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Dynamics in Consumer Response to Product Unavailability: Do Stock-out Reactions Signal Response to Permanent Assortment Reductions?

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Dynamics in Consumer Response to Product Unavailability: Do Stock-out Reactions signal response to Permanent Assortment Reductions?

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Abstract

This paper investigates consumer reactions to out-of-stocks (OOS) – which are unexpected and temporary in nature - as opposed to permanent assortment reductions (PAR). We discuss similarities and differences between OOS and PAR reactions as well as their underlying factors, and empirically test our propositions in two product categories. Next, managerial implications are discussed. Our results indicate that retailer losses incurred in case of a PAR may be substantially larger than those in case of a stock-out for the same item, suggesting that retailers (i)should be cautious in extrapolating consumer response to stock-outs, to situations where the item would be permanently removed, (ii)should keep a minimum of variation in the assortment even if this implies a higher stock-out risk for these items, (iii) may wish to explicitly signal the temporary character of a stock-out by leaving the shelf space of the OOS item unused. The results further suggest that stock-out losses may disproportionally grow with stock-out frequency and duration, emphasizing that even if OOS cannot be completely avoided, efforts should be made to keep their occurrence and length within limits.

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1. Introduction

Current retail practice is characterized by an ever increasing attention to 'Efficient Assortment Management', and this from a strategic as well as an operational perspective. From a *strategic* viewpoint, a core issue is the composition of the assortment to be offered in various product categories (Kahn, 1999). Yet, whereas previous decades witnessed a preoccupation with the selection of items to be added, retailers –being confronted with the cost disadvantages of increasingly wide and deep assortments – have recently turned their attention to efficient downsizing of the assortment (see e.g. Broniarczyk et al. 1998). From an *operational* perspective, efficient assortment management raises the issues of optimal shelf arrangements, and efficient replenishment to avoid or minimize stock-outs. Like permanent assortment reductions, stock-outs can harm retailer results, not only at the item and category level, but also at the overall store level (e.g. by encouraging store switching). Moreover, both issues appear to be intertwined, as is well illustrated by the following statement: 'Because variety is a key component of overall retail strategy and a major means of attracting and retaining target consumers, a retailer should be sure to match the variety offered within a category to consumer demand. [Yet,], the incremental sales from increasing assortment may actually cost retailers sales due to more out-of-stocks occurring on fast moving items' (Untitled, 2000). It follows that product unavailability – as a result of strategic assortment reductions or temporary stock-outs – has become a major area of concern in current assortment management.

In spite of their growing importance, consumer reactions to product unavailability have received little attention in the academic marketing literature. Moreover, research on the subject deals with consumer response to either out-of-stock (OOS) situations, or to permanent assortment reductions (PAR) - treating both reactions as completely separate issues. The purpose of this paper is to shed more light on the similarities and differences between consumer response in both settings. Such insights are important for at least four different reasons. *First*, at a more fundamental level, confronting the (negative) outcomes of temporary versus permanent item inaccessibility sheds more light on the retailer's trade off between wider assortments on the one hand, and higher in-store availability on the other. *Second*, these insights may provide practical guidance to managers faced with the challenge of predicting consumer reactions to permanent item deletions. As these predictions are difficult to accomplish on the basis of other information[i], retailers may be tempted to use stock-out reactions to infer response to permanent item removal. Insights into the similarities and differences between OOS and PAR reactions would clarify the feasibility of such an approach. *Third*, under the assumption that stock-out reactions evolve in the direction of – i.e. become more similar to - PAR responses the longer they last or the more frequently they occur, insights in reaction shifts between both situations can help retailers to assess the dynamic consequences of low in-store availability. *Finally*, the extent to which consumers correctly distinguish between stock-outs and permanent item removals partly depends on retailer practices, i.e. on whether the 'empty' space of out-of-stock items is (temporarily) replenished with other category items. Depending on which of both triggers less harmful reactions, retailers may wish to mask stock-outs or, conversely, clearly signal the temporary character of the unavailability by maintaining an empty space on the shelf.

In view of the limited information available to date, our paper is mainly exploratory in nature. It will focus on two research questions. First, we analyse *whether consumers react differently to an out-of-stock (OOS) than to a permanent assortment removal (PAR) of their favorite item in a category.* Second, provided that differences are observed, we *examine which factors affect the magnitude and direction of these differences*. The paper addresses these questions conceptually as well as empirically. The discussion is organized as follows. In the next section, we briefly discuss a previously developed theoretical framework for explaining OOS response. This framework allows us to formulate expectations on the similarities and differences in reaction between OOS and PAR situations, as will be clarified in section 3. Section 4 provides information on the data and methodology used to empirically test these propositions. The results are reported in section 5. Section 6 discusses retailer implications, while section 7 contains conclusions, limitations, and areas for future research.

2. Consumer reactions to stock-outs: an overview.

In spite of their importance to retailers, the literature on reactions to OOS is fairly scarce and largely empirical (see e.g. Peckham 1963, Walter and Grabner 1975, Schary and Christopher 1979, Zinszer and Lesser 1980, Emmelhainz et al. 1991, Anupindi et al. 1998). From the available OOS studies, two important observations can be derived. First, people can react to a stock-out of their favorite item in very different ways. A distinction is typically made between the following responses: consumers can switch to another item, package size or store, defer the purchase till a next shopping trip, or cancel the purchase altogether. Second, OOS reactions do not only differ between customers groups, but also depend on the product category and purchase situation.

A theoretical explanation of the observed differences in OOS responses is provided in two recent contributions (Corstjens and Corstjens 1995, Campo et al. 2000). These papers start from the assumption that consumers incur different costs for each OOS reaction, and that their response depends on a trade-off between these costs. Major costs associated with OOS reactions are substitution costs, transaction costs and opportunity costs. *Substitution costs* are caused by a decrease in utility following a switch to another alternative (item, package size or store; see Bawa and Shoemaker 1987). *Transaction costs* are costs incurred to acquire the items. They can be broken down into search costs (time and mental effort to find a suitable alternative), handling and storage costs, and – in the case of store switching – transportation costs (time and physical effort to go the another store; see e.g. Park et al. 1989; Mulhern and Padgett 1995; Bell et al. 1998). *Opportunity costs* indicate the loss in utility incurred when consumption in the category is reduced or dropped.

Table 1 provides an overview of OOS reactions and associated costs. As indicated in the first two columns of the Table, switching to another item, package size or store only gives rise to substitution and transaction costs, as no consumption is lost. In contrast, deferring the purchase till a next shopping trip allows to avoid the cost of substituting the favorite item by a less preferred one, but may lead to an opportunity cost (when consumption needs exceed the household stock) and transaction cost (in case of shopping trip acceleration). The cancel purchase option, finally, entails an opportunity cost, but no substitution or transaction costs. Next, as indicated in the third column of Table 1, the magnitude of these costs depends on various consumer, product and situation characteristics, such as store loyalty, availability of acceptable alternatives, regular package size, product importance and consumption rate. For a more detailed discussion of these characteristics and their impact on OOS reactions, we refer to Campo et al. (2000). <insert Table 1>

3. Differences between out-of-stocks and permanent assortment reductions

Compared to OOS analyses, research on consumer response to permanent item deletions is even more scarce and provides little or no theoretical underpinnings for the observed PAR reactions (see Broniarczyk et al. 1998, and Boatwright and Nunes 1999, for some recent findings). Studies on the *link* between reactions to out-of-stocks and permanent assortment reductions are, to our knowledge, non-existent. In analyzing the similarities and differences between both, we therefore start from the conceptual OOS framework described above, and investigate how it translates into a PAR setting.

Both OOS and PAR confront consumers with the problem that they cannot purchase their favorite item in the regular store[ii]. To solve this problem, they can choose among a highly similar set of reactions, which can be expected to depend on the same types of costs. At the same time, OOS and PAR differ on two other fundamental aspects that may cause consumers to respond differently. First, OOS are typically *unexpected* events that consumers are suddenly confronted with during their shopping trip. PAR, in contrast, are known to consumers and can be taken into account before the consumer engages in a new shopping trip. A second difference concerns the *duration* of the product unavailability. While stock-outs are typically short-lived, this is - by definition - not the case for a PAR. Below, we discuss the implications of both issues in more detail.

3.1. Unexpected (OOS) versus expected (PAR) item unavailability.

Whereas OOS situations force consumers to react 'on the spot', the knowledge that a permanently removed product is no longer available at the store allows them to plan the PAR reaction in advance. This implies not only that consumers have more time to make a decision, but also that they will be less restricted by situational constraints like an urgent product need or limited time available for shopping (see e.g. Corstjens and Corstjens 1995, Campo et al. 2000). Compared with an unexpected OOS, this should allow consumers to make more efficient decisions, i.e. to reduce costs associated with PAR reactions. Cost reduction will only be possible, however, for those cost components that are directly related to the shopping trip (and not, for instance, to the consumption experience which takes place at a later instance). More specifically, we expect that the possibility to plan PAR reactions will especially be helpful in reducing store switching costs. For one, deciding in advance to buy the removed product in another store may allow to reduce variable shopping costs. Whereas consumers may have been 'forced' to buy other items on the shopping list in the alternative store as well at OOS (due to situational factors such as stringent time constraints), they can split up their shopping list at a PAR and plan the purchase of the removed product to coincide with other purchases in another regularly visited store. In addition, time and effort costs of store switching can be reduced by planning the additional store visit at more appropriate time periods.

3.2. Temporary (OOS) versus permanent (PAR) unavailability

In addition to the possibility of planning PAR reactions in advance, the permanent versus temporary nature of the product removal can cause consumers to react differently to an OOS and PAR situation for two reasons. First, the fact that the assortment reduction is permanent, implies that some of the temporary solutions to overcome OOS situations are no longer

applicable. Second, the permanent character of the situation may cause the perceived costs of remaining PAR reaction alternatives to differ from similar OOS response costs.

Differences in reaction options

Overall, consumers face very similar choice options to react to a permanent assortment reduction as to a temporary OOS. There is one important difference, however. The decision to defer the purchase of the missing product till a later visit to the same store provides only a temporary answer to the problem of product unavailability. It is not a 'maintainable' solution in case of a PAR. This difference in reaction options may not only affect the retailers' losses, it may also complicate the prediction of PAR implications based on OOS responses. Consumers who deferred their purchase at OOS, may not switch to the remaining PAR reaction options in the same proportion as the observed OOS response frequencies, either because they differ on important characteristics from other customers (e.g. time constraint), or because PAR costs are perceived differently from similar OOS costs (see next section).

Differences in perceived costs of OOS and PAR reactions

The permanent nature of a PAR will cause some of the reaction costs to be evaluated differently than in case of an OOS. To examine these differences in perceived OOS and PAR costs, we distinguish between (i) PAR costs that are incurred only once and (ii) costs that have to be borne repeatedly.

Non-recurring PAR costs

Some of the PAR costs have to be incurred only once or for a very limited period of time. This is especially true for the costs associated with the search for an acceptable alternative item or store. Once a suitable substitute has been found, consumers no longer need to invest

time and effort in looking for another item or store. On the other hand, the effort made to find a satisfying substitute allows consumers to avoid or minimize substitution costs, not only for the current period, but also for all future purchase occasions. Search costs can, for this reason, be considered to constitute an 'investment'in case of a PAR. It follows that consumers may be more willing to spend extra time and effort to find a substitute when the product is permanently removed from the store's assortment, than when it is temporarily unavailable.

Recurring PAR costs

PAR costs *incurred at each purchase occasion* may not be evaluated in the same way as (similar) OOS costs either, and this for two reasons. First, perceived costs of a more **psychological** nature may gradually disappear as a result of psychological processes, such as behavioral learning, preference reinforcement and habituation (see e.g. Raju 1981, Assael 1992). Psychological costs that may affect PAR reactions are the substitution costs associated with the switch to another item or store. These result from emotion-based preferences (rather than objective product or store differences) and/or the consumer's aversion for change. When an alternative item has been bought several times (or alternative store visited repeatedly), consumers may come to like the substitute item or store more and more, making the initially experienced substitution cost gradually disappear. Likewise, consumers who at first disliked having to purchase another item or visit another store out of a psychological resistance to change, may eventually become familiar with the alternative purchasing pattern, leading to a reduction of the perceived cost of change (see e.g. Raju 1981).

Second, costs of a more **objective** nature – like transportation costs, opportunity costs, and substitution costs based on price/quality differences between items or stores - may be perceived more negatively when they have to be incurred repeatedly than when they occur

only once. According to Thaler's Mental Accounting Theory, recurrence of costs over time may make them weigh more heavily than a single cost or 'loss' of the same magnitude (mental accounting theory; Thaler 1985). Several marketing studies provided support for this proposition. For example, consumers were found to react more strongly to successive price increases than to a singular price rise of the same amount (Mazundar and Jun 1993). Based on these findings, we expect that consumers who were prepared to carry costs associated with a particular OOS reaction - such as the time and effort to visit another store - may not be willing to do so on a permanent basis, and search for an alternative reaction with non-recurring or diminishing costs.

To summarize: in spite of the common features, OOS and PAR entail different reaction options and may trigger different cost perceptions and levels - as shown in the last column of Table 1. Based on these observations, we formulate the following general hypotheses:

H1: Consumers react differently to a stock-out (for an item) than to a permanent assortment reduction (for that same item):

H1a: Consumers who choose a 'maintainable' solution to a stock-out, i.e. who do not choose the defer option, will not necessarily stay with the same reaction in case of a PAR.

H1b: Consumers who choose to defer their purchase in case of a stock-out, are not proportionally spread over the remaining reaction options in case of a PAR.

3.3. Moderators of reaction differences between OOS and PAR

Given that different cost types can evolve in opposite directions, shifts in reaction from the OOS to the PAR case will depend on the relative importance of these costs. From previous research we know that the importance of OOS costs depends on a number of consumer, product and situation characteristics (Campo et al. 2000; see Table 1). These variables may

thus explain shifts in reaction from the OOS to the PAR case. For instance, consumer characteristics associated with high opportunity costs of foregone consumption (such as high consumption rates), can be expected to reduce the attractiveness of the cancel purchase option in the PAR case, because consumers evaluate these costs more negatively when they have to carry them repeatedly. Characteristics associated with cost types that decline in case of a PAR will, in contrast, induce consumers to switch to reactions for which these (declining) costs are relevant. Highly store loyal consumers, for example, may in the long run become accustomed to the idea of buying the removed item in another – less preferred – store, and move from the switch item or package size to the switch store option. Table 1 provides an overview of the consumer, product and situation characteristics that were found to have a significant impact on OOS reactions in previous research. Based on the reasoning above, we expect these factors to also affect (changes in) perceived PAR costs, and advance the following hypothesis:

H2: Reaction shifts between OOS and PAR are influenced by consumer characteristics (consumption rate, store loyalty, time availability), product characteristics (availability of acceptable alternatives, product importance, package size) and situational factors (shopping trip type).

4. Empirical analysis: Data and Methods

4.1. Data

Data have been collected through a survey in a specific outlet of a large retail chain for two product categories: margarine, and cereals. For each category and respondent, information was collected on their likely reaction in two settings: (i) when they would suddenly find their favorite product to be temporarily unavailable due to an OOS, and (ii) when their favorite

item would have been permanently removed from the store assortment. Respondents could choose between the reaction options indicated in section 2, with the exception of switch size for cereals (where all items are offered in one size only) and defer purchase for a PAR. Using surveys to evaluate reactions to temporary and permanent assortment reactions is in line with the approach adopted in previous research. We recognize that the use of surveys has some drawbacks, in particular, it may induce a response bias. On the other hand, this approach has clear advantages for our purpose. It allows to clearly specify the settings for which reaction information is collected (unexpected, temporary OOS versus expected, permanent product removal). Our approach also offers an excellent possibility to compare reactions to OOS and PAR under 'matched' conditions, controlling for consumer-, product-, and situation characteristics that were identified in previous research as explanatory factors for consumer reactions to item unavailability. Table 2 provides an overview of these variables and the way they were measured. In total, data were obtained from 447 consumers in the cereals, and 543 consumers in the margarine category. <insert Table 2>

4.2. Methodology

Testing hypothesis 1 can be done by using simple tests of proportions, on observed OOS and PAR reactions. To check hypothesis 2, we estimate a conditional MNL model. This model links PAR reactions (the dependent variable), to OOS responses as well as household, product an situation characteristics (the independent variables, see equation [1]).

[1]

$$P_j^h = \frac{\exp(u_j^h)}{\sum_k \exp(u_k^h)} \qquad \textit{where}$$

$$u_j^h = \alpha_j + \beta_j \, Loyoos_j^h + \gamma_j \, Ddefer^h + \sum_i \delta_{ij} \, X^h$$

P^h_j = probability that consumer h chooses reaction option j when the favorite or regular item is permanently removed from the assortment (j= switch size, switch item, switch store, or cancel purchase).

u^h_j = utility of reaction option j for consumer h

X^h = consumer, product or situation characteristic, as perceived by consumer h

$Loyoos^h_j$ = dummy variable equal to 1 if the consumer selected the same reaction to an OOS as the PAR reaction j, and 0 if another OOS reaction was chosen

$Ddefer^h$ = dummy variable equal to 1 for consumers who postponed their purchase at an OOS, and equal to 0 for consumers who selected another OOS reaction.

In this model, the variable LOYOOSj captures the tendency to stay with an OOS reaction and is thus similar in nature to the 'last purchase variables in dynamic choice models' (Bucklin and Gupta, 1992, Bucklin, Gupta and Siddarth, 1998). Buyers who move away from their OOS reaction – referred to as MOVERS hereafter - have to choose among the remaining PAR responses. The distribution of the MOVERS' choices over the PAR alternatives is captured by the model constants α_j, larger constants representing reactions that are selected relatively more often by MOVERS. In order to be able to distinguish the reactions of these 'voluntary' MOVERS from the segment of consumers who have no other option than to choose a different long term reaction (the ones who deferred their purchase at an OOS) an additional variable Ddefer is incorporated into the base model. When consumers who deferred their purchase have a different preference structure for the PAR reactions than MOVERS, the coefficients associated with the Ddefer variable should be significantly different from zero, and in this way correct for the difference in choice probabilities. Consumer, product and situation characteristics taken up in earlier OOS studies (see Table 2), are included as additional explanatory variables of PAR reactions, their coefficients reflecting whether they significantly affect the tendency to stay with or move away from OOS reactions. Variables with at least one significant parameter, have a differential effect on the various reactions, and can be used to explain why consumers, given their OOS response, opt

for one PAR reaction rather than another. The magnitude of the impact is then assessed by computing the marginal effects of the variables on the PAR reaction options, given the coefficient estimates (see Campo et al. 2000 for a similar approach).

Model [1] is estimated using ML procedures, taking the switch item option as a reference point (more information on the estimation of MNL models can be found in Ben-Akiva and Lerman 1985). Given the limited number of observations, only variables that pass an initial screening stage are considered. In this screening stage, we start from a base model M0 incorporating only OOS loyalty and DEFER variables, and add each of the consumer, product and situation characteristics separately. Only characteristics that improve the explanatory power of the base model are retained for further analysis. In a second stage, a stepwise approach is adopted, starting from the base model, and adding the retained variables in decreasing order of improvement of fit.

5. Empirical analysis: Results

5.1. Differences between PAR and OOS reactions

Table 3 provides an overview of the observed OOS and PAR reactions. The table indicates that a non-negligible number of consumers who opted for a 'maintainable' solution in case of a stock-out (switch item, size or store, cancel purchase) move away from this option when the item is permanently removed. A test on proportions reveals that the percentage of consumers staying with their 'maintainable' stock-out solution (84.7 % for cereals, and 78.6 % for margarine) remains significantly below 99% ($p=.08$ for cereals, and $p=.01$ for margarine), which **confirms hypothesis H1a**. At the same time, the tendency to change strategies is not equally strong for all reaction options. Compared to the cancel purchase option (with a 'stay' rate of 30% for cereals, 8 % for margarine) and the switch size option (with a stay rate of

61% for margarine), a much larger percentage of consumers stick to their switch store (83% for margarine, 93% for cereals) or switch item choice (87% for margarine, 89 % for cereals). Given our framework, this is not totally unexpected, as some of the costs associated with the latter two options will decrease in case of a PAR, either through planning (search costs) or as a result of psychological processes (psychological substitution costs). The cancel and switch size option, in contrast, mainly entail recurring costs that are expected to be evaluated more negatively in the long run (opportunity costs, and handling and storage costs respectively). <insert Table 3>

Concerning hypothesis H1b, we note that the group of consumers who choose to postpone the purchase in case of an OOS is quite important in both categories (29% for margarine, 49% for cereals). A closer look at the tables shows that the distribution of these consumers over the remaining options in case of a PAR, significantly differs from the OOS spread over these options. This **confirms hypothesis H1b**. As can be seen in Table 3, the differences are particularly outspoken for the switch item and switch store options. Compared to the OOS situation, a significantly larger percentage ($p=.01$) of the defer-choosers decides to switch stores at a PAR, to the disadvantage of the switch item option, for which the percentage is significantly smaller ($p=.01$). Estimation results of the MNL model including constants, loyalty variables, and the defer variable (model M0) point in the same direction (see Appendix). In this model, the Ddefer coefficient of the switch store reaction is significant and positive, confirming that this option gains relatively more from consumers postponing their purchase in case of a stock-out than the switch item option. These findings are coherent with previous observations that time availability and lack of acceptable alternatives are the main reasons for postponing the purchase in case of a stock-out (Campo et al 2000), conditions more likely to induce store switching.

5.2. Impact of consumer, product and situation characteristics

As the results above point to significant shifts between OOS and PAR reactions, our next step is to investigate consumer, product and situational variables moderating these shifts. Of the original set of explanatory variables in Table 2, all passed the initial screening stage with the exception of item loyalty (cereals and margarine), shopping attitude (cereals), shopping frequency (cereals and margarine), shopping trip type (margarine) and time constraint (margarine). Results of a Likelihood-Ratio test displayed in the bottom row of Table A.1 and A.2 in Appendix, demonstrate that adding the remaining consumer, product and situation characteristics in the stepwise procedure leads to a significant improvement in overall model fit, except for the 5^{th} and 6^{th} variable (model M5 and M6). The latter result is probably due to the limited number of reaction shifts (see table 3 and 4), compared to the number of variables. Of the variables passing the initial screening stage, the large majority turns out to have at least one significant coefficient at the 10% level in the final model M6, and this in each category, indicating that they can explain shifts in reaction from the OOS to the PAR situation. The only exceptions are the consumption rate for cereals and product importance for margarine which have no significant effect on the PAR reaction probabilities. We conclude that, on the whole, **hypothesis 2 can be accepted for the majority of the moderator variables.**

To get more insight into *how* household and product characteristics affect the consumers' tendency to stay with or move away from their OOS reaction in case of a PAR, we derived marginal effects from the estimation results. These are reported in Table 4, and indicate the change in reaction probability following a (marginal) change in the explanatory variable[iii]. Consider, for instance, the figure .0408 found in Table 4 for the switch item option (column)

and the variable 'availability of acceptable alternatives' (row) in the cereals category. This figure indicates that an increase of, say 1, on the 'availability of acceptable alternatives' scale (see Table 2), enhances the probability of switch item option in case of a permanent assortment reduction by about 4 %.

<insert Table 4>

Looking at table 4, we see that for cereals as well as margarine, both the *availability of acceptable alternatives and store loyalty* lead to a shift away from the switch store option and toward the switch item reaction. For margarine, they also induce a shift away from the switch size option, which was not available for cereals. These shifts can be explained in terms of the expected cost evolutions depicted in Table 1. If store loyalty is mainly based on objective considerations – such as a superior price/quality position, or high accessibility – store switching costs will accumulate if incurred repeatedly. For size switching, also, some costs (i.e. handling and storage costs) will accumulate. Yet, when the favorite store's assortment carries an acceptable substitute – implying that motivations not to switch to another item at OOS are mainly psychological or emotional in nature – item substitution costs will decline over time, making the switch item option relatively more attractive.

In contrast, *time constraint and shopping trip type* variables - which were only retained as significant for cereals- reduce the probability of item switching to the advantage of store switching and – in the case of shopping trip type – of the cancel purchase reaction. This may result from the possibility to plan PAR reactions. Consumers may have purchased another item at their regular store at OOS, simply because they had no time to go to another store or did not want to buy other products on their shopping list over there. By planning the purchase of the removed item to coincide with other purchases in the alternative store and by splitting up their shopping list, these 'situational' difficulties can be circumvented.

High levels of *product importance and consumption rate* encourage a shift away from the cancel purchase option toward the switch item reaction (an effect significant for cereals) and the switch size option (in the case of margarine). Opportunity costs of foregone consumption are typically higher for consumers who attach more importance to the product and/or who consume larger amounts of it per time period (Campo et al.2000). When the product is permanently removed from the assortment, carrying these (accumulating) costs repeatedly may not be an acceptable option.

For margarine, we observe a negative impact of *(large) package size* on the probability of item switching. This indicates that consumers who typically buy a small pack are more inclined to switch to another item in case of a PAR - and much less inclined to change package sizes - than large pack buyers. This, again, is not unexpected. Size switching costs are especially relevant for small pack buyers, who experience an increase in transaction costs, and possibly substitution costs, when they switch to a larger package size. As these costs may weigh more heavily when carried repeatedly, small pack buyers are likely to choose a different option in case of a PAR.

Finally, a favorable *shopping attitude*, appears to increase the probability of item switching for margarine, to the disadvantage of the store switching option. The rationale underlying this shift in reaction is less clear. Possibly, consumers who like shopping decide to go to another store at OOS as a 'change of pace', yet are not willing to spend extra time and effort to visit another store repeatedly (in which case the additional store visit would become routine and hence less stimulating from an hedonic point of view).

6. Implications for retailers

Both the conceptual framework, and the empirical results presented above, point to important differences in reactions to OOS and PAR. From a managerial viewpoint, it is interesting to consider what these differences imply in terms of losses. While the immediate reactions to stock-outs may seem alarming to the retailer (only about 40 to 65 % of consumers engaging in an instant replacement purchase in the store), he can expect to recover a large portion (about 95 %) of his normal sales if post-stock-out periods with 'recovery' purchases are accounted for. Permanent assortment reductions result in more important net losses, as (i) the 'defer purchase' option - which represents a shift in time rather than a sales loss - is no longer available, (ii) consumers who defer their purchase in case of an OOS have a relatively stronger tendency to switch stores in case of a PAR, and (iii) consumers who change stores in case of an OOS stay with that option if the item is permanently removed. In our data set, permanent elimination of the item thus implies a customer loss of 28 % for cereals, and 13 % for margarine, a figure 3 to 6 times as large as the net stock-out loss.

It follows that retailers should be careful extrapolating 'net' stock-out implications to a situation where items are permanently removed. This is the more true in view of the finding that especially heavy users and time constrained consumers (who tend to be large basket shoppers), shift from the switch item to the switch store option in case of a PAR - an effect that is somewhat less outspoken in stores that have built up a loyal clientele.

Our finding that PAR result in more substantial losses than OOS does *not*, however, imply that retailers should tolerate stock-outs in the interest of keeping large assortments. Our results suggest at least one reason why (not), by showing that the shift between OOS and PAR responses crucially depends on the availability of acceptable alternatives. In line with the results reported by Broniarczyk et al. (1998) and Boatwright and Nunes (1999), we find

that the availability of acceptable alternatives in the store assortment, can convince consumers who looked for their product elsewhere in the short run, to invest in identifying a suitable substitute in the store in case of a PAR. From the retailer perspective, this implies that dropping duplicate items permanently, may be much less detrimental than having core or highly preferred items with few substitutes temporarily out-of-stock.

Our framework and empirical outcomes further suggest that losses caused by an OOS may more than proportionally increase with stock-out duration and frequency of stock-out occurrence, in which cases the consumers' reactions will start to mimic PAR responses. A tentative implication is that, even if avoiding stock-outs altogether is not a reasonable objective, retailers should at least make sure that they are resolved quickly, and do not recur often for the same items.

Finally, an interesting observation emerging from our model and results is that retailers who ran out of a particular item, may find it good practice to leave the shelf space of the stock-out item unused. In doing so, they signal that item unavailability is temporary, and encourage the consumer to defer his purchase rather than look for a permanent solution immediately - which is often less appealing to the store.

6. Conclusions, Limitations and Future Research

A conceptual analysis of stock-out and permanent assortment reduction situations points to important similarities, but at the same time emphasizes non-negligible differences. These differences are caused by the *expected* nature of a PAR, and by its *permanent* character.

Because of these PAR characteristics, some (temporary) solutions to OOS situations are no longer available, and cost evaluations of other (maintainable) reactions become more positive or negative. It follows that, although OOS reactions for an item can be indicative of PAR responses for that item, they will not perfectly match them. The conceptual framework also suggests consumer, product and situation characteristics likely to affect reaction shifts from OOS to PAR, shedding more light on the rationale behind those shifts.

Our data analysis largely confirms the expectations from the conceptual framework. First, we find important shifts in reaction from the OOS to the PAR situation, shifts that are in line with the predicted cost evolutions between temporary and permanent product unavailability. A second important observation is that – as expected - several variables found to influence OOS costs in previous research, can also explain changes in reaction from a temporary stock-out to a permanent assortment reduction. Our analysis therefore not only sheds light on how temporary (OOS) reactions translate into permanent (PAR) reactions, but also provides some underlying rationale for these dynamics.

Taken together, our findings lead to tentative - yet important - implications for retailers. First, retailers should be cautious in inferring PAR consequences from OOS reactions, as losses incurred at a PAR can substantially larger than those in case of an OOS for the same item. This is especially true if the store's clientele comprises heavy category users and time constrained consumers, and if it is not particularly loyal to the store. Second, differences in reactions and retailer losses between OOS and PAR depend to a large extent on whether acceptable alternatives are available in the store, suggesting that retailers may find it beneficial to permanently remove duplicate items from the assortment, so as to ensure availability of remaining key items. Third, our results provide - be it indirect - indications that

stock-out losses may disproportionally grow with stock-out frequency and duration. Finally, given the importance of PAR losses, retailers may wish to explicitly signal the temporary character of a stock-out by leaving the shelf space of the OOS item unused - thereby stimulating consumers to defer their purchase rather than buy elsewhere.

Clearly, our study also has important limitations. For one, only two product categories are analyzed. Also, our data stem from 'reported' behavior and measure consumer response to unavailability of their 'favorite' item. Obviously, consumer reactions for items other than their preferred product will be much less outspoken to non-existent. Yet, since this is true for observed OOS as well as PAR reactions, this does not jeopardize our conclusions on reaction dynamics. Finally, only two opposite cases were considered in our empirical analysis: unexpected and temporary unavailability, versus expected and permanent dropouts. Even though reactions to unexpected and permanent, or expected and temporary, item unavailability are likely to be situated somewhere in between, our empirical analysis did not explicitly address these settings. Future research should further validate the outcomes of this study, by examining more settings, product categories, and truly observed reactions for favorite ánd less preferred items. In addition, a worthwhile area for future research lies in the analysis of how reactions to stock-outs evolve as the OOS stretches out over a longer period, or occurs repeatedly over time.

References

Anupindi, R.; M. Dada and S. Gupta (1998), "Estimation of Consumer Demand with Stock-out Based Substitution: An application to Vending Machine Products", Marketing Science, 17 (4), 406-423.

Assael, H. (1992), *Consumer Behavior and Marketing Action*, Boston, Massachusetts: PWS Kent

Bell, D.R., T.H.Ho and C.S.Tang (1998), "Determining Where to Shop: Fixed and Variable Costs of Shopping", *Journal of Marketing Research*, 35(3), 352-369.

Ben-Akiva, M. and S.Lerman (1985), *Discrete Choice Analysis*, Cambridge, Massachusetts: MIT Press.

Borin, Farris & Freeland (1994), "A model for determining retail product category assortment and shelf space allocation", *Decision Sciences*, 25(3), 359-384.

Broniarczyk, S.; W. Hoyer and L. Mc Alister (1998), "Consumers' Perceptions of the Assortment Offered in a Grocery Category: The Impact of Item Reduction", *Journal of Marketing Research*, Vol. XXXV (May), 166-176

Bultez, A. (1997), "Econométrie de la competitivité: modèles et contre-exemples", *Recherche et Applications en Marketing*, 12(1).

Campo K., E. Gijsbrechts and P. Nisol (1999), Towards Understanding Consumer Response to Stock-Outs, *Journal of Retailing*, 76(2), 219-242.

Colombo, R.A. and D.G.Morrison (1989), "A Brand Switching Model with Implications for Marketing Strategies", *Marketing Science*, 8(1), 89-99.

Corstjens, J. and M. Corstjens (1995). *Store Wars : The battle for Mindspace and Shelfspace.*, New York: J.Wiley

Dhar, R. (1997), "Consumer Preference for a No-Choice Option", *Journal of Consumer Research*, 24 (September), 215-231.

Drèze, X., S.J. Hoch, and M.E.Purk (1994), "Shelf Management and Space Elasticity", *Journal of Retailing*, 70(4), 301-326.

Emmelhainz, M., L. Emmelhainz and J. Stock (1991), "Consumer Responses to Retail Stock-outs", *Journal of Retailing*, 67(2), 138-147.

Jain, K. and N.Srinivasan (1990), "An Empirical Assessment of Multiple Operationalizations of Involvement", *Advances in Consumer Research*, 17, 594-602.

Kahn, B.E. (1999), "Introduction to the Special Issue: Assortment Planning", Journal of Retailing, 75, 289-293

Krishnan, T. and H. Soni (1997), "Guaranteed Profit Margins : A Demonstration of Retailer Power", *International Journal of Research in Marketing*, 14 (1), 35-56.

Mazundar, T. and S.Y.Jun (1992), "Consumer Evaluations of Multiple versus Single Price Change", *Journal of Consumer Research*, 20(December), 441-450.

Mulhern, F.J.,and D.T.Padgett (1995), "The Relationship between Retail Price Promotions and Regular Price Changes", *Journal of Marketing Research*, 34(May), 248-261.

Park, C., E.Iyer and D.Smith (1989), "The Effects of Situational Factors on In-Store Grocery Shopping Behaviour: The Role of Store Environment and Time Available for Shopping", *Journal of Consumer Research*, 15(March), 422-433.

Peckham, J.(1963), "The Consumer Speaks", *Journal of Marketing*, October, 21-26.

Raju, P.S. (1981), "Theories of Exploratory Behavior: Review and Consumer Research Implications", *Research in Marketing*, 4, 223-249.

Schary, Ph. and M. Christopher (1979), "The Anatomy of a Stock-out", *Journal of Retailing*, 55(2), 59-70.

Thaler, R. (1985), "Mental Accounting and Consumer Research", *Marketing Science*, 4(3), 199-214.

Untitled (2000), 'Survival of the Fullest', unpublished report, Anderson Consulting Analysis.

Walter, C. and J. Grabner (1975), "Stock-out Cost Models: Empirical tests in a Retail Situation", *Journal of Marketing*, 39, July, 56-68.

Zinszer, P.H. and J.A. Lesser (1981), "An Empirical Evaluation of the Role of Stock-Out on Shopper Patronage Processes", *Advances in Consumer Research*, 8, 221-224.

Table 1: Basic costs and cost factors associated with OOS reactions

OOS REACTION	ASSOCIATED COSTS	COST FACTORS	CHANGE IN PERCEIVED COST	
			Cost type	**Evaluation at PAR**
Switch item	• Substitution costs	• Item loyalty, variety seeking tendency	Recurring	
			- psychological	diminishing (+)
		• Availability of acc.alternatives	- objective	accumulating (-)
	• Transaction costs: Search costs	• Product experience	Non-recurring	investment (+)
Switch package size	• Substitution costs	• Regular size	Recurring	
			- objective	accumulating (-)
	• Transaction costs: Handling and storage costs	• Regular size and use rate	Recurring	
			- objective	accumulating (-)
Switch store	• Substitution costs	• Store loyalty, variety seeking tendency	Recurring	
			- psychological	diminishing (+)
		• Type of shopping trip	- objective	accumulating (-)
	• Transaction costs: Search and Transportation costs		Non-recurring	investment (+)
		• Time constraint, shopping attitude	Recurring	accumulating (-)
			- objective	or planning (+)
Defer purchase	• Transaction costs Transportation costs	• Time constraint, shopping attitude and frequency	Not relevant at PAR	Not relevant at PAR
	• Opportunity costs	• Required purchase quantity		
Cancel purchase	• Opportunity costs	• Required purchase quantity, type of shopping trip	Recurring	
			- objective	accumulating (-)

Source: The overview of OOS costs and cost factors is derived from Corstjens and Corstjens (1995) and Campo et al. (2000)

Table 2: Explanatory Factors for OOS and PAR reactions

VARIABLE	MEASURE*
Item loyalty	Tendency to repurchase the same item in a product category, measured by 3 statements from the Exploratory Acquisition of Products scale (Baumgartner and Steenkamp 1996)
Availability Of Acceptable Alternatives	Extent to which the consumer finds choosing another than the regular item from the product category an easy task, measured by 3 statements of the risk dimension of the involvement scale (Jain and Srinivasan 1990)
Consumption rate	Average household consumption of the product category, in packages per day
Package Size	Size that the household usually purchases, measured as a dummy variable equal to one for large packages and equal to zero for small packages
Product importance	Degree to which the consumer finds having a stock at home important, approximated by the number of units the consumer always tries to have in stock ('safety stock', see Campo et al. 1999)
Store Loyalty	Tendency to revisit the same store for grocery purchases, measured by 3 adjusted statements from the Exploratory Acquisition of Products scale (Baumgartner and Steenkamp 1996)
Shopping attitude	Degree to which the consumer finds grocery shopping an enjoyable task, measured by 3 adjusted statements of Babin et al's (1994) Hedonic Shopping Value scale
Shopping trip type	Dummy variable equal to one if the product is purchased on a major shopping trip, and equal to zero when it is purchased on a minor shopping trip (see Kahn and Schmittlein 1992)
Shopping frequency	Average number of weeks between two successive shopping trips for groceries
Time constraint	Restrictions on the time spent on shopping, approximated by the employment rate (number of working hours per week).

* Results of a Chronbach alpha and principal component analysis provided support for the reliability and discriminant validity of the self-report scales, and can be obtained from the authors on request.

Table 3: Cross-tabulation of OOS by PAR reactions

CEREALS	PAR				
OOS	Switch item	Switch store	Cancel purchase	Total	Percentage[a]
Switch item	175	17	5	197	86%
Switch store	1	14	0	15	6.5%
Cancel purchase	6	6	5	17	7.5%
Defer purchase (percentage[b])	140 (64%)	63 (30%)	15 (6%)	218	
Total	322	100	25	447	

MARGARINE	PAR					
OOS	Switch item	Switch size	Switch store	Cancel purchase	Total	Percentage[a]
Switch item	241	16	18	2	277	72%
Switch size	26	51	7	0	84	22%
Switch store	1	1	9	0	11	2.9%
Cancel purch.	2	5	4	1	12	3.1%
Defer purchase (percentage[b])	87 (55%)	45 (28%)	24 (15%)	3 (2%)	159	
Total	357	118	62	6	543	

[a] Share of OOS reaction as a percentage of all maintainable solutions (i.e. reactions other than 'defer purchase').
[b] Share of PAR reaction as a percentage of all customers who chose to defer their purchase at OOS.

Table 4: Marginal effects of explanatory variables on PAR reaction probabilities*

Variable	Switch size	Switch item	Switch store	Cancel purchase
Cereals				
A.A.alternatives	n.r.	0.0408	-0.0381	-0.0026
Store loyalty	n.r.	0.0331	-0.0383	0.0052
Consump. Rate	n.r.	-0.0167	0.0389	-0.0224
Time constraint	n.r.	-0.0464	0.0430	0.0033
Prod.importance	n.r.	0.0926	-0.0355	-0.0571
Shop.trip type	n.r.	-0.0756	0.0231	0.0525
Margarine				
A.A.alternatives	-0.0208	0.0497	-0.0302	0.0014
Store loyalty	-0.0071	0.0248	-0.0157	-0.0020
Consump. Rate	-0.0583	0.0428	0.0335	-0.0181
Shopping att.	-0.0045	0.0196	-0.0121	-0.0030
Prod.importance	-0.0310	0.0323	-0.0012	-0.0001
Package size	0.0908	-0.0708	-0.0184	-0.0017

* n.r. = not relevant

Appendix

Table A1: Estimation results Cereals

Variable	M0	M1	M2	M3	M4	M5	M6
Switch store							
Constant	-2.06[a]	0.70	0.09	1.85[b]	1.94[b]	1.86[b]	1.84[b]
Loyoos	4.73[a]	4.78[a]	4.92[a]	4.66[a]	4.70[a]	4.64[a]	4.64[a]
Ddefer	1.26[a]	1.40[a]	1.44[a]	1.26[a]	1.27[a]	1.29[a]	1.31[a]
Store loyalty		-0.24[a]	-0.22[a]	-0.22[a]	-0.22[a]	-0.22[a]	-0.22[a]
Time constraint			0.29[a]	0.28[a]	0.28[a]	0.27[b]	0.26[b]
Availabity acc.alternatives				-0.22[a]	-0.22[a]	-0.23[a]	-0.23[a]
Product importance					-0.19	-0.29	-0.29
Consumption rate						0.19	0.20
Shopping trip type							0.21
Cancel purchase							
Constant	-3.53[a]	-3.52[a]	-3.84[a]	-3.18[b]	-2.90[b]	-2.69[c]	-2.99[c]
Loyoos	2.78[a]	2.78[a]	2.70[a]	2.66[a]	2.66[a]	2.62[a]	2.49[a]
DDefer	1.30[a]	1.30[b]	1.34[b]	1.28[b]	1.39[b]	1.35[b]	1.45[b]
Store loyalty		-0.002	0.004	0.002	0.04	0.04	0.04
Time constraint			0.18	0.19	0.16	0.15	0.12
Availability acc.alternatives				-0.08	-0.09	-0.09	-0.10
Product importance					-1.24[b]	-1.05[b]	-1.08[b]
Consumption rate						-0.40	-0.35
Shopping trip type							0.98[c]
Loglikelihood	-290	-281	-276	-271	-267	-265	-263
LR-test statistic		18[a]	10[a]	10[a]	8[b]	4	4

[a] Significant at the 1% level

[b] Significant at the 5% level

[c] Significant at the 10% level

Table A2: Estimation results Margarine

Variable	M0	M1	M2	M3	M4	M5	M6
Switch size							
Constant	-2.39[a]	-0.97[c]	-0.67	0.30	0.66	0.72	-0.02
Loyoos	2.94[a]	2.92[a]	2.98[a]	2.96[a]	2.96[a]	2.95[a]	2.90[a]
Ddefer	1.73[a]	1.61[a]	1.63[a]	1.68[a]	1.68[a]	1.69[a]	1.73[a]
Availability acc.alternatives		-0.16[a]	-0.16[b]	-0.16[b]	-0.17[a]	-0.17[b]	-0.17[b]
Consumption rate			-0.37[b]	-0.38[b]	-0.37[b]	-0.36[b]	-0.33[b]
Store Loyalty				-0.07	-0.07	-0.07	-0.07
Shopping attitude					-0.06	-0.06	-0.05
Product importance						-0.12	-0.19
Package size							0.52[c]
Switch store							
Constant	-2.22[a]	0.60	0.39	2.62[b]	3.52[a]	3.48[a]	3.55[b]
Loyoos	3.82[a]	3.69[a]	3.72[a]	3.69[a]	3.66[a]	3.66[a]	3.62[a]
Ddefer	0.94[a]	0.68[b]	0.65[c]	0.81[b]	0.82[b]	0.82[b]	0.81[b]
Availability acc.alternatives		-0.34[a]	-0.35[a]	-0.35[a]	-0.35[a]	-0.35[a]	-0.35[a]
Consumption rate			0.23	0.21	0.25	0.25	0.24
Store Loyalty				-0.18[b]	-0.18[b]	-0.18[b]	-0.18[b]
Shopping attitude					-0.14[c]	-0.14[c]	-0.14[c]
Product importance						0.06	0.08
Package size							-0.06
Cancel purchase							
Constant	-4.87[a]	-5.72[a]	-3.73	-0.68	1.28	1.13	1.18
Loyoos	2.65[b]	2.70[b]	2.53	2.88	2.24	2.26	2.27
Ddefer	1.50	1.60	1.62	1.82	1.80	1.92	1.90
Availability acc.alternatives		0.09	0.08	0.05	0.09	0.07	0.06
Consumption rate			-2.71	-2.57	-2.24	-1.89	-1.87
Store Loyalty				-0.25	-0.28	-0.24	-0.24
Shopping attitude					-0.37	-0.33	-0.33
Product importance						-0.80	-0.79
Package size							-0.06
Loglikelihood	-416	-402	-396	-391	-387	-387	-385
LR-test statistic		28[a]	13[a]	9.5[b]	7[c]	0.8	4

[a] Significant at the 1% level

[b] Significant at the 5% level

[c] Significant at the 10% level

Footnotes

[i] As indicated in the literature, collecting information on consumer reactions to product removal is not an easy task. One approach would be to experiment in the store, leaving products out for a number of periods and monitoring the consequences (see e.g. Drèze et al. 1994). Such experiments are costly and risky, though, and difficult to design. It is not clear, for instance, for how many periods a product should be unavailable before reactions stabilise (Broniarczyk et al. 1998). An alternative possibility is to use stock-out reactions as indicative of consumer response to a permanent reduction. Despite efforts to avoid them, stock-outs occur fairly regularly, for successful as well as less appealing products. For managers, it is thus tempting to extract information from such stock-out reactions to predict consumer response to permanent item removal.

[ii] The discussion concentrates on the group of buyers of the missing product. Buyers of other products do not have to change their purchase behavior and are therefore not taken into account here.

[iii] In interpreting these results, it is relevant to note that the effects of consumer, product and situation characteristics are partial effects, over and above the impact of the loyalty variables -which capture the behavior of consumers who stay with their OOS option- and of the Ddefer variables – which account for the allocation of those who postponed their purchase in the stock-out case. Interestingly, we find that the loyalty and Ddefer variable coefficients do not substantially change as consumer and product characteristics are added to the model [iii], in contrast to the model constants, which systematically decrease or increase as more variables are incorporated (see Appendix for a complete overview of these results). As these model constants reflect how consumers who move away from their OOS choices are spread over the PAR reactions (see section 4), this means that our moderators mainly explain the distribution of these MOVERS.