which the gas station belonged after constructing an additive tree (Sattath and Tversky 1980) of all the gas stations within Pamplona's beltway in each of the two sample years. Since the former constructs consistently dominated the latter ones in preliminary tests, we limit our attention to the former constructs.

We considered two features for each gas station: the number of competitors within 5kms. of a gas station, which is a direct measure of competition faced by each station each year, and the distance to the nearest competitor within 5 kms. of a gas station, which is an inverse measure of competition faced by each station each year. The distances were calculated using the GPS system for Spain which indicates the actual distance to go from one gas station to the others allowing for the configuration of city streets. Table 1 shows that competition increased between

the two years when measured by the average number of competitors. The distance variable did not have an impact in any specification, was dropped from consideration and is not reported in Table 1.

We also considered a number of characteristics of the services provided by the gas stations based on the reports of the interviewers and our own observations. All of these measures discussed below capture some dimension of assurance of product delivery, D_4. We tried others but preliminary tests indicated that they did not matter at all. The ones reported below where the ones that mattered in some contexts. Nonetheless, the only one actually employed in the Tables reporting regressions in the text is the presence or absence of self service. Table 1 indicates that between 1998 and 2007 the mean proportion of stations offering self-service as an option remained about the same.

Since the next three variables were not used in any of the specifications presented in text tables, we excluded them from Table 1. We report them here because they were used in some of the alternatives mentioned but not explicitly reported in the text. One of them is hours of operation, which corresponds to another dimensions of assurance of product delivery. The number of pumps times the number of aisles provides a measured of the ease and convenience of getting in and out of the station, which is also another dimension of assurance of product delivery. Finally, the number of hoses provides an alternative measure of this dimension of assurance of product delivery. While not shown in Table 1 mean opening hours decreased slightly, and the mean number of pumps times the number of aisles as well as the mean number of hoses increased, but only for the last one was the increase between the two years statistically significant at the 1% level.