"THE DYNAMICS OF THE CONSIDERATION SET FORMATION PROCESS: A RATIONAL MODELLING PERSPECTIVE AND SOME NUMERICAL RESULTS"

by

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The Dynamics of the Consideration Set Formation Process: A Rational Modeling Perspective and Some Numerical Results

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ABSTRACT

The notion of a consideration set describing a subset of brands from which an individual consumer will select or choose has received considerable attention in the recent literature. This paper develops a rational model of the consideration set formation process which is characterized by a sequential search balancing incremental benefit with decision costs. In contrast to previous work, the operationalization defines both incremental benefit and decision costs in the utility domain recognizing the existence of perceptual complexity, preference differences, involvement, search economies, and inertia effects once a brand belongs to the consideration set. The model enables full analysis of the dynamics of consideration set formation over time. Extensive numerical results add validity to the process and its operationalization, and provide important insights into the likelihood of expansion and contraction of consideration sets.

Key Words: CONSIDERATION SET, RANDOM UTILITY, SEARCH, CHOICE.

INTRODUCTION

The notion of a consideration set describing a subset of brands from which an individual consumer will select or choose is receiving considerable attention in the recent literature. Given behavioral evidence that choice sets are defined prior to choice (see, e.g., Bettman 1987, Payne 1983) and theoretical evidence in the transportation economics literature on the lack of robustness in choice model estimates when ignoring the subset selection phenomenon (see, e.g., Ben Akiva and Lerman 1985, Swait and Ben Akiva 1986), marketing researchers are demonstrating a serious interest in consideration sets (Shocker et. al. 1991), the processes by which they might arise (Hauser and Wernerfelt 1990), and their integration into choice models (Roberts and Lattin 1991, Vanhonacker 1991).[1]

Despite differences in terminology and definition, the notion of a consideration set generally refers to the identification of a subset of brands from which a choice will be made. Given that choices will be limited to the alternatives in the set, there is substantial managerial interest in how these sets are formed and to what extent the formation process can be influenced. Academics have positioned the notion within the sequential choice paradigm, approaching the formation of consideration sets as a step prior to choice. A number of contemporary research questions arising from this positioning are discussed in Shocker et. al. (1991).

Because of an inability to directly observe the consideration set formation process, researchers have to be content with theoretical postulates on how that process might develop. As the process has an inherent search characteristic, a rational conceptualization relying on the economics of information has been adopted by some authors. Hauser and Wernerfelt (1990) conceptualize the process as a balancing of incremental benefit and costs. As long as the costs of evaluating an additional brand at the time of choice are outweighed by the incremental benefit it provides, the brand will be added to the consideration set. This conceptualization influenced the work by Roberts and Lattin (1991) and Vanhonacker (1991).

The operationalization of the concept has been limited. Roberts and Lattin (1991) describe an aggregate-level process where incremental benefit is defined in the utility domain using Ben Akiva and Lerman's (1985) results which are based on random utility assumptions identical to those underlying the multinomial logit model. Decision costs, identical across brands, are treated as constants and are estimated endogenously. Vanhonacker (1991) describes an individual-level process where both incremental benefit and decision cost are defined in the utility domain relying on similar random utility assumptions. Specifically, incremental benefit is defined as in Ben Akiva and Lerman (1985), and decision cost is operationalized using Shugan's (1980) "cost of thinking" notion. As the

objective in both Roberts and Lattin (1991) and Vanhonacker (1991) is to integrate the process in a parsimonious choice model, the rational consideration set formation process is not develop in its entirety.

The objective of this paper is to fully describe the consideration set formation process at the individual level. The process is described as a rational one, using the conceptualization of Hauser and Wernerfelt (1990). The model of the process is specified entirely in the utility domain with random utility assumptions identical to the ones underlying the multinomial logit choice model. As in Roberts and Latin (1991), the cost-benefit comparison is modeled in a compensatory sense. The novelty of the process model is its explicit recognition of perceptual complexity, search economies, and inertia which arise during the sequential search. Shugan's (1980) cost of thinking is extended to capture these realistic phenomena existing in sequential decisions. In contrast to previous attempts, the resulting model fully describes the dynamics of consideration set formation. Extensive numerical results provide intuitively appealing insights into the likelihood of expansion and contraction of consideration sets over time.

CONSIDERATION SET FORMATION

Rational Conceptualization

The consideration set formation process is modeled at the individual consumer level. As the model is developed in the utility domain, some basic assumptions about the individual's utility towards brands have to be stated. In the tradition of random utility models, the individual consumer has a utility towards each of the m brands in the universal set of all brands available in the market which consists of both a deterministic component and a random component. Stated algebraically, the utility that an individual consumer attaches to brand j equals

$$U_j = V_j + \mu_j. \qquad \text{for } j=1,2,...m \qquad (1)$$

where V_j describes the deterministic utility component, and μ_j describes the random utility component.

Following McFadden (1974), the random utility component is assumed to be independent and identically distributed (i.i.d.) across all brands according to a Type - 1 Extreme Value distribution (see Johnson and Kotz (1970), Chapter 21 for a description of this distribution). This particular distribution together with the i.i.d. assumption allows McFadden (1974) to derive the parsimonious logit choice model given the choice rule of utility maximization. We will maintain these basic assumptions throughout subsequent development.

The consideration set is defined deterministically as the outcome of a rational process. Following Hauser and Wernerfelt (1990) and Roberts and Lattin (1991), brands belonging to the consideration set are identified using a sequential sampling process balancing consumption utility and evaluation cost. In this process, a pre-evaluation is done with respect to each brand. At the time of forming the consideration set, the cost of this pre-evaluation is a sunk cost. Based on the pre-evaluation, the individual consumer will assess the incremental benefit which could be gained from considering the brand in addition to those already belonging to the consideration set. If the incremental benefit is judged to be larger than the cost which would be incurred in having to evaluate an additional brand at the time of choice, the brand will be added to the consideration set[2]. Specifically, a brand will be added (deleted) if the expected maximum utility of choosing from (n+1) brands minus the expected maximum of choosing from n brands exceeds (does not exceed) the additional cost of evaluating this additional brand. Algebraically, this rule can be stated as: the $(n+1)^{th}$ brand is added if

$$E\,[\max\,(n+1)] - E\,[\max\,(n)] > d_{n+1} \qquad (2)$$

where E denotes the expectations operator, max (n) denotes the maximum utility which could be derived form choosing among n brands, and d_{n+1} denotes the cost of evaluating the $(n+1)^{th}$ brand given that n brands are already in the choice set. Using similar arguments, deleting a brand from the consideration set is a result of

$$E\,[\max(n)] - E\,[\max(n-1)] < d_n.$$

In operationalizing the process, two issues have to be addressed. First, both the left and right sides of the inequality have to be operationalized in detail. Second, the sequence of brand consideration has to be determined.

Operationalization of Decision Costs (d_{n+1})

In this work, both the left and right sides of inequality (2) are defined in the utility domain. Hence, in contrast to Roberts and Lattin (1991), the decision costs are not fixed but are allowed to vary depending on the utility profiles of the brands considered. The operationalization suggested here follows Vanhonacker (1991) and builds on Shugan's (1980) "cost of thinking" notion. We will first define the notion and show how it can be operationalized using the random utility assumptions stated above. Subsequently, we will argue that a number of modifications have to be introduced to accommodate the realities of the sequential search and the role it plays in the choice process.

Shugan (1980) argues that the cost of evaluating two brands with the objective of selecting one is directly proportional to the perceptual complexity of the comparison, and inversely related to both the difference in preference between the brands and the confidence at which the choice must be made. This is operationalized in the utility domain by Shugan as

$$f_p = \frac{Var(U_j) + Var(U_k) - Cov(U_j, U_k)}{(1-\alpha)\,[E(U_j) - E(U_k)]^2} \qquad (3)$$

where f_p denotes the potential cost of comparing brands j and k, U_j and U_k are the utilities of the two brands (as in expression (1)), and α denotes the level of confidence at which the selection between both brands must be made. In a behavioral sense, α can be interpreted as a measure of involvement. In this operationalization, the numerator captures perceptual complexity which is measured by the variance of the difference in utility between the two brands (i.e., Var (U_j - U_k)). The denominator captures involvement (the $(1-\alpha)$ component), and the preference difference between the two brands which is measured by the squared difference in mean utility. Accordingly, both the

perceptual complexity and the preference difference are defined in a compensatory way relying on base utilities. One technical advantage of this operationalization is that the resulting measure in (3) is scale invariant.

With the utility functions and the distributional assumptions of their random components as defined in relation to (1), Shugan's operationalization of the decision cost in (3) becomes

$$f_p = \frac{2\beta}{(1-\alpha)(V_j - V_k)^2}$$

where β denotes the constant variance parameter of the Type-1 Extreme Value distribution. Note that because of the i.i.d. assumption with respect to the random utility components, the covariance term in the numerator of (3) equals zero and, hence, drops out of the expression. As Shugan considers the costs of each pairwise comparison as additive, the decision cost of evaluating the $(n+1)^{th}$ brand, given n brands in the consideration set, becomes the sum of the pairwise evaluation costs. Accordingly, the operationalization of d_{n+1} in the present model becomes

$$d_{n+1} = \frac{2\beta}{(1-\alpha)} \sum_{j \neq n+1} \frac{1}{(V_j - V_{n+1})^2} \tag{4}$$

where the summation sign captures the sum of all pairwise comparisons involved.

Expression (4) captures Shugan's (1980) operationalization of the "cost of thinking" using the random utility assumptions postulated above. Two immediate observations can be made with respect to this operationalization. Both observations are a direct result of the random utility assumptions made here and question the appropriateness of Shugan's operationalization in light of these common assumptions. First, the scale invariance property has been lost, and second, the concept of perceptual complexity is no longer incorporated. To preserve the basic "cost of thinking" conceptualization as developed in Shugan (1980), the operationalization in (4) needs to be adapted to address these two issues. Furthermore, additional improvements need to be made because of the realities of the sequential search process to which the notion is applied here. These realities are discussed in some detail now. To accommodate these realities and the two issues raised with respect to expression (4), an improved operationalization of the decision cost d_{n+1} is developed subsequently.

Since the consideration set formation process is modeled as a sequential search process, multiple comparisons - some involving the same brands - will be made each time a set is formed. Clearly, certain economies can develop throughout the process. Accordingly, the search and comparison effort (captured in the decision costs) are likely to decline with multiple comparisons. Both search

economies (as a learning or experience effect) and lack of effort (as a fatigue effect) will make the decision costs decline in the sequential, rational process. Furthermore, a certain inertia might give rise to asymmetries in entry to and exit from the consideration set. It is reasonable to assume that once a brand is in the consideration set, the longer it stays in the more difficult it will be to drop out. These search economies and inertia arising in sequential evaluations are not incorporated in Shugan's operationalization in (4). That operationalization views the decision cost of each pairwise comparison as totally independent from any other pairwise comparison and from whether or not the brands have been retained in the consideration set. Moreover, an improved operationalization has to be derived incorporating search economies and inertia and addressing the concern on the loss of the scale invariance property and the perceptual complexity notion raised above. The improvement in the operational measure of decision cost is developed addressing each of the issues separately.

(a) Perceptual Complexity and Scale Invariance

Given the utility functions in (1) and maintaining the desire to keep a holistic (compensatory) view, the variability in complexity of the brands is contained in the variability of the deterministic utility components. Accordingly, perceptual complexity (above and beyond the constant variance of the random utility) is defined here as the sample variance in the deterministic utility components, or

$$\text{perceptual complexity} = \frac{1}{m}\sum_{j=1}^{m}(V_j - \overline{V})^2 \tag{5}$$

$$\text{with} \quad \overline{V} = (1/m)\sum_{j=1}^{m} V_j.$$

The nice side benefit of integrating this measure into the decision cost in (4) is that the scale invariability inherent in Shugan (1980)'s general operationalization is restored.

(b) Search Economies

Search economies are incorporated as an exponentially declining cost reduction factor. Hence, no specific assumptions are made about the nature of the learning effects. Also, no distinction is made between decision cost reduction as the result of actual learning (real search economies) and decision cost reduction as a manifestation of reduced effort because of fatigue. The proposed operationalization equals a cost reduction factor defined as:

$$\text{cost reduction factor as a result of search economies} = \frac{1}{\exp(\delta_1 S)} \tag{6}$$

where S denotes the number of times the consideration set is changed throughout the process of sequential search. As will be discussed shortly, each comparison in the process leads to either an add or a drop decision. Whichever decision is made, the set changes in composition and the incremental benefits of all alternatives change. The evaluation process then restarts and continues until no further changes occur. Variable S captures the number of restarts of the evaluation process given specific utilities at one point in time. As one would expect, the number of restarts is positively related to the size of the universal set but not necessarily to the size of the consideration set.

c) Inertia

Inertia is incorporated directly into the utility domain. It is assumed that individuals make a positive utility adjustment as brands maintain their membership in the consideration set over time. Hence, inertia effects are captured very much like the re-evaluation of alternatives in reducing postdecision dissonance (Festinger 1957). The suggested operationalization is that utilities of brands in the consideration set are adjusted upwards, or

$$\text{Adjusted Utility of brand j} = (V_j)\left[\frac{\gamma_1}{1+\exp(-\gamma_2 T)}\right] \tag{7}$$

where γ_1 and γ_2 are positive, and T denotes the time since brand j entered the consideration set. The adjustment factor in (7) is an S-shaped function, with the lower point (i.e., T = 0) equal to one and the upper asymptote (i.e., $T \rightarrow \infty$) equal to γ_1.

Finally, incorporating the proposed operationalization of perceptual complexity, search economies, and inertia, the decision cost d_{n+1} in (4) becomes

$$d_{n+1} = \frac{2\beta(1/m)\sum_{j=1}^{m}(V_j - \overline{V})^2}{(1-\alpha)\exp(\delta_1 S)} \sum_{j \neq n+1} (V_j - V_{n+1})^2 \tag{8}$$

where the deterministic utility of all brands belonging to the consideration set, V_j, is adjusted as in (7).

Operationalization of Incremental Benefits

The operationalization of the incremental benefit (i.e., the left side of inequality (2)) is as in Roberts and Lattin (1991) and Vanhonacker (1991). Both papers follow Ben Akiva and Lerman (1985) who show that under the random utility assumptions stated above, the incremental benefit equals

$$E[\max(n+1)] - E[\max(n)] = \ln \frac{\sum_{j=1}^{n+1} \exp(V_j)}{\sum_{j=1}^{n} \exp(V_j)} \tag{9}$$

which in a multinomial logit sense equals the odds ratio of selecting any brand from a set of n versus selecting it from a set of (n+1) brands. With both decision costs in (8) and incremental benefit in (9) defined in the utility domain, the rational entry rule defined in (2) is fully operationalized. Before the dynamics of the process can be fully demonstrated, however, the sequence of evaluation needs to be determined.

Sequence of Consideration

A number of different ordering mechanisms can be adopted defining the order in which brands will be evaluated either for entry into or exit from the consideration set. Shugan (1980, p.104) suggests the relative magnitude of the decision costs, commencing with the least costly. Roberts and Lattin (1991) use the relative magnitude of the brand utilities, commencing with the brand with the highest utility. In either case, at each point in time, one starts from an empty set and builds up to a consideration set. Hence, the dynamics of the process over time are not fully captured. The ordering mechanism adopted here relies on incremental benefits and does allow for the expansion and contraction of the consideration set to be fully described.

It is assumed that at time t, the process starts with the historical consideration set of time (t-1); that is, we start with a consideration set of size n, where $n \leq m$. All other (m-n) brands are candidates to enter the consideration set at time t; all n brands in the consideration set at (t-1) are candidates to be dropped. The sequence of adding and/or dropping is determined as follows: For each of the (m-n) brands not currently in the consideration set, the incremental benefit of adding this brand to the set configuration of (t-1) is computed using expression (9). The first brand to be considered for inclusion is the one with the largest incremental benefit. All others will be considered in descending order of incremental benefit. For the n brands already in the consideration set we first compute, using (9), the incremental benefit that would be lost if the brand were dropped. This value is then subtracted from the maximum incremental benefit across all brands (irrespective of whether or not they belonged to the consideration set at time (t-1)). The first brand to be considered for deletion is the one with the largest difference, as this reflects low benefit relative to another member of the existing or potential set. All other (n-1) brands will be considered in descending order of this difference. To determine whether an add or a drop decision will be made first, the incremental benefits for the potential entrants are merged with the differences of the potential departures and their relative magnitudes determine the overall ordering mechanism. Hence, if the incremental benefit, given brand utilities at time t and the consideration set configuration of (t-1), is largest for a brand not yet in the consideration set, that brand will be considered first. If the largest incremental benefit is associated with a brand already in the consideration set at time (t -1), then that brand will not be considered for removal until the last step of the overall sequence. In essence, the ordering mechanism is driven by potential gains and losses given the utility values of all brands at time t.[3]

Dynamics

To illustrate the complete process at a point in time when the configuration of the consideration set is being re-evaluated, consider a simple numerical example. There are 10 brands in the market at time (t-1), 4 brands are in the consideration set. Appendix 1 shows the computations required to modify the consideration set at time t. Table 1 summarizes the sequential search process and shows how after five iterations the new consideration set contains two brands previously in the set plus a new brand not previously included. Note that the order mechanism described above leads to an ordering which does not change substantially over the various decisions; brand 8, having the highest utility at time t, is consistently ranked first. This is a direct result from the fact that the ordering mechanism is driven by incremental benefits (or the left side of inequality (8)). Still, brand 8 never enters the consideration set despite having the highest utility. As is shown in the table, the decision costs in considering that brand are consistently high because of its similarity (in utility) to brand 4 whose utility is inertia adjusted because it belonged to the consideration set at time (t -1). To get more insight into the basic characteristics of the process and its dynamics, an extensive number of numerical results are discussed next.

Table 1

Summary of Numerical Illustration[a]

	Brands									
	1	2	3	4	5	6	7	8	9	10
Utility at time t	0.10	0.40	0.00	0.60	0.80	0.00	0.50	0.90	0.60	0.30
Inertia Adjusted Utilities	0.15	0.58	0.00	0.88	0.80	0.00	0.50	0.90	0.60	0.30
Consideration Set at time (t-1)[b]	1	1	1	1	0	0	0	0	0	0
Process Dynamics										
• Decision 1										
Sequence of Evaluation[c]	4	9	2	10	3	8	6	1	5	7
Incremental Benefits	0.20	0.33	0.17	0.48	0.30	0.15	0.23	0.33	0.25	0.19
Decision Costs			65.81					2514.50		
Outcome[b]	1	1	0	1	0	0	0	0	0	0
• Decision 2										
Sequence of Evaluation	2	7	8	10	3	9	5	1	4	6
Incremental Benefits	0.24	0.41	0.17	0.60	0.35	0.17	0.27	0.38	0.29	0.22
Decision Costs	3.36							924.45		
Outcome	0	1	0	1	0	0	0	0	0	0
• Decision 3										
Sequence of Evaluation	7	5	8	10	2	9	4	1	3	6
Incremental Benefits	0.24	0.58	0.21	0.85	0.43	0.21	0.33	0.46	0.36	0.28
Decision Costs		2.04			33.02		25.49	339.78	762.81	
Outcome	0	0	0	1	0	0	0	0	0	0
• Decision 4										
Sequence of Evaluation	7	4	8	10	2	9	5	1	3	6
Incremental Benefits	0.39	0.58	0.35	1.21	0.66	0.35	0.52	0.70	0.56	0.45
Decision Costs		0.75			10.76		0.45	124.35	0.84	
Outcome	0	0	0	1	0	0	1	0	0	0
• Decision 5										
Sequence of Evaluation	7	5	8	10	2	9	3	1	4	6
Incremental Benefits	0.25	0.37	0.22	0.90	0.44	0.22	0.52	0.47	0.37	0.29
Decision Costs	0.23	3.56			4.22		0.17	45.89	2.67	0.66
Outcome	1	0	0	1	0	0	1	0	0	0
• Decision 6										
Sequence of Evaluation	2	5	8	10	3	9	6	1	4	7
Incremental Benefits	0.25	0.30	0.18	0.62	0.36	0.18	0.38	0.39	0.30	0.23
Decision Costs	0.09	1.35	0.45	0.05	1.57	0.45	0.13	16.90	1.02	0.61
Outcome	1	0	0	1	0	0	1	0	0	0

[a] All details are provided in Appendix 1; boxes highlight the decision outcome.
[b] 1 = in the consideration set, 0 = not in the consideration set.
[c] Result of Order Mechanism.

NUMERICAL ANALYSIS

Data Generation and Standard Pattern Results

In order to get a feel for the rational process operationalized above, a number of numerical analyses were performed. The objective was to assess whether or not the process leads to reasonable consideration set sizes under a variety of conditions. Given empirical results on consideration set sizes for various product categories, these results would provide an initial validation check on the rational process postulated.

Another objective of the numerical analysis is to get a better understanding of the dynamics of expansion and contraction. In this fashion, prior beliefs and theoretical hypotheses can be contrasted with inherent dynamics of the rational process. Numerical results consistent with these beliefs and hypotheses would add further face validity to the proposed rational process.

Deterministic brand utilities for a ten brand market were drawn out of five different Beta distributions (i.e., utility values were confined to the zero-one range)[4]. Two distributions were asymmetric (i.e., left and right skewed with identical variances), and three distributions were symmetric with increasing variances. The latter three were a centralized distribution (unimodal at 0.5), an uniform (or rectangular) distribution, and a polarized distribution (bi-modal, with modes at zero and one). The five distributions span in a concise manner many possible utility distributions across brands in a market.

For each distribution, 500 sets of utility values were drawn and entered into the rational process. Each time, the consideration set sizes at time (t-1) were varied between one, four, and ten. At the same time, the level of confidence (involvement) was varied with α equal to 0.1 (low involvement), 0.5, and 0.9 (high involvement). In each instance, the mean, the mode, and the variance in the resulting consideration set sizes were computed across the 500 replications. The likelihood of expansion and contraction were also derived.

In structuring and studying the results, four major scenarios were followed. First, the results for a "standard" pattern were considered. This pattern was identified through a search over various parameter values until consideration set sizes were obtained which were very much in line with empirical results reported in field studies and experiments. The particular parameter values for this pattern were as follows: $\delta_1 = 1$ for search economies in expression (6), and $\gamma_1=2$; $\gamma_2=1$ and $T = 1$ for inertia in expression (7). This pattern forms a basis for comparison. Second, a pattern with strong inertia effects is reported. In this instance, the parameters of the inertia process in equation (7) were set arbitrarily at $\gamma_1=8$, $\gamma_2=1$ and $T = 2$. Third, a pattern with strong search economies is reported.

Here, the parameter δ_1 of the search economies adjustment in expression (6) was set arbitrarily at 3. In both of the latter cases, the other parameters were kept at the values of the standard pattern. Fourth, a pattern which combines strong inertia effects with extensive search economies is reported. In this case, the respective parameters were set at the arbitrary levels of the two previous patterns. We will first discuss the standard pattern results. The others are dealt with subsequently.

For the standard scenario, the mean consideration set sizes are summarized in Table 2. The values range from 1 to 7 (for the modal values, see Appendix 2), which is in line with empirical sizes reported in the literature. Hauser and Wernerfelt (1990) summarize evidence regarding consideration set sizes for each of a large number of product categories. They cite a range in mean from 2 - 8 with most set sizes in the range of 3 - 6 (p. 394). Hence, the mean results reported in Table 2 add some credence to the postulated rational process.

A number of general patterns emerge from the mean results in Table 2. First, irrespective of the size of the historical consideration set or the shape of the utility distributions across brands, the mean consideration set size decreases with increased involvement (i.e., as α approaches one). This pattern is consistent with social judgment theory which suggests that "uninvolved consumers are willing to consider a wider number of brands because of a lack of commitment to one or several brands" (Assael 1981, p. 86).

Comparing the asymmetric distribution results in Table 2, a second pattern emerges. Right concentrated utility distributions lead to significantly larger consideration sets than left concentrated utility distributions. Hence, a consumer who likes many brands will consider more brands than a consumer who likes few brands. One should also note, however, that the variance in consideration set sizes increases substantially with the mode of the utility distribution shifting from the left to the right (except when the historical consideration set was limited to a single brand). Perhaps the results suggest that the comparison effort is less warranted when few brands are liked, and few of them are retained for consideration.

Third, size of consideration set is not strongly related to the dispersion of the utilities across brands. As discussed in the previous observation, strong differences in mean consideration set sizes were observed between the two asymmetric distributions despite them having identical variances. Furthermore, for the symmetric distributions the mean sizes do not uniformly increase with increased variance; in some cases, the reverse seems to be the case. In the rational process developed above, the sample variance of the utilities across brands was incorporated as a measure of perceptual complexity directly affecting decision costs. Specifically, as is evident from expression (8), decision costs increase as that variance increases. Higher decision costs would make it harder for brands to enter the consideration set but easier to drop out. Hence, from that perspective, one would expect a

Table 2

Mean Consideration Set Sizes: Standard Process - Numerical Results[a] -

Number of Brands in Consideration Set at t-1	Involvement (α)	Utility Distributions Across Brands				
		Asymmetric		Symmetric		
		Left Concentrated (0.027)[b]	Right Concentrated (0.027)	Centralized (0.036)	Uniform (0.083)	Polarized (0.125)
10	0.1	4.25	6.06	6.21	7.11	7.03
		(1.03)[c]	(2.55)	(1.01)	(1.00)	(1.45)
	0.5	4.25	6.02	6.21	7.11	7.02
		(1.02)	(2.35)	(1.01)	(1.00)	(1.43)
	0.9	4.22	5.82	6.20	7.06	6.91
		(1.00)	(1.73)	(1.00)	(1.00)	(1.60)
4	0.1	3.60	5.38	5.99	5.88	5.27
		(1.11)	(3.12)	(3.90)	(5.22)	(4.97)
	0.5	3.00	4.25	4.10	4.62	4.47
		(0.92)	(1.98)	(2.70)	(5.66)	(5.84)
	0.9	2.58	3.44	3.92	3.41	2.89
		(0.67)	(2.77)	(4.44)	(3.18)	(1.61)
1	0.1	2.14	2.68	2.37	2.14	2.04
		(0.25)	(0.23)	(0.27)	(0.13)	(0.08)
	0.5	1.88	1.98	1.86	1.81	1.63
		(0.25)	(0.05)	(0.15)	(0.16)	(0.23)
	0.9	1.05	1.02	1.01	1.04	1.02
		(0.20)	(0.02)	(0.01)	(0.04)	(0.02)

[a] Total number of brands equals 10; 500 replications.

[b] Variance of utility distributions across brands (Beta (p, q)).

[c] Variance in consideration set sizes.

reduction in mean consideration set size with increased variance in the utility distributions. The results in Table 2, however, suggest counterbalancing effects in either incremental benefit and/or relative preference as defined in (4).

Focusing on the symmetric utility distributions, the results in Table 2 also exhibit a general pattern in the variances of the consideration set sizes. The variance is consistently largest for the historical consideration set size of 4. Starting either with a single brand or with the entire universe of brands in the consideration set leads to more stable consideration set sizes than does starting with an intermediate number of brands. Apparently, at intermediate levels the dynamics process can drive the consideration set size in either direction, whereas at the extremes, it can drive the consideration set size only in one direction; as the process moves in one direction, it seems to converge on similar set sizes.

To more fully appreciate the dynamics of the proposed consideration set formation process, Table 3 summarizes the likelihood of expansion or contraction for the standard pattern. A number of observations can be made, some of which reinforce observations made in regard to Table 2. In all instances, when the historical consideration set size is large (i.e., close to the size of the universal set), contraction is almost certain. This is consistent with general beliefs and empirical evidence that consumers use rather limited consideration sets relative to the large number of brands available in many product categories. It is encouraging to see that the modeled process drives down large consideration sets with virtual certainty.

At the other extreme (i.e., consideration sets containing a single brand), however, the probability of expansion is conditional on the level of involvement. The likelihood of expansion drops quickly as the level of involvement increases. This pattern signals that at high involvement levels there is a strong commitment (or loyalty) towards a single brand which constitutes the consideration set. Involved consumers are less willing to consider a larger number of brands as discussed above. Another general pattern evident in the results of Table 3 which can be explained in similar terms is that at the midrange of historical consideration set sizes (n=4), the probability of contraction increases with the level of involvement irrespective of the shape or dispersion of the utility distribution. It is interesting to note that for the symmetric distributions, the magnitude of the increase in the likelihood of contraction is correlated with the variance in utility distribution. This is rather intuitive as loyalty and brand commitment are stronger and will develop more rapidly in polarized utility distribution (i.e., high preference variance). For the asymmetric distributions and n=4, the left concentrated utility distribution gives rise to much higher contraction probabilities than the right concentrated utility distribution. Intuitively, a consumer who likes many brands is willing to consider more brands than a consumer who likes few brands.

Table 3

Consideration Set Dynamics: Likelihood of Expansion and Contraction Standard Process: Numerical Results[a]

Number of Brands in Consideration Set at t-1	Involvement (α)	Likelihood of Expansion(+) and Contraction(-)	Utility Distributions Across Brands				
			Asymmetric		Symmetric		
			Left Concentrated (0.027)[b]	Right Concentrated (0.027)	Centralized (0.036)	Uniform (0.083)	Polarized (0.125)
10	0.1	-	1.00	0.98	1.00	0.99	0.99
	0.5	-	1.00	0.98	1.00	0.99	0.99
	0.9	-	1.00	1.00	1.00	0.99	0.99
4	0.1	+	0.14	0.62	0.70	0.61	0.51
		-	0.54	0.21	0.13	0.20	0.30
	0.5	+	0.07	0.26	0.22	0.36	0.36
		-	0.80	0.34	0.47	0.53	0.60
	0.9	+	0.01	0.21	0.29	0.14	0.06
		-	0.88	0.68	0.56	0.73	0.85
1	0.1	+	0.99	1.00	0.99	0.99	0.98
	0.5	+	0.86	0.97	0.85	0.81	0.63
	0.9	+	0.04	0.02	0.01	0.04	0.02

[a] Total number of brands equals 10; 500 replications.

[b] Variance of utility distributions across brands (Beta (p,q)).

In sum, a number of intuitively appealing results are emerging from Tables 2 and 3. Although far from a comprehensive validation, the results do provide a sense of plausibility and support for the rational model of consideration set formation advocated above. Using these results as reference points, we turn now to three specific patterns to assess the direction in which consideration sets will develop given either strong inertia effects, significant search economies, or both.

The Effects of Inertia

Inertia refers to the fact that brands might not easily leave the consideration set once they are a member. This effect might grow stronger the longer the brands stay in the set. These possible effects were incorporated in the process through an S-shaped time-dependent adjustment of the utility values of the brands in the consideration set (see expression(7)). The proposed adjustment function has two parameters: γ_1 which measures the upper asymptote, and γ_2 which measures the rate at which the utilities are adjusted over time. The pattern of strong inertia was simulated with $\gamma_1 = 8$, $\gamma_2 = 1$ and T=2. The absolute magnitude of these parameters is purely arbitrary, but they reflect strong inertia effects relative to the standard pattern discussed above (where $\gamma_1 = 2$, $\gamma_2 = 1$ and T=1). As such, this pattern provides a useful point of comparison to assess the impact of inertia on the consideration set formation process.

The mean sizes of the consideration sets for the inertia pattern are shown in Table 4. The modal values are contained in Appendix 2. Table 5 summarizes the likelihoods of expansion and contraction. When comparing the relative magnitude of the derived means across the various cells in Table 4, the results are in general not very different from those reported in Table 2 for the standard pattern. There is, however, a striking difference in the absolute values of the mean sizes of the consideration sets. Comparing the results in Table 4 with the corresponding results in Table 3, it is clear that the mean sizes are smaller in all instances. Hence, increased inertia leads to reduced consideration sets. This effect is also visible in Table 5 where the contraction probabilities for n=10 and n=4 are substantially higher than the corresponding values in Table 3 (with the expansion probabilities being virtually equal to zero). For consideration sets containing a single brand, there are non-zero expansion probabilities, but again they are substantially smaller than the corresponding values in Table 3. Moreover, and consistent with intuition, as consumers exhibit more resistance to dropping brands from their consideration sets, they are less willing to consider a larger number of brands.

Table 4

Mean Consideration Set Sizes: Standard Process with Inertia - Numerical Results[a] -

Number of Brands in Consideration Set at t-1	Involvement (α)	Utility Distributions Across Brands				
		Asymmetric		Symmetric		
		Left Concentrated (0.027)[b]	Right Concentrated (0.027)	Centralized (0.036)	Uniform (0.083)	Polarized (0.125)
10	0.1	4.18	5.88	6.09	6.38	5.76
		(0.97)	(1.95)	(1.02)	(2.07)	(2.71)
	0.5	4.13	5.75	5.99	6.21	5.74
		(0.94)	(1.69)	(1.24)	(2.33)	(3.09)
	0.9	3.93	5.41	5.88	5.25	4.84
		(1.03)	(1.34)	(1.47)	(3.92)	(3.98)
4	0.1	2.67	2.17	2.74	2.35	2.05
		(0.61)	(0.55)	(1.23)	(0.70)	(0.53)
	0.5	2.45	1.78	2.33	1.93	1.61
		(0.64)	(0.73)	(0.83)	(0.87)	(0.54)
	0.9	2.05	1.75	1.35	1.27	1.26
		(0.67)	(0.74)	(0.34)	(0.27)	(0.23)
1	0.1	1.96	1.04	1.33	1.43	1.38
		(0.29)	(0.05)	(0.27)	(0.31)	(0.27)
	0.5	1.85	1.03	1.15	1.25	1.23
		(0.27)	(0.03)	(0.13)	(0.19)	(0.18)
	0.9	1.05	1.00	1.00	1.04	1.01
		(0.20)	(0.00)	(0.00)	(0.04)	(0.01)

[a] Total number of brands equals 10; 500 replications.

[b] Variance of utility distributions across brands (Beta (p,q)).

Table 5

Consideration Set Dynamics: Likelihood of Expansion and Contraction Standard Process with Inertia: Numerical Results[a]

Number of Brands in Consideration Set at t-1	Involvement (α)	Likelihood of Expansion(+) and Contraction(-)	Utility Distributions Across Brands				
			Asymmetric		Symmetric		
			Left Concentrated (0.027)[b]	Right Concentrated (0.027)	Centralized (0.036)	Uniform (0.083)	Polarized (0.125)
10	0.1	-	1.00	1.00	1.00	0.99	0.99
	0.5	-	1.00	1.00	1.00	1.00	0.99
	0.9	-	1.00	1.00	1.00	1.00	1.00
4	0.1	+	0.01	0.00	0.10	0.03	0.01
		-	0.90	0.96	0.79	0.92	0.97
	0.5	+	0.01	0.00	0.03	0.02	0.01
		-	0.91	0.96	0.90	0.95	0.98
	0.9	+	0.00	0.00	0.00	0.00	0.00
		-	0.97	0.96	1.00	1.00	1.00
1	0.1	+	0.89	0.03	0.31	0.40	0.36
	0.5	+	0.84	0.03	0.15	0.25	0.23
	0.9	+	0.04	0.00	0.00	0.04	0.01

[a] Total number of brands equals 10; 500 replications.

[b] Variance of utility distributions across brands (Beta (p,q)).

The Effect of Search Economies

The search economies incorporated in the rational consideration set formation process capture the reduction in decision costs because of either learning (i.e., the consumer becomes more efficient in comparing alternatives throughout the sequential search) or fatigue (i.e., the consumer gets tired and spends less time and effort on the consideration decision as the sequential search continues). A simple operationalization of an exponentially declining cost adjustment was suggested in expression (6). The parameter capturing the rate of decline with each sequential restart of the process was set equal to $\delta_1=3$ (relative to $\delta_1=1$ in the standard pattern discussed above).

The mean consideration set sizes for the pattern with enhanced search economies are summarized in Table 6. Relative to corresponding entries for the standard pattern in Table 2, the entries are much larger. As one would expect, as the decision costs decline, brands in the consideration set will have an easier time staying in even if their incremental benefit becomes marginal. Brands not in the consideration set will have an easier time entering because the decision cost barrier relative to the incremental benefit is reduced. These dynamics are also reflected in the large expansion probabilities for n=1 and n=4 and the small contraction probabilities for n=10 shown in Table 7.

Other than the increase in consideration set sizes, the general patterns when comparing different cells within Tables 6 and 7 coincide with those discussed at length in relation to the corresponding Tables 2 and 3 for the standard pattern.

It is important to point out that, as reported in Appendix 2, the frequency distribution of consideration set sizes over the 500 replications were bi-modal in all cells of the table. Hence, the mean sizes reported in Table 6 are not necessarily representative. In some cases, within a single cell, the consideration sets were quite large and contained all brands where in others the sets were quite small. As the members of the historical consideration sets at the beginning of the simulation are picked at random, the utility profile at time t of the consideration set members can be quite different from that of the non-members. Although not reported here in detail, further investigation uncovered that when the brands not belonging to the consideration set had substantially larger utilities at time t than those belonging to the set, an expansion in set size was generally observed. When the opposite was true, set sizes generally contracted. Clearly, more analysis needs to be done on the individual brand membership beyond the analysis of general patterns reported in this research.

The pattern of enhanced search economies was next combined with that of increased inertia to evaluate the interaction of both effects and their relative impact on the sizes of consideration sets. Table 8 summarizes the mean set sizes for the mixed pattern, and Table 9 reports the likelihoods of expansion and contraction for the same pattern. The means reported in Table 8 are higher than the

Table 6

Mean Consideration Set Sizes: Standard Process With Search Economies - Numerical Results[a] -

Number of Brands in Consideration Set at t-1	Involvement (α)	Utility Distributions Across Brands				
		Asymmetric		Symmetric		
		Left Concentrated (0.027)[b]	Right Concentrated (0.027)	Centralized (0.036)	Uniform (0.083)	Polarized (0.125)
10	0.1	9.40	9.75	9.72	9.18	8.68
		(1.98)	(0.45)	(0.64)	(1.57)	(2.41)
	0.5	9.14	9.65	9.63	9.34	8.73
		(2.67)	(0.59)	(0.92)	(1.39)	(2.39)
	0.9	9.56	9.72	9.71	9.44	8.77
		(1.61)	(0.49)	(0.89)	(1.19)	(2.35)
4	0.1	8.00	9.33	9.89	9.85	9.65
		(7.66)	(2.85)	(0.64)	(0.78)	(1.43)
	0.5	7.82	9.43	9.94	9.90	9.57
		(8.19)	(2.68)	(0.31)	(0.46)	(1.73)
	0.9	6.63	9.13	9.56	9.29	8.65
		(9.99)	(3.52)	(2.45)	(4.30)	(6.53)
1	0.1	6.17	8.91	9.89	9.99	9.80
		(10.78)	(5.44)	(0.64)	(0.07)	(1.10)
	0.5	5.94	8.81	9.88	9.94	9.54
		(10.29)	(5.80)	(0.68)	(0.32)	(2.23)
	0.9	4.79	7.22	9.25	9.57	8.80
		(6.63)	(7.67)	(4.35)	(2.90)	(6.95)

[a] Total number of brands equals 10; 500 replications.

[b] Variance of utility distributions across brands (Beta (p,q)).

Table 7

Consideration Set Dynamics: Likelihood of Expansion and Contraction Standard Process with Search Economies Numerical Results[a]

Number of Brands in Consideration Set at t-1	Involvement (α)	Likelihood of Expansion(+) and Contraction(-)	Utility Distributions Across Brands				
			Asymmetric		Symmetric		
			Left Concentrated (0.027)[b]	Right Concentrated (0.027)	Centralized (0.036)	Uniform (0.083)	Polarized (0.125)
10	0.1	-	0.15	0.14	0.12	0.33	0.47
	0.5	-	0.22	0.19	0.15	0.27	0.46
	0.9	-	0.11	0.16	0.10	0.25	0.46
4	0.1	+	0.83	0.94	0.98	0.98	0.99
		-	0.08	0.00	0.00	0.00	0.00
	0.5	+	0.80	0.95	0.99	0.99	0.99
		-	0.12	0.00	0.00	0.00	0.01
	0.9	+	0.59	0.94	0.96	0.90	0.85
		-	0.28	0.01	0.04	0.09	0.14
1	0.1	+	1.00	1.00	1.00	1.00	1.00
	0.5	+	1.00	1.00	1.00	1.00	1.00
	0.9	+	0.97	1.00	0.97	0.97	0.94

[a] Total number of brands equals 10; 500 replications.

[b] Variance of utility distributions across brands (Beta (p,q)).

Table 8

Mean Consideration Set Sizes: Standard Process With Inertia and Search Economies - Numerical Results[a] -

Number of Brands in Consideration Set at t-1	Involvement (α)	Utility Distributions Across Brands				
		Asymmetric		Symmetric		
		Left Concentrated (0.027)[b]	Right Concentrated (0.027)	Centralized (0.036)	Uniform (0.083)	Polarized (0.125)
10	0.1	8.70	9.69	9.39	9.00	8.49
		(4.55)	(0.68)	(1.70)	(1.86)	(2.60)
	0.5	8.27	9.61	9.23	9.03	8.49
		(5.44)	(0.94)	(2.10)	(1.82)	(2.62)
	0.9	7.70	9.57	9.29	8.99	8.40
		(6.56)	(1.17)	(2.00)	(1.93)	(2.69)
4	0.1	6.15	5.56	7.71	6.81	6.76
		(9.06)	(9.69)	(9.53)	(11.80)	(11.21)
	0.5	6.07	6.31	7.20	7.18	7.58
		(8.72)	(9.73)	(10.92)	(11.51)	(9.96)
	0.9	5.17	6.73	9.16	8.81	7.56
		(7.42)	(8.65)	(4.46)	(6.71)	(10.50)
1	0.1	5.41	1.71	6.29	6.67	5.65
		(9.31)	(3.68)	(15.52)	(17.59)	(18.84)
	0.5	5.26	1.54	5.32	6.35	5.18
		(9.01)	(3.12)	(17.03)	(18.88)	(18.43)
	0.9	4.00	1.18	2.62	3.96	3.46
		(5.58)	(1.40)	(10.28)	(17.31)	(14.64)

[a] Total number of brands equals 10; 500 replications.

[b] Variance of utility distributions across brands (Beta (p,q)).

Table 9

Consideration Set Dynamics: Likelihood of Expansion and Contraction Standard Process with Inertia and Search Economies: Numerical Results[a]

Number of Brands in Consideration Set at t-1	Involvement (α)	Likelihood of Expansion(+) and Contraction(-)	Utility Distributions Across Brands				
			Asymmetric		Symmetric		
			Left Concentrated (0.027)[b]	Right Concentrated (0.027)	Centralized (0.036)	Uniform (0.083)	Polarized (0.125)
10	0.1	-	0.27	0.15	0.20	0.39	0.55
	0.5	-	0.36	0.18	0.24	0.38	0.55
	0.9	-	0.46	0.18	0.22	0.39	0.55
4	0.1	+	0.57	0.43	0.71	0.56	0.59
		-	0.28	0.53	0.27	0.44	0.40
	0.5	+	0.57	0.56	0.63	0.61	0.72
		-	0.28	0.39	0.36	0.38	0.28
	0.9	+	0.44	0.65	0.92	0.86	0.74
		-	0.37	0.23	0.08	0.13	0.25
1	0.1	+	0.99	0.28	0.83	0.74	0.59
	0.5	+	0.98	0.18	0.68	0.63	0.52
	0.9	+	0.87	0.03	0.29	0.35	0.32

[a] Total number of brands equals 10; 500 replications.

[b] Variance of utility distributions across brands (Beta (p,q)).

corresponding means for the standard pattern reported in Table 9; however, they are not as high as the mean values reported in Table 6 for the pattern focusing exclusively on search economies. Moreover, a one-to-one comparison of corresponding cells indicates that the search economies dominate the inertia effects[5]. A similar conclusion can be drawn from comparing the probabilities of expansion and contraction in Table 9 with the corresponding values in Table 3 (for the standard pattern) and Table 7 (for the inertia pattern).

A relative comparison of the mean values contained in Table 8 further strengthens the conclusion of the dominating search economies. The relative patterns in the means are almost exactly identical to those identified in the enhanced search economies scenario tabulated in Table 6. One difference worth pointing out is that in Table 8, the reported variances in mean consideration set sizes are generally higher than the corresponding variances in Table 6. The former results are the largest dispersion values obtained in any of the numerical analyses reported in this study. Because of the dominating search economies, the frequency distributions of the derived consideration sets were again bi-modal, but the increased inertia in the mixed pattern seems to have had a more polarizing effect on the dispersion of the search process outcomes given the specific brand utility profiles. The general contraction effect on the size of consideration sets from the inertia phenomenon identified in isolation above seems to have driven the left mode of the bi-modal distribution closer to consideration sets containing a single brand. One should keep in mind, however, that all results are relative and should be interpreted as such. An insightful summary of the general patterns identified in the analysis is discussed next.

Dynamics

The dynamics of the consideration set formation process and their characteristics are rapidly emerging. To concisely summarize the effects discussed in detail above, Figure 1 illustrates graphically the expansion and contraction patterns relative to historical set sizes given increased inertia, strong search economies, or both simultaneously. The figure was generated for uniformly distributed utility values. The four orthogonally-drawn dimensions in number of brands capture the four patterns highlighted in the preceding discussion. The symmetric diamond in the middle of the figure indicates the historical consideration set size of four (i.e., n=4). Connecting the mean consideration set sizes for corresponding levels of involvement gives rise to three asymmetric diamonds (one for each level of involvement considered). Their degree of asymmetry (i.e., reshaping of the symmetric diamond at t-1) indicates either expansion or contraction of the size of the consideration set. To the extent that the three diamonds intersect, the impact of involvement on the mean consideration set sizes is reversed. Moreover, the figure exhibits in a concise manner the general pattern of dynamics of the rational consideration set formation process operationalized above. In the standard pattern, the consideration set either expands or contracts depending on the level of

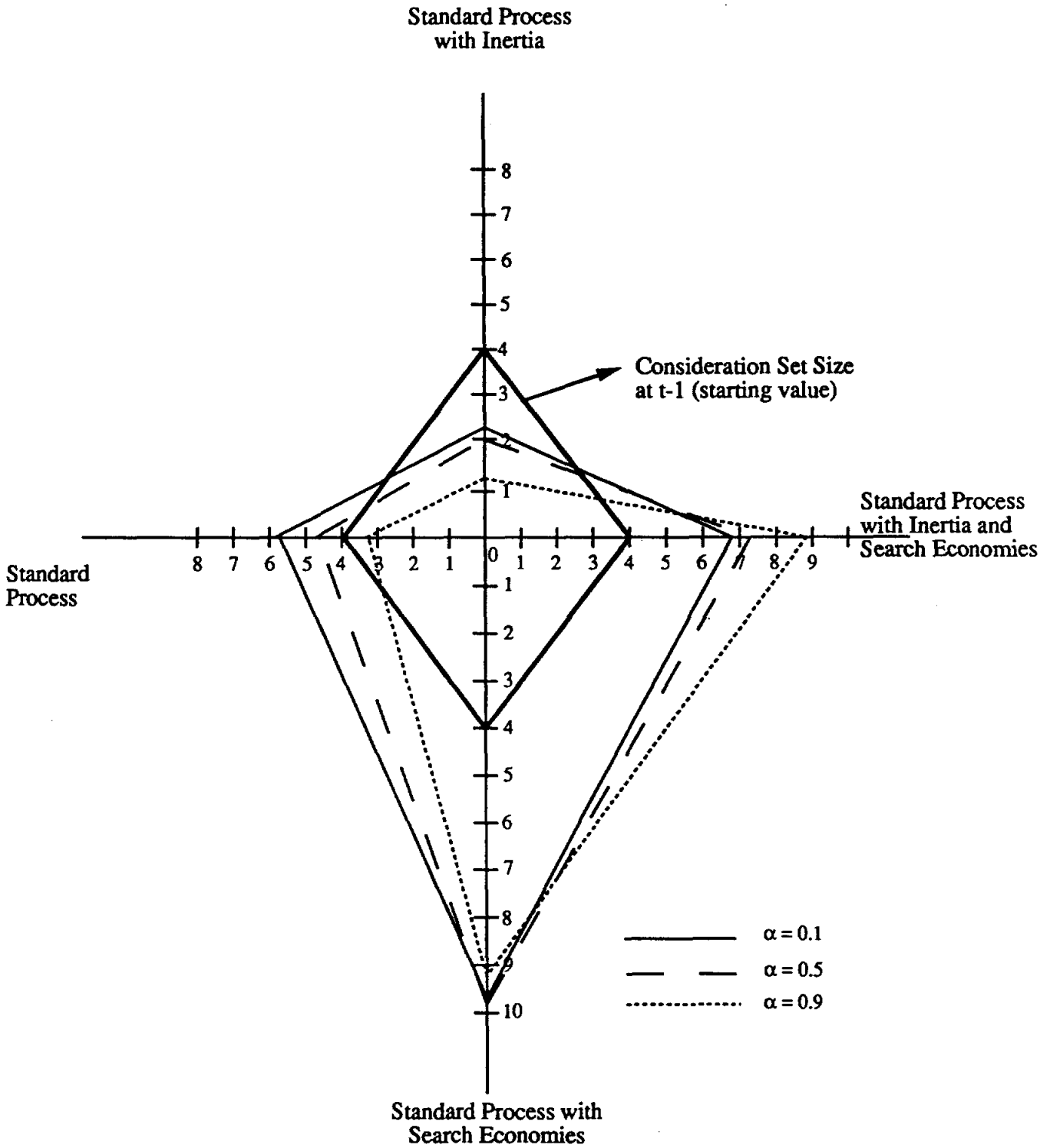

Figure 1

Consideration Set Sizes for Uniformly
Distributed Utilities Across Brands

involvement of the consumer. Under high involvement, the consumer is less willing to consider a wider set of brands. Under low involvement, the consumer is willing to consider a set of brands which is larger than the set considered in the previous time period. With increased inertia, the mean consideration set sizes contract from the historical size with the degree of contraction proportional to the level of involvement. With enhanced search economies, the mean consideration set sizes expand beyond the historical size with the degree of expansion somewhat inversely related to the level of involvement. The combination of increased inertia effects and enhanced search economies results in an expansion of mean consideration set size beyond the historical size; this time, however, the rate of expansion is inversely related to the degree of involvement. Hence, in combining both effects, the search economies drive up the consideration set size but the inertia effects reverse the impact of involvement.[6] If search economies dominate, consumers may be willing to increase the set size. Whether this is a real phenomenon or merely an artifact of the modeled process and its arbitrary parameterization needs further investigation. Note, however, that some literature suggests that experts will evaluate more brands because the evaluation is easy for them. They can chuck information and interpret it without difficulty. If experts have high search economies, this result makes intuitive sense. Further investigation of this interesting possibility is nevertheless warranted.

CONCLUSION AND DIRECTIONS FOR FUTURE RESEARCH

This paper developed a rational model of the consideration set formation process at the individual level characterising that process as a sequential search balancing incremental benefit with search costs. Its contribution lies in the representation of incremental benefits and search costs in the utility domain recognizing realistic phenomena such as perceptual complexity, preference differences, involvement, search economies, and inertia effects. Integrating the appealing rule governing the consideration decision into a sequential search process which starts with the historical consideration set of the individual consumer enables a full analysis of the dynamics of the search process over time. Numerical results provide intuitively appealing and plausible insights into a process underlying choice decisions which until recently have been largely ignored.

Certain limitations do characterize the work. First of all, the process is assumed to be rational. Although in line with various recent conceptualizations, the question still remains if a rational approach provides an adequate representation. Second, the consideration decision is cast in the utility domain using a compensatory model; as suggested in Roberts and Lattin (1991), the modeling and cross-validation of the conjunctive aspects of the formation process are areas warranting further attention. Third, focus in the numerical analyses was primarily on the general patterns in summary statistics. More work needs to be done on individual brand movements in and out of the consideration set. For example, if our results showed no change in the consideration set size from the historical size, there is still the intriguing question of whether or not the identical brands were retained. This requires further analysis of the utility profiles of brands in the consideration set versus the profiles of those not in the set. Such analyses are further provoked by the bi-modal frequency distributions obtained in this research. Finally, as with any numerical work, it is difficult to argue the completeness of the reported results. An attempt was made to consider many realistic and potentially interesting scenarios. Perhaps "the consideration set" was too small and more work is needed to fully comprehend the consideration process modeled.

Research reported in this work makes the notion of consideration set come to life. It is hoped that along with the recognized managerial relevance of the notion, this work stimulates further research. Once the basic process of consideration set formation has been characterized and validated, external factors affecting it need to be incorporated, and ultimately the whole process integrated in a comprehensive model of choice.

FOOTNOTES

1 Extensive reviews of relevant literature are given in Roberts and Lattin (1991) and Shocker et. al. (1991).

2 At the pre-evaluation stage, the extent and depth of evaluation and information processing is not as extensive as at the time of actual choice. Vanhonacker (1991) differentiates the utility functions underlying both processes.

3 It is interesting to point out that the rational rule developed here consistently leads to consideration set sizes of one using the illustrative utility functions in Roberts and Lattin (1991). Their assumption of a constant decision cost of 0.05 is far below the decision costs calculated here in the utility domain (see Appendix 1).

4 Note that the utility functions in (1) are defined up to an additive constant, and that both the left and right hand sides of inequality (8) are invariant under such a transformation.

5 A limited sensitivity analysis on the parameters resulted in the search economies consistently dominating the inertia effects. Hence, the result is not a function of the specific parameter values used in the reported simulation.

6 The exact reversal is not true consistently across all cells investigated (see Table 8). However, as is the case in Table 6, the strict inverse relationship between involvement and consideration set size observed in other scenarios is not present.

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Appendix 1: Numerical Example of Process Dynamics

Consider a market with 10 brands (i.e., m=10). Their utility values at time t are:

V(1) = 0.1	V(3) = 0.0	V(5) = 0.8	V(7) = 0.5	V(9) = 0.6
V(2) = 0.4	V(4) = 0.6	V(6) = 0.0	V(8) = 0.9	V(10) = 0.3

The consideration set at time (t-1) consisted of {1, 1, 1, 1, 0, 0, 0, 0, 0, 0} or brands 1, 2, 3 and 4. The sample variance in the utilities equals 0.1066 (equation (5)). With the inertia adjustment factor in equation (7) and assuming T=1, γ_1=2, and γ_2 =1, the inertia adjusted utilities for the four brands in the consideration set are:

for brand 1: 0.1462	for brand 3: 0.0000
for brand 2: 0.5848	for brand 4: 0.8773

The incremental benefits using equation (9) are:

1: 0.2010	3: 0.1712	5: 0.3002	7: 0.2306	9: 0.2520
2: 0.3318	4: 0.4752	6: 0.1461	8: 0.3271	10: 0.1926

The maximum value is for brand 4 and equals 0.4752. Subtracting the incremental benefits for the brands belonging to the consideration set from this maximum and keeping the incremental benefits for the remaining brands, we obtain:

for brand 1: 0.2742	for brand 3: 0.3040	for brand 5: 0.3002	for brand 7: 0.2306
for brand 2: 0.1434	for brand 4: 0.0000	for brand 6: 0.1461	for brand 8: 0.3271

for brand 9: 0.2520
for brand 10: 0.1926

Accordingly, the order in which brands will be evaluated either to enter or exit the consideration set equals: 8, 3, 5, 1, 9, 7, 10, 6, 2, 4. Hence, brand 8 will be considered first; since it was not in the consideration set at (t-1), it will be considered for entry.

First Decision Sequence (S=1):

At this first iteration, the cost reduction factor given search economies with $\delta_1=1$ equals 0.3677 (equation (6)).

(1) Brand 8: to add or not?

- incremental benefit (brand 8) = 0.3271 (equation 9)
- decision cost (brand 8) = 2514.5005 (equation 8)

Accordingly, the incremental benefit is less than the decision cost and brand 8 is not added. For the time being, the consideration set remains the same.

(2) Brand 3: to drop or not?

- incremental benefit (brand 3) = 0.1712
- decision cost (brand 3) = 65.8098

Accordingly, the incremental benefit is less than the decision cost and brand 3 is dropped. Hence, the consideration set becomes {1, 1, 0, 1, 0, 0, 0, 0 , 0, 0}.

Given a change in consideration set configuration, the first decision sequence ends.

Second Decision Sequence (S =2):

The incremental benefits given the new temporary consideration set configurations are (equation (9))

1: 0.2435	3: 0.1712	5: 0.3475	7: 0.2683	9: 0.2928
2: 0.4081	4: 0.5958	6: 0.1712	8: 0.3779	10: 0.2247

The maximum is for brand 4. Computing the difference between the maximum and the relative benefit for the three brands temporary in the consideration set and integrating those results with the incremental benefits of the other brands, the order in which brands will be evaluated becomes: 8, 1, 5, 9, 7, 10, 2, 3, 6, 4.

(1) Brand 8: to add or not?

- incremental benefit (brand 8) = 0.3779
- decision cost (brand 8) = 924.4469

Accordingly, brand 8 is not added. Since no change occurs in the temporary consideration set, we continue in the established sequence.

(2) Brand 1: to drop or not?

- incremental benefit (brand 1) = 0.2435
- decision cost (brand 1) = 3.3555

Accordingly, brand 1 is dropped, and the temporary consideration set becomes {0, 1, 0, 1, 0, 0, 0, 0, 0, 0}.

Third Decision Sequence (S=3)

The incremental benefits (equation 9) become:

1: 0.2435	3: 0.2136	5: 0.4253	7: 0.3312	9: 0.3604
2. 0.5576	4: 0.8500	6: 0.2136	8: 0.4611	10: 0.2787

The maximum is for brand 4. Following the same process as above, the sequence of consideration becomes: 8, 5, 9, 7, 2, 10, 1, 3, 6, 4.

(1) Brand 8: to add or not?

- incremental benefit = 0.4611
- decision cost = 339.7777

Accordingly, brand 8 is not added.

(2) Brand 5: to add or not?

- incremental benefit = 0.4253
- decision cost = 33.0211

Accordingly, brand 5 is not added.

(3) Brand 9: to add or not?

- incremental benefit = 0.3604
- decision cost = 762.8112

Accordingly, brand 9 is not added.

(4) Brand 7: to add or not?

- incremental benefit = 0.3312
- decision cost = 25.4851

Accordingly, brand 7 is not added.

(5) Brand 2: to drop or not?

- incremental benefit = 0.5576
- decision cost = 2.0422

Accordingly, brand 2 is dropped. The temporary consideration set becomes {0, 0, 0, 1, 0, 0, 0, 0, 0, 0}.

<u>Fourth Decision Sequence</u> (S=4)

The incremental benefits (equation 9) become:

1: 0.3930	3: 0.3478	5: 0.6553	7: 0.5222	9: 0.5641
2: 0.5576	4: 1.2250	6: 0.3478	8: 0.7046	10: 0.4456

The maximum is for brand 4. Following the same process as above, the sequence of consideration becomes: 8, 5, 9, 2, 7, 10, 1, 3, 6, 4.

(1) Brand 8: to add or not?

- incremental benefit = 0.7046
- decision cost = 124.3504

Accordingly, brand 8 is not added.

(2) Brand 5: to add or not?

- incremental benefit = 0.6553
- decision cost = 10.7599

Accordingly, brand 5 is not added.

(3) Brand 9: to add or not?

- incremental benefit = 0.5641
- decision cost = 0.8357

Accordingly, brand 9 is not added.

(4) Brand 2: to add or not?

- incremental benefit = 0.5576
- decision cost = 0.7513

Accordingly, brand 2 is not added.

(5) Brand 7: to add or not?

- incremental benefit = 0.5222
- decision cost = 0.4512

Accordingly, brand 7 is added. The temporary consideration set becomes {0, 0, 0, 1, 0, 0, 1, 0, 0, 0}.

Fifth Decision Sequence (S=5)

The incremental benefits (equation 9) become:

1: 0.2512	3: 0.2205	5: 0.4377	7: 0.5222	9: 0.3713
2: 0.3666	4: 0.8995	6: 0.2205	8: 0.4743	10: 0.2875

The maximum is for brand 4. Following the same process as above, the sequence of consideration becomes: 8, 5, 7, 9, 2, 10, 1, 3, 6, 4.

(1) Brand 8: to add or not?

- incremental benefit = 0.4743
- decision cost = 45.8937

Accordingly, brand 8 is not added.

(2) Brand 5: to add or not?

- incremental benefit = 0.4377
- decision cost = 4.2210

Accordingly, brand 5 is not added.

(3) Brand 7: to drop or not?

- incremental benefit = 0.5222
- decision cost = 0.1660

Accordingly, brand 7 is not dropped.

(4) Brand 9: to add or not?

- incremental benefit = 0.3713
- decision cost = 2.6708

Accordingly, brand 9 is not added.

(5) Brand 2: to add or not?

- incremental benefit = 0.3666
- decision cost = 3.5594

Accordingly, brand 2 is not added.

(6) Brand 10: to add or not?

- incremental benefit = 0.2875
- decision cost = 0.6618

Accordingly, brand 10 is not added.

(7) Brand 1: to add or not?

- incremental benefit = 0.2512
- decision cost = 0.2330

Accordingly, brand 1 is added.

The temporary consideration set becomes {1, 0, 0, 1, 0, 0, 1, 0, 0, 0}.

Sixth Decision Sequence (S=6)

The incremental benefits (equation 9) become:

1: 0.2512	3: 0.1756	5: 0.3557	7: 0.3804	9: 0.2999
2: 0.2960	4: 0.6189	6: 0.1756	8: 0.3867	10: 0.2304

The maximum is for brand 4. Following the same process as above, the sequence of consideration becomes: 8, 1, 5, 9, 2, 7, 10, 3, 6, 4.

(1) Brand 8: to add or not?

- incremental benefit = 0.3867
- decision cost = 16.8986

Accordingly, brand 8 is not added.

(2) Brand 1: to drop or not?

- incremental benefit = 0.2512
- decision cost = 0.0857

Accordingly, brand 1 is not dropped.

(3) Brand 5: to add or not?

- incremental benefit = 0.3557
- decision cost = 1.5731

Accordingly, brand 5 is not added.

(4) Brand 9: to add or not?

- incremental benefit = 0.2999
- decision cost = 1.0248

Accordingly, brand 9 is not added.

(5) Brand 2: to add or not?

- incremental benefit = 0.2960
- decision cost = 1.3546

Accordingly, brand 2 is not added.

(6) Brand 7: to drop or not?

- incremental benefit = 0.3804
- decision cost = 0.1305

Accordingly, brand 7 is not dropped.

(7) Brand 10: to add or not?

- incremental benefit = 0.2304
- decision cost = 0.6111

Accordingly, brand 10 is not added.

(8) Brand 3: to add or not?

- incremental benefit = 0.1756
- decision cost = 0.4528

Accordingly, brand 3 is not added.

(9) Brand 6: to add or not?

- incremental benefit = 0.1756
- decision cost = 0.4528

Accordingly, brand 6 is not added.

(10) Brand 4: to drop or not?

- incremental benefit = 0.6189
- decision cost = 0.0509

Accordingly, brand 4 is not dropped.

The entire sequence has been completed and no change occurred. Accordingly, the consideration set at time t consists of {1, 0, 0, 1, 0, 0, 1, 0, 0, 0} or brands 1, 4 and 7.

Appendix 2: Modal Values

Modal Values of Consideration Set Sizes: Standard Process
- Numerical Results[a] -

Number of Brands in Consideration Set at t-1	Involvement (α)	Utility Distributions Across Brands				
		Asymmetric		Symmetric		
		Left Concentrated (0.027)[b]	Right Concentrated (0.027)	Centralized (0.036)	Uniform (0.083)	Polarized (0.125)
10	0.1	4	5	6	7	7
	0.5	4	5	6	7	7
	0.9	4	5	6	7	7
4	0.1	3	6	7	4	3
	0.5	3	4	3	3	3
	0.9	2	2	2	3	2
1	0.1	2	3	2	2	2
	0.5	2	2	2	2	2
	0.9	1	1	1	1	1

[a] Total number of brands equals 10; 500 replications.

[b] Variance of utility distributions across brands (Beta (p,q)).

Modal Values of Consideration Set Sizes: Standard Process with Inertia - Numerical Results[a] -

Number of Brands in Consideration Set at t-1	Involvement (α)	Utility Distributions Across Brands				
		Asymmetric		Symmetric		
		Left Concentrated (0.027)[b]	Right Concentrated (0.027)	Centralized (0.036)	Uniform (0.083)	Polarized (0.125)
10	0.1	4	5	6	7	4
	0.5	4	5	6	7	4
	0.9	3	5	6	3	3
4	0.1	3	2	2	2	2
	0.5	2	1	2	2	1
	0.9	2	1	1	1	1
1	0.1	2	1	1	1	1
	0.5	2	1	1	1	1
	0.9	1	1	1	1	1

[a] Total number of brands equals 10; 500 replications.

[b] Variance of utility distributions across brands (Beta (p,q)).

Modal Values of Consideration Set Sizes: Standard Process with Search Economies - Numerical Results[a] -

Number of Brands in Consideration Set at t-1	Involvement (α)	Utility Distributions Across Brands				
		Asymmetric		Symmetric		
		Left Concentrated (0.027)[b]	Right Concentrated (0.027)	Centralized (0.036)	Uniform (0.083)	Polarized (0.125)
10	0.1	10[c]	10	10	10	10
	0.5	10	10	10	10	10
	0.9	10	10	10	10	10
4	0.1	10	10	10	10	10
	0.5	10	10	10	10	10
	0.9	10	10	10	10	10
1	0.1	10	10	10	10	10
	0.5	10	10	10	10	10
	0.9	4	10	10	10	10

[a] Total number of brands equals 10; 500 replications.

[b] Variance of utility distributions across brands (Beta (p,q)).

[c] All frequency distributions were bi-modal; only the highest mode is shown.

Modal Values of Consideration Set Sizes: Standard Process with Inertia and Search Economies
- Numerical Results[a] -

Number of Brands in Consideration Set at t-1	Involvement (α)	Utility Distributions Across Brands				
		Asymmetric		Symmetric		
		Left Concentrated (0.027)[b]	Right Concentrated (0.027)	Centralized (0.036)	Uniform (0.083)	Polarized (0.125)
10	0.1	10[c]	10	10	10	10
	0.5	10	10	10	10	10
	0.9	10	10	10	10	10
4	0.1	10	3	10	10	10
	0.5	10	2	10	10	10
	0.9	3	10	10	10	10
1	0.1	10	1	10	10	10
	0.5	4	1	10	10	1
	0.9	4	1	1	1	1

[a] Total number of brands equals 10; 500 replications.

[b] Variance of utility distributions across brands (Beta (p,q)).

[c] All frequency distributions were bi-modal; only the highest mode is shown.

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89/44	Balaji CHAKRAVARTHY and Peter LORANGE	"Strategic adaptation in multi-business firms", June 1989.
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89/46	Marcel CORSTJENS, Carmen MATUTES and Damien NEVEN	"Entry Encouragement", July 1989.
89/47	Manfred KETS DE VRIES and Christine MEAD	"The global dimension in leadership and organization: issues and controversies", April 1989.
89/48	Damien NEVEN and Lars-Hendrik RÖLLER	"European integration and trade flows", August 1989.

89/49	Jean DERMINE	**"Home country control and mutual recognition"**, July 1989.
89/50	Jean DERMINE	**"The specialization of financial institutions, the EEC model"**, August 1989.
89/51	Spyros MAKRIDAKIS	**"Sliding simulation: a new approach to time series forecasting"**, July 1989.
89/52	Arnoud DE MEYER	**"Shortening development cycle times: a manufacturer's perspective"**, August 1989.
89/53	Spyros MAKRIDAKIS	**"Why combining works?"**, July 1989.
89/54	S. BALAKRISHNAN and Mitchell KOZA	**"Organisation costs and a theory of joint ventures"**, September 1989.
89/55	H. SCHUTTE	**"Euro-Japanese cooperation in information technology"**, September 1989.
89/56	Wilfried VANHONACKER and Lydia PRICE	**"On the practical usefulness of meta-analysis results"**, September 1989.
89/57	Taekwon KIM, Lars-Hendrik RÖLLER and Mihkel TOMBAK	**"Market growth and the diffusion of multiproduct technologies"**, September 1989.
89/58 (EP,TM)	Lars-Hendrik RÖLLER and Mihkel TOMBAK	**"Strategic aspects of flexible production technologies"**, October 1989.
89/59 (OB)	Manfred KETS DE VRIES, Daphna ZEVADI, Alain NOEL and Mihkel TOMBAK	**"Locus of control and entrepreneurship: a three-country comparative study"**, October 1989.
89/60 (TM)	Enver YUCESAN and Lee SCHRUBEN	**"Simulation graphs for design and analysis of discrete event simulation models"**, October 1989.
89/61 (All)	Susan SCHNEIDER and Arnoud DE MEYER	**"Interpreting and responding to strategic issues: The impact of national culture"**, October 1989.
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89/64 (TM)	Enver YUCESAN and Lee SCHRUBEN	**"Complexity of simulation models: A graph theoretic approach"**, November 1989.
89/65 (TM, AC, FIN)	Soumitra DUTTA and Piero BONISSONE	**"MARS: A mergers and acquisitions reasoning system"**, November 1989.
89/66 (TM,EP)	B. SINCLAIR-DESGAGNÉ	**"On the regulation of procurement bids"**, November 1989.
89/67 (FIN)	Peter BOSSAERTS and Pierre HILLION	**"Market microstructure effects of government intervention in the foreign exchange market"**, December 1989.

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90/01 TM/EP/AC	B. SINCLAIR-DESGAGNÉ	**"Unavoidable Mechanisms"**, January 1990.
90/02 EP	Michael BURDA	**"Monopolistic Competition, Costs of Adjustment, and the Behaviour of European Manufacturing Employment"**, January 1990.
90/03 TM	Arnoud DE MEYER	**"Management of Communication in International Research and Development"**, January 1990.
90/04 FIN/EP	Gabriel HAWAWINI and Eric RAJENDRA	**"The Transformation of the European Financial Services Industry: From Fragmentation to Integration"**, January 1990.
90/05 FIN/EP	Gabriel HAWAWINI and Bertrand JACQUILLAT	**"European Equity Markets: Toward 1992 and Beyond"**, January 1990.

90/06 FIN/EP	Gabriel HAWAWINI and Eric RAJENDRA	"Integration of European Equity Markets: Implications of Structural Change for Key Market Participants to and Beyond 1992", January 1990.
90/07 FIN/EP	Gabriel HAWAWINI	"Stock Market Anomalies and the Pricing of Equity on the Tokyo Stock Exchange", January 1990.
90/08 TM/EP	Tawfik JELASSI and B. SINCLAIR-DESGAGNÉ	"Modelling with MCDSS: What about Ethics?", January 1990.
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90/10 TM	Joyce BRYER and Tawfik JELASSI	"The Impact of Language Theories on DSS Dialog", January 1990.
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90/12 EP	Michael BURDA	"Structural Change, Unemployment Benefits and High Unemployment: A U.S.-European Comparison", January 1990.
90/13 TM	Soumitra DUTTA and Shashi SHEKHAR	"Approximate Reasoning about Temporal Constraints in Real Time Planning and Search", January 1990.
90/14 TM	Albert ANGEHRN and Hans-Jakob LÜTHI	"Visual Interactive Modelling and Intelligent DSS: Putting Theory Into Practice", January 1990.
90/15 TM	Arnoud DE MEYER, Dirk DESCHOOLMEESTER, Rudy MOENAERT and Jan BARBE	"The Internal Technological Renewal of a Business Unit with a Mature Technology", January 1990.
90/16 FIN	Richard LEVICH and Ingo WALTER	"Tax-Driven Regulatory Drag: European Financial Centers in the 1990's", January 1990.
90/17 FIN	Nathalie DIERKENS	"Information Asymmetry and Equity Issues", Revised January 1990.
90/18 MKT	Wilfried VANHONACKER	"Managerial Decision Rules and the Estimation of Dynamic Sales Response Models", Revised January 1990.
90/19 TM	Beth JONES and Tawfik JELASSI	"The Effect of Computer Intervention and Task Structure on Bargaining Outcome", February 1990.
90/20 TM	Tawfik JELASSI, Gregory KERSTEN and Stanley ZIONTS	"An Introduction to Group Decision and Negotiation Support", February 1990.
90/21 FIN	Roy SMITH and Ingo WALTER	"Reconfiguration of the Global Securities Industry in the 1990's", February 1990.
90/22 FIN	Ingo WALTER	"European Financial Integration and Its Implications for the United States", February 1990.
90/23 EP/SM	Damien NEVEN	"EEC Integration towards 1992: Some Distributional Aspects", Revised December 1989
90/24 FIN/EP	Lars Tyge NIELSEN	"Positive Prices in CAPM", January 1990.
90/25 FIN/EP	Lars Tyge NIELSEN	"Existence of Equilibrium in CAPM", January 1990.
90/26 OB/BP	Charles KADUSHIN and Michael BRIMM	"Why networking Fails: Double Binds and the Limitations of Shadow Networks", February 1990.
90/27 TM	Abbas FOROUGHI and Tawfik JELASSI	"NSS Solutions to Major Negotiation Stumbling Blocks", February 1990.
90/28 TM	Arnoud DE MEYER	"The Manufacturing Contribution to Innovation", February 1990.

90/29 FIN/AC	Nathalie DIERKENS	"A Discussion of Correct Measures of Information Asymmetry", January 1990.
90/30 FIN/EP	Lars Tyge NIELSEN	"The Expected Utility of Portfolios of Assets", March 1990.
90/31 MKT/EP	David GAUTSCHI and Roger BETANCOURT	"What Determines U.S. Retail Margins?", February 1990.
90/32 SM	Srinivasan BALAK-RISHNAN and Mitchell KOZA	"Information Asymmetry, Adverse Selection and Joint-Ventures: Theory and Evidence", Revised, January 1990.
90/33 OB	Caren SIEHL, David BOWEN and Christine PEARSON	"The Role of Rites of Integration in Service Delivery", March 1990.
90/34 FIN/EP	Jean DERMINE	"The Gains from European Banking Integration, a Call for a Pro-Active Competition Policy", April 1990.
90/35 EP	Jae Won PARK	"Changing Uncertainty and the Time-Varying Risk Premia in the Term Structure of Nominal Interest Rates", December 1988, Revised March 1990.
90/36 TM	Arnoud DE MEYER	"An Empirical Investigation of Manufacturing Strategies in European Industry", April 1990.
90/37 TM/OB/SM	William CATS-BARIL	"Executive Information Systems: Developing an Approach to Open the Possibles", April 1990.
90/38 MKT	Wilfried VANHONACKER	"Managerial Decision Behaviour and the Estimation of Dynamic Sales Response Models", (Revised February 1990).
90/39 TM	Louis LE BLANC and Tawfik JELASSI	"An Evaluation and Selection Methodology for Expert System Shells", May 1990.
90/40 OB	Manfred KETS DE VRIES	"Leaders on the Couch: The case of Roberto Calvi", April 1990.
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90/42 MKT	Joel STECKEL and Wilfried VANHONACKER	"Cross-Validating Regression Models in Marketing Research", (Revised April 1990).
90/43 FIN	Robert KORAJCZYK and Claude VIALLET	"Equity Risk Premia and the Pricing of Foreign Exchange Risk", May 1990.
90/44 OB	Gilles AMADO, Claude FAUCHEUX and André LAURENT	"Organisational Change and Cultural Realities: Franco-American Contrasts", April 1990.
90/45 TM	Soumitra DUTTA and Piero BONISSONE	"Integrating Case Based and Rule Based Reasoning: The Possibilistic Connection", May 1990.
90/46 TM	Spyros MAKRIDAKIS and Michèle HIBON	"Exponential Smoothing: The Effect of Initial Values and Loss Functions on Post-Sample Forecasting Accuracy".
90/47 MKT	Lydia PRICE and Wilfried VANHONACKER	"Improper Sampling in Natural Experiments: Limitations on the Use of Meta-Analysis Results in Bayesian Updating", Revised May 1990.
90/48 EP	Jae WON PARK	"The Information in the Term Structure of Interest Rates: Out-of-Sample Forecasting Performance", June 1990.
90/49 TM	Soumitra DUTTA	"Approximate Reasoning by Analogy to Answer Null Queries", June 1990.
90/50 EP	Daniel COHEN and Charles WYPLOSZ	"Price and Trade Effects of Exchange Rates Fluctuations and the Design of Policy Coordination", April 1990.

90/51 EP	Michael BURDA and Charles WYPLOSZ	"Gross Labour Market Flows in Europe: Some Stylized Facts", June 1990.
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90/53 EP	Michael Burda	"The Consequences of German Economic and Monetary Union", June 1990.
90/54 EP	Damien NEVEN and Colin MEYER	"European Financial Regulation: A Framework for Policy Analysis", (Revised May 1990).
90/55 EP	Michael BURDA and Stefan GERLACH	"Intertemporal Prices and the US Trade Balance", (Revised July 1990).
90/56 EP	Damien NEVEN and Lars-Hendrik RÖLLER	"The Structure and Determinants of East-West Trade: A Preliminary Analysis of the Manufacturing Sector", July 1990
90/57 FIN/EP/ TM	Lars Tyge NIELSEN	Common Knowledge of a Multivariate Aggregate Statistic", July 1990
90/58 FIN/EP/TM	Lars Tyge NIELSEN	"Common Knowledge of Price and Expected Cost in an Oligopolistic Market", August 1990
90/59 FIN	Jean DERMINE and Lars-Hendrik RÖLLER	"Economies of Scale and Scope in the French Mutual Funds (SICAV) Industry", August 1990
90/60 TM	Peri IZ and Tawfik JELASSI	"An Interactive Group Decision Aid for Multiobjective Problems: An Empirical Assessment", September 1990
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90/62 EP	Damien NEVEN and Menno VAN DIJK	"Public Policy Towards TV Broadcasting in the Netherlands", August 1990
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90/64 SM	Sumantra GHOSHAL	"Internal Differentiation and Corporate Performance: Case of the Multinational Corporation", August 1990
90/65 EP	Charles WYPLOSZ	"A Note on the Real Exchange Rate Effect of German Unification", August 1990
90/66 TM/SE/FIN	Soumitra DUTTA and Piero BONISSONE	"Computer Support for Strategic and Tactical Planning in Mergers and Acquisitions", September 1990
90/67 TM/SE/FIN	Soumitra DUTTA and Piero BONISSONE	"Integrating Prior Cases and Expert Knowledge In a Mergers and Acquisitions Reasoning System", September 1990
90/68 TM/SE	Soumitra DUTTA	"A Framework and Methodology for Enhancing the Business Impact of Artificial Intelligence Applications", September 1990
90/69 TM	Soumitra DUTTA	"A Model for Temporal Reasoning in Medical Expert Systems", September 1990
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90/72 TM	Enver YÜCESAN	"Analysis of Markov Chains Using Simulation Graph Models", October 1990
90/73 TM	Arnoud DE MEYER and Kasra FERDOWS	"Removing the Barriers in Manufacturing", October 1990
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90/75 MKT	Roger BETANCOURT and David GAUTSCHI	"The Outputs of Retail Activities: Concepts, Measurement and Evidence", October 1990
90/76 MKT	Wilfried VANHONACKER	"Managerial Decision Behaviour and the Estimation of Dynamic Sales Response Models", Revised October 1990
90/77 MKT	Wilfried VANHONACKER	"Testing the Koyck Scheme of Sales Response to Advertising: An Aggregation-Independent Autocorrelation Test", October 1990
90/78 EP	Michael BURDA and Stefan GERLACH	"Exchange Rate Dynamics and Currency Unification: The Ostmark - DM Rate", October 1990
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90/80 TM	Anil GABA and Robert WINKLER	"Using Survey Data in Inferences about Purchase Behaviour", October 1990
90/81 TM	Tawfik JELASSI	"Du Présent au Futur: Bilan et Orientations des Systèmes Interactifs d'Aide à la Décision," October 1990
90/82 EP	Charles WYPLOSZ	"Monetary Union and Fiscal Policy Discipline," November 1990
90/83 FIN/TM	Nathalie DIERKENS and Bernard SINCLAIR-DESGAGNE	"Information Asymmetry and Corporate Communication: Results of a Pilot Study", November 1990
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90/89 OB	Manfred F.R. KETS DE VRIES	"The CEO Who Couldn't Talk Straight and Other Tales from the Board Room," December 1990
90/90 MKT	Philip PARKER	"Price Elasticity Dynamics over the Adoption Lifecycle: An Empirical Study," December 1990

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91/01 TM/SM	Luk VAN WASSENHOVE, Leonard FORTUIN and Paul VAN BEEK	"Operational Research Can Do More for Managers Than They Think!," January 1991
91/02 TM/SM	Luk VAN WASSENHOVE, Leonard FORTUIN and Paul VAN BEEK	"Operational Research and Environment," January 1991
91/03 FIN	Pekka HIETALA and Timo LÖYTTYNIEMI	"An Implicit Dividend Increase in Rights Issues: Theory and Evidence," January 1991
91/04 FIN	Lars Tyge NIELSEN	"Two-Fund Separation, Factor Structure and Robustness," January 1991
91/05 OB	Susan SCHNEIDER	"Managing Boundaries in Organisations," January 1991
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91/16 TM	Arnoud DE MEYER and Kasra FERDOWS et.al.	"Factories of the Future: Executive Summary of the 1990 International Manufacturing Futures Survey", March 1991
91/17 TM	Dirk CATTRYSSE, Roelof KUIK, Marc SALOMON and Luk VAN WASSENHOVE	"Heuristics for the Discrete Lotsizing and Scheduling Problem with Setup Times", March 1991
91/18 TM	C.N. POTTS and Luk VAN WASSENHOVE	"Approximation Algorithms for Scheduling a Single Machine to Minimize Total Late Work", March 1991
91/19 MKT	Vikas TIBREWALA and Bruce BUCHANAN	"An Aggregate Test of Purchase Regularity", March 1991
91/20 MKT	Darius SABAVALA and Vikas TIBREWALA	"Monitoring Short-Run Changes in Purchasing Behaviour", March 1991
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91/23 TM	Spyros MAKRIDAKIS and Michèle HIBON	"Exponential Smoothing: The Effect of Initial Values and Loss Functions on Post-Sample Forecasting Accuracy", April 1991 (Revision of 90/46)
91/24 TM	Louis LE BLANC and Tawfik JELASSI	"An Empirical Assessment of Choice Models for Software Evaluation and Selection", May 1991
91/25 SM/TM	Luk N. VAN WASSENHOVE and Charles J. CORBETT	"Trade-Offs? What Trade-Offs?" April 1991
91/26 TM	Luk N. VAN WASSENHOVE and C.N. POTTS	"Single Machine Scheduling to Minimize Total Late Work", April 1991
91/27 FIN	Nathalie DIERKENS	"A Discussion of Correct Measures of Information Asymmetry: The Example of Myers and Majluf's Model or the Importance of the Asset Structure of the Firm", May 1991
91/28 MKT	Philip M. PARKER	"A Note on: 'Advertising and the Price and Quality of Optometric Services', June 1991
91/29 TM	Tawfik JELASSI and Abbas FOROUGHI	"An Empirical Study of an Interactive, Session-Oriented Computerised Negotiation Support System (NSS)", June 1991

91/30 MKT	Wilfried R. VANHONACKER and Lydia J. PRICE	"Using Meta-Analysis Results in Bayesian Updating: The Empty Cell Problem", June 1991
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91/32 OB	Susan C. SCHNEIDER	"Organisational Sensemaking: 1992", June 1991
91/33 EP	Michael C. BURDA and Michael FUNKE	"German Trade Unions after Unification - Third Degree Wage Discriminating Monopolists?", June 1991
91/34 FIN	Jean DERMINE	"The BIS Proposal for the Measurement of Interest Rate Risk, Some Pitfalls", June 1991
91/35 FIN	Jean DERMINE	"The Regulation of Financial Services in the EC, Centralization or National Autonomy?" June 1991
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91/42 TM	Rob R. WEITZ and Tawfik JELASSI	"Solving A Multi-Criteria Allocation Problem: A Decision Support System Approach", August 1991
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91/46 MKT	Philip M. PARKER	"Pricing Strategies in Markets with Dynamic Elasticities", October 1991
91/47 MKT	Philip M. PARKER	"A Study of Price Elasticity Dynamics Using Parsimonious Replacement/Multiple Purchase Diffusion Models", October 1991
91/48 EP/TM	H. Landis GABEL and Bernard SINCLAIR-DESGAGNE	"Managerial Incentives and Environmental Compliance", October 1991
91/49 TM	Bernard SINCLAIR-DESGAGNE	"The First-Order Approach to Multi-Task Principal-Agent Problems", October 1991
91/50 SM/TM	Luk VAN WASSENHOVE and Charles CORBETT	"How Green is Your Manufacturing Strategy?" October 1991
91/51 MKT	Philip M. PARKER	"Choosing Among Diffusion Models: Some Empirical Guidelines", October 1991
91/52 EP	Michael BURDA and Charles WYPLOSZ	"Human Capital, Investment and Migration in an Integrated Europe", October 1991
91/53 EP	Michael BURDA and Charles WYPLOSZ	"Labour Mobility and German Integration: Some Vignettes", October 1991
91/54 TM	Albert ANGEHRN	"Stimulus Agents: An Alternative Framework for Computer-Aided Decision Making", October 1991

91/55 **EP/SM**	Robin HOGARTH, Claude MICHAUD, Yves DOZ and Ludo VAN DER HEYDEN	**"Longevity of Business Firms: A Four-Stage Framework for Analysis"**, November 1991
91/56 **TM/EP**	Bernard SINCLAIR-DESGAGNE	**"Aspirations and Economic Development"**, November 1991
91/57 **MKT**	Lydia J. PRICE	**"The Indirect Effects of Negative Information on Attitude Change"**, November 1991
91/58 **OB**	Manfred F. R. KETS DE VRIES	**"Leaders Who Go Crazy"**, November 1991
91/59 **OB**	Paul A. L. EVANS	**"Management Development as Glue Technology"**, November 1991
91/60 **TM**	Xavier DE GROOTE	**"Flexibility and Marketing/Manufacturing Coordination"**, November 1991 (revised)
91/61 **TM**	Arnoud DE MEYER	**"Product Development in the Textile Machinery Industry"**, November 1991
91/62 **MKT**	Philip PARKER and Hubert GATIGNON	**"Specifying Competitive Effects in Diffusion Models: An Empirical Analysis"**, November 1991
91/63 **EP**	Michael BURDA	**"Some New Insights on the Interindustry Wage Structure from the German Socioeconomic Panel"**, December 1991
91/64 **FIN**	Jean DERMINE	**"Internationalisation of Financial Markets, Efficiency and Stability"**, December 1991

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92/01 **MKT/EP/TM**	Wilfried VANHONACKER	**"CONPRO*DOGIT: A New Brand Choice Model Incorporating a Consideration Set Formation Process"**, January 1992