Behavioral effects of using software agents for product and merchant brokering:

An experimental study of consumer decision making.

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ABSTRACT

Agent technology has been applied to design new services simplifying product and merchant brokering in several consumer industries. The term “shopbots” is generally used to characterize these services. It is proposed that shopbots will reduce consumer search costs and make consumer buying behavior more rational. Based upon a decision making model, we propose twelve hypotheses of the effects of using shopbots on consumer buying behavior. The hypotheses are tested in an experimental study of consumers choosing a financial service provider. We find strong support for the hypotheses of change in information search behavior, but only partial support for the hypothesis of change in choice behavior. Further, we find no evidence of differences at the problem recognition and judgment stages of the buying process between consumers using shopbots and other consumers.

KEYWORDS AND PHRASES: Software agents, shopbots, product brokering, consumer buying behavior, Internet marketing.

1. INTRODUCTION[1]

It has been proposed that electronic markets will be more efficient than traditional markets (see [18] for a review). This is partly due to reduced supplier menu costs and partly due to lower consumer search costs. Most suppliers of products and services have designed websites where existing and potential customers can find information about product attributes and prices. However, the amount of information is so large that consumers may have problems identifying the relevant information on products and vendors' alternatives. To help the consumers in this situation, several information service providers have made aggregation of information for product and merchant brokering one of their main services[2] [10]. Such services are generally termed "shopbots". It has been proposed that the availability of shopbots is one of the reasons why electronic markets will be more efficient [12]. This is mainly explained by more rational consumer buying behavior and reduced consumer loyalty. A proposed additional effect is that consumers will be more satisfied in electronic markets because it will be easier for the consumers to find products that better meet their needs. In this paper, we investigate the first of these propositions - the hypothesis of consumer rationality. We argue that the market efficiency effects of electronic commerce should originate from behavioral effects at the individual

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[2] See e.g. http://www.jango.com; http://www.dealpilot.com/; http://shop.lycos.com/.

level. Consequently, shopbots should change individual consumers' buying behavior if any improvement in market efficiency is to be expected.

The effects of shopbots and similar software agents in electronic markets have been studied using several approaches. In microeconomic theory, simple models of the relationship between information of price, utility and consumer choice are applied. Based upon these models, Greenwald and Kephart [5] have made predictions of increased efficiency in electronic markets as a result of shopbot use. Their predictions correspond well to the analytic predictions of Bakos [2]. Another approach is the application of software agents with a cognitive architecture consisting of beliefs, preferences and intentions. Such models have been applied to the study of software agents in auction markets (e.g. [14]). A third approach is to apply a decision making model of the consumer buying process. Such models have been used to characterize the roles of software agents in electronic commerce [10, 21]. Recently, these models have also been applied to study the behavioral effects of using shopbots and other software agents on the consumer buying process [6, 9]. In this study, a similar decision making approach is applied. The setting of the study is the consumer banking market. Consequently, the products we study are differentiated and information rich. The paper is organized as follows: First, we use behavioral decision theory and consumer behavior literature to propose twelve hypotheses of how the consumer buying process is affected by using shopbots. Next, we present the experimental design used to test the twelve hypotheses. We then present our findings and discuss relevant validity threats. In the final section we

discuss implications of our findings to research, to financial service providers[3], and to information service providers.

2. THEORY AND PROPOSITIONS

In the consumer's task of choosing product and vendor, shopbots may be seen as decision tools supporting the consumer's buying process [6]. However, it is not clear if decision tools will be used to improve the quality of the decision, to reduce the cognitive efforts of the task, or to reduce task completion time [19]. Thus, the simple relationship between reduced search costs and change in consumer buying behavior assumed by some models predicting improved efficiency of electronic markets may be questioned. As an alternative, a behavioral model of the consumer buying process may be used to investigate the different behavioral effects of using shopbots on the consumer buying process. There are many models of this process. Most of the models are developments of Simon's [16] original idea of describing the decision making process as a set of stages. The number of stages in these models ranges from two stages of information search and choice [6], to more than ten stages in models including post decisional behavior [8]. Our decision making model is based upon a model by Solomon [17]. It describes the buying process in four stages, and excludes all post decisional behavior. The four stages of the model are problem recognition, information search, the judgment or evaluation stage, and the choice stage.

[3] In this paper, the term "financial service provider" is used of all providers offering financial services to consumers in the consumer banking industry. Examples of such providers are banks, insurance companies, credit card companies and other payment service companies.

At the recognition stage, problem or need identification is focused. It is often assumed that behavior at this stage is driven by the consumers' individual "theories" or "scripts" [20]. Generally, it is assumed that availability of domain knowledge and information increases the perceived complexity of and attention to the decision problem. Applied to a consumer buying problem, this means that more informed customers will have a better understanding of the complexity of the problem and will be more focused in their attention to the buying problem. If shopbots give users information of irrelevant aspects of the problem, their understanding of problem complexity may be dysfunctional, and attention may be drawn to irrelevant aspects of the problem. However, if shopbots provide information of relevant aspects, a better understanding of problem complexity and a more focused attention to the problem are both functional, and may improve decision quality. Few would argue that the price and attribute information provided by shopbots are irrelevant to the problem of selecting the best product and vendor. Consequently, access to shopbots will improve buying decision quality because consumers using these services will have a better understanding of the complexity of the buying problem. They will also have a more focused attention to the problem. Thus, we propose two hypotheses of the problem recognition stage:

H1: Users of shopbots are more focused in their attention to the buying problem.
H2: Users of shopbots have a better understanding of the complexity of the buying problem.

When studying the information search stage, a specific search model is often assumed. One of the most widely applied search models is the "unit circle" model [1, 2]. This model assumes that information search is sequential, and that the consumer considers extending his search each time information about a product is collected. The consumer compares the utility of price and other attributes of the products known so far to the expected utility of collecting information about one additional product at each "stage in the unit circle". Bakos assumes that:

> "*If the cost of search is low enough, buyers look at all the product offerings and purchase the one best serving their needs, resulting in a socially optimal allocation*" [2, p. 1682]

Shopbots change product and vendor information search from a sequential to several parallel searches, dramatically reducing the search costs of the consumer at each "loop of the unit circle model". Generally, a reduction in search costs leads to an increase in the amount of information and the number of information sources searched. Shopbots may aggregate information from various sources. Price and attribute information is typically ordered and filtered, reducing both the time and cognitive effort needed to comprehend the informational content. As a consequence, three hypotheses are proposed about the information search stage:

H3: Users of shopbots spend less time searching for information.

H4: Users of shopbots collect information from more information sources.

H5: Users of shopbots collect a greater amount of product information.

The perceived satisfaction with Internet as an information medium is also affected by the availability of shopbots. Because shopbots make more information from more sources available to the user with less effort, we propose the following hypothesis of satisfaction with the Internet as an information search medium:

H6: Users of shopbots are more satisfied with the Internet as an information search medium.

At the judgment stage, the consumer evaluates relevant alternatives and their attributes. It is often assumed that different cognitive heuristics are used to reduce the size of the consideration set at this stage (see [3]). Shopbots may prevent the dysfunctional effects of using many of these heuristics, such as the availability or representativeness heuristics. By presenting product and vendor information in an easily comprehensible way, the consumer may not overemphasize the latest investigated or most well known alternatives. It is also easier to identify dominated alternatives when using shopbots. Both reduced importance of heuristics and easier identification of dominated alternatives contribute to a reduction in the size of the consideration set of the users of shopbots. Since shopbots provide aggregated information of alternative products, vendors, and the attributes of both products and vendors, it can be proposed that more attributes are taken into consideration during evaluation. However, the attributes most easily presented by shopbots are quantitative attributes. This may make shopbots introduce new heuristics at the judgment stage of the decision process. Depending upon what kind of product is

being evaluated, more attention to quantitative attributes can be either functional or dysfunctional. We propose the following three hypotheses of the judgment stage:

H7: Users of shopbots seriously consider a smaller number of alternatives.
H8: Users of shopbots evaluate a larger number of product attributes.
H9: Users of shopbots pay more attention to quantitative attributes in product evaluation.

It is assumed that the consumers will make a choice based upon the collected information, their beliefs and their preferences. Even though the consumers' rationality may be bounded or limited in many of the ways we have indicated above, some form of preference satisfaction is assumed. However, beliefs and preferences are not necessarily independent [11]. Since shopbots will draw attention to quantitative attributes, the preferences of shopbot users may emphasize quantitative attributes. Consequently, shopbot users will choose a larger share of alternatives with non-dominated quantitative attributes. Furthermore, many shopbot services assist the user in combining the evaluation of several attributes. One example is the optimization algorithms used by the shopbots of Frictionless.com[4]. Another example is assistance in the calculation of the product price of products with a complex pricing scheme. With assistance in combining attributes, shopbot users will prefer more non-dominated alternatives when evaluated by a combined criterion. As an example, users of shopbots will prefer financial service providers that offer services with lower total cost rather than providers with low costs of

[4] See http://www.frictionless.com or an application of their shopbots at http://shop.lycos.com/.

one particular financial service. Since shopbots simplify information processing at the choice stage, less cognitive effort is required by the consumer to eliminate dominated and choose non-dominated alternatives. Thus, we propose the following three hypotheses on the effects of using shopbots at the choice stage:

H10: Users of shopbots apply more quantitative criteria at the choice stage.
H11: Users of shopbots prefer more alternatives with non-dominated quantitative attributes.
H12: Users of shopbots prefer more alternatives with non-dominated combined quantitative attributes.

Our setting for testing these hypotheses is the consumer banking industry. Financial services are information rich products with easily defined and often quantitative attributes. Several shopbot services are available[5], and the consumers have an indisputable interest in selecting the financial service provider with the best offer. Consequently, major changes have been predicted both in individual consumer behavior and in market structure from increased use of shopbots and similar services in consumer banking (see e.g. [4]).

[5] E.g. http://www.bankrate.com and http://www.quickenmortgage.com.

3. METHOD

To test the twelve hypotheses, a web-based experiment was designed. The setting of the experiment was a consumer banking situation. The experimental procedure consisted of a pre-experimental questionnaire, a task presentation, conditional access to a shopbot service, and a post-experimental questionnaire[6]. Extensive logging was combined with self-reported measures. To prevent the subjects from applying an inappropriate sequence of the different tasks, a session was created and controlled with "cookies" for each participant. By visiting the experiment website, the subjects were first given a brief introduction to the experiment. Next, the pre-experimental questionnaire was answered. Then the task context and the task were presented. In the task context, the student subjects were supposed to have recently graduated and had been employed in a fairly well paid job. They had supposedly been given a monetary gift from their parents and were about to buy an apartment. The task itself consisted of choosing a financial service provider for a mortgage, a savings account, and a current account for their monthly average outstanding salary after tax. The task description is shown in appendix A. To assist the subjects in their choice, a web page of links was designed. The design of the web page represented the manipulation of the experiment. Subjects in the control group were given links to financial service providers only. Subjects in the manipulated group were given the same links, but in addition they were given access to a shopbot service. This service was especially designed for the experiment, and provided aggregated

[6] The procedure, questionnaires and task are found at the experiment site http://sol.nhh.no/design (in Norwegian).

information on product and vendor attributes particularly relevant to the task[7]. To assess if subjects in the control group used shopbot services, or if subjects in the manipulated group preferred not to use the shopbot, logging was applied. It was no need to reassign subjects based upon these logs. When the subjects had made their choice, they were directed to a post-experimental questionnaire in which their choice and other post experimental observations were reported. No time limits were set, but the subjects were informed that normal completion time was estimated at one hour. Average completion time was 72 minutes. As an incentive to participate, the subjects could voluntarily register their email address for a lottery. The procedure and questionnaires were pre-tested and discussed in a pilot study involving eight PhD-students.

The subjects were recruited from a student pool at two different colleges at two different occasions. Participation was voluntary, and the opportunity to participate was announced in relevant student classes. To get sufficient variation in age, sex, domain knowledge, technical knowledge and innovativeness, students from a business school and from an engineering college were selected. The subjects were randomly assigned to the control and manipulated groups. A total of 144 subjects participated in the experiment. The distribution of the subjects is shown in table 1.

Insert table 1 about here.

[7] A somewhat simplified version of the service is found at http://sol.nhh.no/noagents/idefault.asp.

Table 1 shows a skewed distribution of male and female subjects in the two groups. This is primarily due to the low proportion of female students in engineering education. To identify any other systematic bias in the assignment of the subjects, we used four variables to compare shopbot users and non-users. Descriptive statistics showing the differences between the users and non-users are found in table 2.

Insert table 2 about here.

The knowledge and innovativeness variables were multi item scales designed to measure knowledge of the consumer banking industry, knowledge of information technology and innovativeness respectively. The reliabilities of the measures are indicated by Cronbach's alpha in table 2. T-tests of differences in means were used to reveal any systematic differences in the four variables between users and non-users. A significant difference between the two groups was found in knowledge of the consumer banking industry. The user group had significantly more knowledge of the industry. We discuss possible validity effects of the skewed gender distribution and the knowledge difference in section 4.

As indicated above, the stimulus variable was operationalized by giving users access to a shopbot service. The shopbot was particularly designed for the task context of the experiment, and included ordered display tables of financial service providers' terms, an overview of the expected financial costs of using each provider in different market segments, and a calculation service making it possible for the users to calculate the total

financial costs of using each financial service provider. The shopbot also included a notification service where the users could require personal notification by email if the terms of a particular financial service provider changed.

The dependent variables of each hypothesis were either observed directly or measured in the post-experimental questionnaire. All attitudinal measures from the post-experimental questionnaire were multi item measures. An overview of all concepts, measures and reliabilities is found in table 3.

Insert table 3 about here.

All attitudinal measures were based upon the subjects' agreement or disagreement with a number of attitudinal statements. A five-point scale was used to indicate agreement. An overview of the statements used to measure each concept is shown in appendix B. Since this was one of the first attempts to test the effects of using shopbots, and since there were no standardized measures of the concepts in table 3, all measures except the problem complexity measure were considered sufficiently reliable [13]. The problem complexity measure could have been designed as a single item measure. Since using single item attitudinal measures seldom give any improvement in reliability, we preferred to keep the problem complexity measure a multi item measure and accepted the somewhat lower reliability. The single item measures of table 3 were either self reported numbers or unobtrusive measures. Since information search presumably represented most of the variation in task completion time, it was considered a good proxy for search time.

The database of the shopbot service was used to obtain the mortgage, savings and current account rates of the financial service providers at the time each subject completed the experimental procedure. The subjects also self-reported these terms, and both self reported and unobtrusive measures were used in analyzing the results. Total costs were calculated based upon the task information, the self reported terms, and the obtained unobtrusive terms of the chosen financial service providers. All dependent variables except observed mortgage rate and total costs based upon observed terms were approximately gaussian. Due to differences between fixed and adjustable interest rates, the distribution of the observed mortgage rate was bimodal.

4. RESULTS

In the experiment, 96 (67.7 %) of the subjects successfully completing the task chose a financial service provider different from the one they reported as their current provider. It was no systematic difference in this frequency between shopbot users and non-users. The twelve hypotheses of section 2 were tested using traditional analysis of variance models with shopbot use as the independent variable and the variables listed in table 3 as dependent variables. In table 4, a summary of the findings is shown.

Insert table 4 here.

Table 4 shows each dependent variable, the means of each variable in the user and non-user groups, the degrees of freedom of the F-tests, and the F-values of each analysis of variance.

For the two hypotheses of change at the *problem recognition* stage of the buying process, no significant differences were found between shopbot users and non-users. Thus, the use of shopbots did not seem to affect the way the financial service provider choice problem was conceived. The users of the shopbot did not seem to be more focused in their attention to the choice problem (H1). Neither did they seem to have a better understanding of the complexity of the financial service provider choice problem (H2).

All tests of the hypotheses of differences in buying behavior at the *information search* stage were found significant. Shopbot users spent less time searching for information (H3). Furthermore, they reported a significantly larger number of information sources than non-users (H4). Shopbot users also reported that they collected a greater amount of information than non-users (H5). Finally, shopbot users were generally more satisfied with using the Internet as an information search medium (H6). All the findings were in the proposed directions, and strongly supported the proposition that access to shopbots affects the information search stage of the consumer buying process.

Three hypotheses were proposed of differences in consumer buying behavior at the *judgment stage*, but none of the tests of these hypotheses were found significant. Shopbot users did not seem to have smaller consideration sets than non-users (H7). Furthermore,

shopbot users did not seem to evaluate more attributes of each alternative than non-users (H8), and they did not pay more attention to quantitative attributes than non-users (H9). Consequently, users of shopbots did not seem to behave differently from non-users at the judgment or evaluation stage when choosing a financial service provider.

The three hypotheses of the choice stage were tested using the nine different dependent variables listed in table 3. We first tested the hypothesis that shopbot users applied more quantitative criteria at the choice stage (H10). We found no support for this hypothesis. Next, we tested the hypothesis that more non-dominated alternatives were chosen by shopbot users (H11). This hypothesis was first tested with self-reported mortgage rates, savings rates and current account rates. We assumed that if a larger share of non-dominated alternatives were selected by shopbot users, they would chose financial service providers with lower mortgage rates, higher savings rates and higher current account rates than non-users. None of the tests of differences in self reported mortgage rates, savings rates, and current account rates were found significant. We performed the same tests using observed mortgage rates, savings rates and current account rates. Similar results were found, but as indicated in section 3, the distribution of the observed mortgage rates was not approximately gaussian. Because some subjects selected loans with fixed rates and some selected loans with adjustable rates, observed mortgage rates had a bimodal distribution. We first tested the differences in observed mortgage rates using the Mann-Whitney test. The test showed a significant difference in mortgage rates between shopbot users and non-users ($U=1293$, $Z=1.993$, $p<0.05$). Since mortgage rates

are very important to most consumers, we decided to further investigate this finding. In table 5, an overview of the relevant results is found.

Insert table 5 about here.

As can be seen in table 5, a significant difference in mortgage rates was found between shopbot users and non-users who chose loans with an adjustable rate. No significant differences were found for subjects choosing fixed rates and in the subjects' self-reported rates. Even though the difference in self-reported rates was of the same magnitude, random errors in the self-reported measures contributed to a high variance in the variable, and thus, the difference was not significant. The finding of a significant difference in adjustable mortgage rates gave some support to the hypothesis that shopbot users choose more non-dominated alternatives. However, with nine relevant tests of this hypothesis and only one significant result, the support was not very convincing, and should be considered partial (H11).

Finally, we tested the hypothesis that more alternatives with non-dominated combined attributes were chosen by shopbot users (H12). The total cost variable was used as a measure of the combined attributes. This variable was a weighted average of mortgage rates, savings rates and current account rates, where loan amounts, savings amounts and average outstanding current account amounts represented the weights. The hypothesis was first tested with total costs based upon self-reported rates. As shown in table 4, this test was not significant. Due to the large weight of mortgage rates in the total cost

variable, the distribution of total costs based upon observed rates was also bimodal. A similar treatment was given to this total cost variable as was given to the mortgage rate variable above. The analysis revealed a significant difference in total costs between shopbot users and non-users in a Mann-Whitney test ($U=1225.5$, $Z=2.217$, $p<0.05$). As can be seen from table 5, the same pattern of significant and non-significant results was found for the total cost variable as was found for the mortgage rate variable. Consequently, we found only partial support for the hypothesis that shopbot users would choose more alternatives that were non-dominated when evaluated with a combined criterion (H12). Since only one of three tests of this hypothesis was significant, the support for the hypothesis was far from strong.

Due to skewed distributions of gender, age and domain knowledge, we tested age and domain knowledge as covariates in the models. Neither age nor domain knowledge proved significant as covariates in these models. We tested for the effects of the skewed gender distributions by including the gender variable in a factorial model. We also made a similar analysis including the education of the subjects (business school or engineering college) as a variable in a factorial model. No significant interaction effects of the gender and education variables were found with the variable indicating shopbot use. Based upon these tests, we conclude that the findings reported above are internally valid.

To sum up, we found no support for differences in consumer buying behavior between shopbot users and non-users at the problem recognition and judgment stage of the buying process. We found only partial and weak support for the hypotheses of differences at the

choice stage. However, we found very strong evidence of differences in buying behavior at the information search stage. These findings indicate that problem recognition, information search, judgment and choice may not be as integrated as first assumed in models predicting "*increased allocational efficiency and possible lower prices and increased competition among sellers*" (cited from [2], p. 1690) in electronic markets. Consequently, the predictions of increased efficiency may also need revision.

5. DISCUSSION AND IMPLICATIONS

Even though our findings were considered internally valid, the uniqueness of the subjects, the financial task context and the particular shopbot service used in the experiment may limit the external validity of the study. It can be argued that students are not representative of consumers in general. However, the student subjects of this experiment had an average age of 24.4 years, and 11 % of the subjects were more than 30 years old. Furthermore, age showed no explanatory power in the covariate models indicated above. In addition, 141 of the 144 subjects had an established relationship with a financial service provider, and should be considered as consumers with a low, but stable income. It is even possible that the uniqueness of the subjects strengthens the external validity of this study. We argue that if these subjects were less loyal than consumers in general, it is even less likely that consistent findings of changed behavior at the problem attention, judgment and choice stages will be found among more loyal consumers.

The uniqueness of the financial task context is mainly represented by the attributes of financial services. These "products" are rich in information content and their attributes are easily comparable. However, the buying process may be different from the one used when buying other products. One example is that a loan decision is integrated with the decision of buying the product that the loan is financing. We argue that the information richness and the easily comparable attributes of financial services make them well suited for a test of the effects of using shopbots. These features are in fact ideal for the application of shopbot services, and this makes it even more surprising that so few effects were found. We argue that since so few effects were found when using shopbots as an assistance tool in buying information rich and easily comparable products, it is unlikely that more effects will be found with less information rich and less comparable products. The complexity of financial services represents a true threat to the external validity of our results. Complex products often imply higher shifting costs and more loyal customers. However, the complexity of the financial services did not prevent 67.7 % of the subjects from changing their financial service provider. We also found no differences in customer loyalty between shopbot users and non-users. Product complexity may however be one of the reasons why no significant results were found at the judgment stage. This may prevent generalization of our results to consumers buying simple products like books and CDs, and explain the differences in findings between our study and the study of Häubl & Trifts [6]. They studied consumers using shopbots when buying tents and stereo systems, and found significant differences at the judgment stage between users and non-users. However, our findings of few differences between shopbot users and non-users at the

choice stage are consistent with Häubl & Trifts' [6] findings that shopbot users did not choose more non-dominated alternatives than non-users.

It may be argued that the stimulus of the task – the shopbot service – was not properly operationalized, meaning that if other shopbots had been offered to the subjects, more significant effects may have been observed. This argument always applies to tests of propositions of the behavioral effects of new technology. It also seems that very little documentation is required of those proposing such behavioral effects. In fact, this situation is very different from other disciplines. In medicine, it is unlikely that any effect of a new drug can be proposed without proper posterior documentation. However, in information systems research, similar norms do not seem to exist. We still argue that the shopbot service offered to the subjects of this study was representative of services for product and merchant brokering of financial services. The significant difference in satisfaction with the Internet as a search medium between users and non-users also indicated that the shopbot was seen as a useful and satisfactory service for product and merchant brokering. We argue that the uniqueness of the subjects, the financial task context and the shopbot service used in this study do not seriously limit the external validity of our conclusions.

This study has several implications for research, for financial service providers, and for information service providers. The results may indicate that the stages of the buying process may be less integrated when shopping on the Internet. Consumers seem to isolate the information search stage from the rest of the buying process. If this is the case,

consumers may use the Internet to perform information search and use physical channels to perform the real choice of products and vendors. This may have behavioral effects in the physical channels that may not be observed in an isolated study of electronic markets alone. It would be interesting to follow this line of reasoning in an experiment including the physical channel as well as the electronic channel. It would also be interesting to see if our conclusions are consistent across different categories of products. In particular, comparable studies of consumer behavior when buying both complex and less complex products would be interesting.

It has been argued that use of shopbots may favor low priced products and products with easily represented attributes [7]. As a consequence, shopbots may influence competition in favor of low cost – low quality vendors. Our experimental results indicate that this will not necessarily be the case. Even though users of shopbots search more information of the products and vendors they evaluate, evaluation does not seem to be based upon simple or quantitative criteria alone. Choice seems to be based upon complex criteria both among shopbot among users and non-users. Suppliers who base their competitive advantage on product attributes like quality, personal service and safety need not necessarily fear the consequences of shopbots. In fact, using shopbots to effectively present quality information may reduce the search costs for this information and consequently, decrease price sensitivity [9]. It is likely that most shopbot systems will soon include techniques that better represent the product attributes of high quality vendors [7]. Access to shopbots increases consumers' satisfaction with the Internet as an information search medium, and may also be seen by customers as an indication of

vendor honesty. If the vendors give customers access to such services, vendors may both improve their image in the electronic channel and increase the number of consumers performing their shopping in electronic channels.

Two strategies are usually found among information service providers offering shopbot services. One strategy is to offer product information from a large number of vendors. With this strategy, the service providers make product information a service in itself, and hope that customer trust and vendor independence will create site traffic, and consequently income. In the consumer banking market, BankRate[8] relies on this strategy. Another strategy is to cooperate with selected vendors and create value added services on top of the information service. One example is to make it easier for customers to order the products they finally choose by providing direct links from the shopbot service to the participating vendors. With this strategy, both site traffic and fees of participating vendors generate the necessary income. In the consumer banking market, Quickenmortgage[9] relies on this strategy. Our findings indicate that consumers' information search stage is only loosely coupled to the rest of the buying process. Satisfying the information needs of consumers may require a separate service with other preconditions for success than the product supplier service itself. Thus, a strategy of vendor independence and consumer trust may be more successful for information service providers. We intend to investigate both this possible implication for information service providers and the implications for financial service providers indicated above in a case research design in the near future.

[8] See http://www.bankrate.com.

[9] See http://www.quickenmortgage.com.

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Group/Education	Business	Engineering	Total
Nonusers	Male: 16 Female: 18	Male: 27 Female: 10	Male: 43 Female: 28
Users	Male: 30 Female: 10	Male: 27 Female: 6	Male: 57 Female: 16
Total	Male: 46 Female: 28	Male: 54 Female: 16	Male: 100 Female: 44

Table 1 Distribution of subjects (N).

Variable	Group	Mean (N)	t-value	alpha
Age	Nonusers	23.4 (71)	2.081	Single item
	Users	25.4 (71)		
Banking knowledge	Nonusers	8.3 (71)	2.413*	0.812
	Users	9.4 (71)		
Technology knowledge	Nonusers	9.8 (70)	0.592	0.745
	Users	10.1 (72)		
Innovativeness	Nonusers	6.7 (70)	1.087	0.697
	Users	7.0 (71)		

Table 2. Descriptive statistics for users and nonusers (** $p<0.01$, * $p<0.05$).

Concept of each hypothesis	Measure	Items	Alpha
Problem attention	Attitudinal	3	0.769
Problem complexity	Attitudinal	2	0.576
Search time	Task completion time	Single item	-
Information sources	Self reported number	Single item	-
Amount of information	Attitudinal	3	0.650
Internet search satisfaction	Attitudinal	3	0.770
Consideration set size	Attitudinal	4	0.615
Attributes evaluated	Attitudinal	3	0.796
Attention to quantitative attributes	Attitudinal	2	0.752
Quantitative criteria used in choice	Attitudinal	3	0.711
Single quantitative criteria	Mortgage rate: Self reported and observed Savings rate: Self reported and observed Current account rate: Self reported and observed	Single items Single items Single items	- - -
Combined quantitative criterion	Calculated total costs	Single items	-

Table 3. Concepts and their measures.

Dependent variable	Nonuser mean	User mean	d.f.	F-value
Problem attention	10.46	10.78	1, 136	0.565
Problem complexity	6.76	6.59	1, 138	0.415
Search time	2320 sec.	1940 sec.	1, 134	7.536**
Information sources	10.21	15.16	1, 129	8.768**
Amount of information	9.86	10.67	1, 129	4.276*
Internet search satisfaction	11.29	12.48	1, 137	8.123**
Consideration set size	14.41	14.34	1, 135	0.003
Attributes evaluated	8.77	9.13	1, 135	0.728
Attention to quantitative attributes	6.84	7.06	1, 135	0.578
Quantitative criteria used in choice	9.91	10.26	1, 135	0.723
Mortgage rate, self reported	7.95%	7.86%	1. 138	0.167
Mortgage rate, observed	8.01%	7.91%	1, 114	0.967
Savings rate, self reported	5.66%	5.51%	1, 135	0.992
Savings rate, observed	4.78%	5.01%	1, 117	2.338
Current account rate, self reported	2.12%	2.46%	1, 121	2.116
Current account, observed	1.73%	1.83%	1, 116	0.348
Total costs, self reported	NOK 28711	NOK 28416	1, 119	0.168
Total costs, observed	NOK 29423	NOK 28813	1, 113	1.815

Table 4. Results of the analysis of variance of each dependent variable (** $p<0.01$, * $p<0.05$).

Dependent variable	Nonuser mean	User mean	d.f.	F-value
Mortgage rate, self reported - fixed	6.70%	6.90%	1. 24	0.207
Mortgage rate, self reported - adjustable	8.24%	8.09%	1, 114	1.095
Mortgage rate, observed - fixed	6.85%	6.77%	1, 20	1.165
Mortgage rate, observed - adjustable	8.27%	8.16%	1, 94	8.730**
Total costs, self reported – fixed	NOK 23088	NOK 24766	1, 21	0.817
Total costs, self reported – adjustable	NOK 30027	NOK 29188	1, 98	1.923
Total costs, observed – fixed	NOK 24407	NOK 24055	1, 19	0.834
Total costs, observed - adjustable	NOK 30402	NOK 29871	1, 94	9.426**

Table 5. Results of the analysis of variance of mortgage rates and total costs. (** $p<0.01$, * $p<0.05$).

Appendix A. Task given to the subjects.

"You have recently graduated and have been employed in a fairly well paid job. Your yearly salary is NOK 320 000. However, the transition from student to employee requires you to make some financial decisions. First of all, you have decided to buy an apartment. You have found a good apartment priced at NOK 600 000. As a graduation gift, your parents have decided to give you NOK 250 000. Their requirement is that NOK 200 000 of the gift is used as equity in financing your apartment. The rest of the amount is to be placed in a savings account to cover for unforeseen future events. You are also interested in getting the best possible terms on your current account. This account is to be used in payment services and as a debit account for your cards. In this new situation, you are reconsidering the relationship you have with your existing bank. Either you can continue as a customer in your current bank, or you can change to a different financial service provider. However, this task requires that you select one, and only one, service provider for the following services:

- A mortgage of NOK 400 000
- A savings account of NOK 50 000
- A current account with good terms

With the assistance you can get from using the Internet, we ask you to select your financial service provider for the services listed above. To help you locate the relevant information, we have designed a web page with links to relevant sources of information."

Appendix B. Statements used for the attitudinal measures of the study.

Concept	Statements
Problem attention	"By focusing my attention on a few important criteria, I made the task simpler" The structure of the information I used made it easier to focus my attention on solving the task" "The way the information was organized made it simpler to focus my attention on solving the task"
Problem complexity	"To structure the problem, I separated it in several sub problems" The problem consisted of several sub problems that I could use to structure the task"
Amount of information	"I could base my choice on a considerable amount of information" " A large amount of information was collected to solve the choice problem" " A large amount of information was found relevant to solving the choice problem"
Internet search satisfaction	"Using the Internet gave more relevant information than search based on conventional methods" "I found more relevant information using the Internet than I would have found without access to the Internet" "The search on the Internet gave more relevant information than I would have expected form a traditional search"
Consideration set size	" A relatively large number of banks were considered serious alternatives to me" "I selected a large sample of banks for serious consideration" "I based my judgment on evaluating a large number of banks" Normalized value of the answer to the question: "How many banks did you seriously consider as alternatives?"
Attributes evaluated	"I based my decision on evaluating many attributes of each bank" "I considered many attributes when evaluating each bank" "Many attributes of each bank were important to my choice"
Attention to quantitative attributes	"I focused my attention on quantitative attributes when I collected the information" "The most important attributes of the evaluation were quantitative"
Quantitative criteria used in choice	"I can justify my choice by referring to quantitative criteria" "I can show by calculation that the choice I made was the best" "I can specify quantitatively the attributes that was critical to my choice"