# Purchasing complex services on the Internet; An analysis of mortgage loan acquisitions

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| BIBLIOGRAPHIC DATA AND CLASSIFICATIONS | | |
|---|---|---|
| Abstract | In contrast to, for example, books and compact discs, the number of complex services offered on the Internet is still small. A good example of such a service concerns mortgage loans. The decision-making process differs for complex services in that they have an extra intermediate step of `indication of interest'. The web site is (1) visited and searched for information, subsequently (2) a request for the service is made, which may lead to (3) a purchase. This difference in the buying process and the complexity of the decision-making process, requires afurther investigation on purchasing complex services on the Internet. We therefore focus on online purchases of complex services, paying special attention to the determinants of a purchase of such services. To this end, we acquired a unique data set from an online Dutch financial service provider, which offers services like mortgage loans and insurances on the Internet. This data contains, besides clickstream data, also data on user-specific information like demographics. We also obtained information on whether the request for the service resulted in a purchase. Search behavior, product familiarity and trust appear to be useful determinants of purchase of complex services. Direct managerial applications of our model include the ability to identify customer characteristics of successful applicants, and subsequently the selection of customers. | |
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**Abstract**

In contrast to, for example, books and compact discs, the number of complex services offered on the Internet is still small. A good example of such a service concerns mortgage loans. The decision-making process differs for complex services in that they have an extra intermediate step of 'indication of interest'. The web site is (1) visited and searched for information, subsequently (2) a request for the service is made, which may lead to (3) a purchase. This difference in the buying process and the complexity of the decision-making process, requires a further investigation on purchasing complex services on the Internet. We therefore focus on online purchases of complex services, paying special attention to the determinants of a purchase of such services.

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keywords: online purchase behavior, search behavior, trust, decision support system, Internet

# 1 Introduction

Today, the Internet seems to turn into a profitable and valuable business. During the first quarter of 2003, online US retail sales covered a total of $ 11.9 billion, an increase with 200 percent compared to the first quarter of 2000 (U.S. Census Bureau, 2003). Consumers favor the Internet for its 24 hour shopping ability, easy accessible information and tools to assist in the decision-making process, without having to leave their home. This is an ideal situation for purchasing products like compact discs and books, which are therefore offered in large amounts by many retailers on the Internet, such as *Amazon.com*.

In contrast, the number of more complex services offered on the Internet is still low and the number of retailers offering these services is even smaller. It seems that the Internet is not as well accepted for this kind of services and possibly also less suited (Peterson *et al.*, 1997). With complex services we mean services that consist of many items per attribute, that are often tailor-made, infrequently purchased, more difficult to comprehend, and that require in general assistance during the decision-making process. A good example concerns acquiring a mortgage loan on the Internet. In case of a mortgage loan it is still customary to go to a local offline intermediary to acquire such a service. Often, the Internet is used to advertise the service, that is, to provide information on where the mortgage broker is located and how she or he can be contacted. Compared to the Internet, the local intermediary provides a less anonymous environment combined with personal interaction. These features may be desirable, especially for a service like a mortgage loan, as personal information is shared and assistance of an expert is often needed. Furthermore, it is possible to negotiate on specifications of the service, including its price.

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In contrast to a product like a book - that can be bought on the Internet with a single click on an icon 'buy now' - the exact specifications of a complex service are not known until the point of purchase. Consequently, also the process of acquiring a complex service on the Internet differs from buying a book. For a book, (1) consumers visit the online store and search for information, (2) subsequently they purchase the book. In addition to these two steps, a complex service requires an additional third step. Complex services have an extra intermediate step of 'indication of interest'. The web site is (1) visited and searched for information, subsequently (2) a request for the service is made, which (3) may lead to a purchase. This difference in the buying process and the complexity of the decision-making process when buying a complex service online, requires a further investigation on purchasing complex services on the Internet.

Only a few empirical studies have considered the visit to a web site and the subsequent purchase of a product or a service on that web site. Moe (2003) investigates consumer intentions of an online store visit. She uses navigational clickstream data to differentiate between online shoppers via demonstrated differences in search behavior. In addition, based on disaggregate clickstream data, Bucklin and Sismeiro (2003) develop a modeling approach to understand the duration of a page view, and the consumers' decision to continue or to stop browsing a web site. The findings of these two studies on online consumer behavior are of importance for web site design and customization of the web site. Finally, Moe and Fader (2003) developed and estimated a model explaining the purchase of simple products, such as books, on the Internet. No studies have, however, modeled the purchase of complex services on the Internet. In this study we therefore focus on online purchases of complex services, and we study the determinants of purchase

of such a service.

To this end, we acquired a unique data set from an online Dutch financial service provider, which offers services like mortgage loans and insurances on the Internet. This data is unique in the sense that, besides clickstream data, we also obtained data on user-specific information like demographics. Although clickstream data provide large amounts of information, a limitation is that user-specific information is generally not available (Moe, 2003). Furthermore, we also obtained information on whether the request for the service resulted in a purchase. We will focus on the case of online mortgage loans as an example of a complex service on the Internet.

Our contribution to the literature is two-fold. First, we study the purchases of complex services using the Internet. Second, we combine three data sources, namely, clickstream data, online user provided data and purchase data to analyze online purchases of complex services. Direct managerial applications of our model include the ability to identify customer characteristics of successful applicants. This is useful as not all online requests will be converted into a purchase, and accordingly will yield only costs and no profits. We show how our model can be used to select the more successful mortgage loan applications 'at the gate'.

The structure of the paper is as follows. In Section 2 we discuss the relevant theoretical background for the decision to purchase complex services online, which shapes the discussion of our modeling. In Section 3 we describe the data we obtained for our analysis. We discuss model specifications and findings in Section 4. In Section 5 we illustrate how our findings can be used for customer selection. Finally, we conclude in Section 6.

# 2  Theoretical considerations

Complex services are characterized by many items per attribute, are often tailor-made, purchased infrequently, difficult to comprehend, and often require assistance during the decision-making process. Clearly, these services differ from other online products like compact discs and books. Due to characteristics of complex services, specific issues will have to be taken into account to explain purchases using the Internet.

Based on previous studies we define four sets of determinants of online purchases of complex services. First, demonstrated search behavior may reveal the purpose of the online store visit, and subsequently the intention of purchase (Moe, 2003). Second, trust in the online retailer is an issue of concern for customers to adopt the Internet as a transaction channel and therefore of importance for purchase (Peterson *et al.*, 1997; McKinny *et al.*, 2002). Third, product knowledge may influence the probability of purchase (Alba and Hutchinson, 1987, among others). Fourth, socio-demographics may provide insights in online purchase behavior (see, for example, Ratchford *et al.*, 2003).

The diversity created due to differences in products/services offered on the Internet, makes it difficult to classify a buyer on the Internet based on socio-demographic information. Therefore, it is not possible to determine which variables should a-priori be included into an analysis of purchases of complex services. In addition, these variables are mainly data driven, that is, dependent on availability in the data set. We elaborate on the socio-demographic variables in Section 3, where we discuss the measures of purchase determinants of mortgages loans using the Internet, as an example of complex services. We elaborate on each of other three sets of determinants below.

## 2.1 Search behavior

We distinguish two types of search behavior that may be of importance for online purchases of complex services. First, 'online search behavior' characterizes the behavior demonstrated during the visit of a web site, for example, the number of pages visited and the time spent on the web site. Second, 'competitive search behavior' characterizes comparison of services or retailers during search activities. Information on the latter type of search behavior originates from the extra information that can be obtained during the decision-making process of complex services.

*Online search behavior*

The availability of clickstream data enables researchers to study the behavior of a customer on a web site. Especially, specific search strategies can be revealed. Moe (2003) defines four search strategies that customers can demonstrate on the web site of an online store, which are, direct-buying, search/deliberation, hedonic browsing and knowledge building. These strategies are based on the two dimensions 'search' (goal-directed versus exploratory) and 'purchase horizon' (immediate versus future), as defined by Moe (2003). Direct-buying indicates a strategy that will result into an immediate purchase. Search/deliberation is aimed at forming a consideration set of available options. Both strategies have the intention of purchase but differ on the timing of that purchase. Hedonic browsing is a strategy that is mainly stimulus-driven, possibly resulting in impulse purchases. Knowledge building is a strategy with the objective to gain expertise. The latter two strategies are both exploratory, that is, they focus on information gathering but differ in intention of purchase.

Due to the specific characteristics of complex services two strategies will

no longer exist. First of all, a direct-buying strategy is not plausible. The exact specifications of the service are not known until the point of purchase, eliminating the option of a direct purchase. Especially, the customer can negotiate on specifications of the service. Second, complex services are not the type of services one purchases by impulse, eliminating the hedonic-browsing option. Only the two shopping strategies search/deliberation and knowledge building could be demonstrated on a web site of complex services.

Although there are differences in the number of strategies that can be investigated, we believe that the same characteristics for these search strategies hold as defined by Moe (2003). Differences in repeat service viewings and variety in category search and service search allow us to distinguish between these two search strategies. That is, consumers with an intention of purchase (search/deliberation strategy) will reveal very focussed and goal-directed search behavior. In contrast, consumers demonstrating a knowledge building strategy will reveal a very broad search pattern.

*Competitive search behavior*

The Internet, with its low search costs, is an ideal medium to compare products and services as well as retailers. In fact, tools on the Internet have specifically been developed to perform such activities. We call this type of search behavior competitive search behavior. This is especially of importance for services that have a large financial and long-term impact on consumers. For these services consumers often use an extended decision process, in which several offers of competing firms are compared (Verhoef *et al.*, 2001).

As mentioned before, the decision-making process of a complex service contains an extra step, that is, the request for an offer of the service. During

this request, information on offers from competitors can easily be obtained, for example, as part of the application form for the service. Consumers that already have been in contact with a competitor will be less likely to purchase the service using the Internet.

## 2.2 Trust/Privacy

Before engaging in online transactions, consumers have to adopt the Internet as a new transaction channel. It appears that especially trust in the online store is of importance for adoption of the Internet for transactions. Trust is defined as "the extent to which a consumer believes that its exchange partner is honest and/or benevolent" (Geyskens *et al.*, 1998). Low trust will refrain consumers from adopting e-commerce (McKnight *et al.*, 2002). More in detail, low trust initiates network privacy concerns, which in turn reduce the willingness to provide (personal) information over the Internet (Peterson *et al.*, 1997).

The issue of trust may be very important during the decision-making process of acquiring a complex service. In contrast to, for example, purchasing a book on the Internet, much is at stake when a consumer engages in the purchase of a complex service like a mortgage loan. Therefore, trust in the company offering the service is of importance, both offline and online. Especially, the issue of privacy is of importance, as much personal information is exchanged during the decision-making process (Stewart and Segars, 2002). In case of an online shop, this information will be transmitted over the Internet, which may increase concerns about trust and privacy.

The main consequence of this issue is the concern about the way information is treated. As a result, people may refrain from providing information until a certain level of trust is obtained. In addition, people may deliberately

provide incorrect information. Until the required level of trust is obtained, consumers will not engage in a purchase. Therefore, erroneous answers or missing data may signal concerns about trust.

## 2.3   Product knowledge

Product knowledge consists of two components, that are, familiarity and expertise (see, Alba and Hutchinson, 1987). Familiarity arises from experience related to the product and expertise indicates the capability to perform tasks related to the product successfully. Both components have been considered as an important variable in shaping consumer behavior both offline and online.

Product expertise can be acquired via information search, and product familiarity can be acquired via the acquisition of a similar service in the past. We have defined complex services as services with many items per attribute, which will likely differ in complexity. Before the decision of purchase is made, a certain level of expertise on the service will be required. This level of expertise on service specifications can be used as an indicator for the progress in the decision-making process. The higher the level of knowledge acquired, the closer the customer will be to the point of purchase of the service.

In addition, the effect of purchases made in the past may be two-fold. First, there is the effect of experience with the service. And second, there is the effect of experience with the purchasing process. For complex services, the effect of experience with the service is difficult to define. Consumers will not acquire an identical service twice, as these services are often custom-made. However, due to the specific characteristics of the service, experience with the decision process of acquiring such a service may be of value to the

customer. This familiarity allows the customer to focus on service specifications and accordingly it may simplify the decision-making process.

# 3   Data

The data we acquired for our study are obtained from a Dutch online financial service provider. This company is an intermediary on the Internet for large financial corporations and offers a wide range of financial services, including insurances, savings accounts and mortgage loans, among other products. The company is market leader in the Netherlands in facilitating the purchase of financial services on the Internet.

## 3.1   Online mortgage loan applications

In March 2001 the company started with the service of offering mortgage loans on the Internet. The part of the web site concerning mortgage loans facilitates information search and several utilities that aid in estimating costs and consequences of variants of attributes of mortgage loans. For example, one can calculate the maximum amount that can be borrowed and the corresponding monthly costs. Before we provide details of the data we acquired, we first elaborate on the process of applying for a mortgage loan using the Internet at this company. This process is typical for online firms selling complex services. Examples of web sites where complex products or services are sold include, among many others, *www.countrywide.com* and *www.amomortgage.com* for mortgage loans, *www.carsdirect.com* for cars and *www.insweb.com* for insurances.

*Purchasing a mortgage loan using the Internet*
We mentioned in the introduction the difference in the online decision pro-
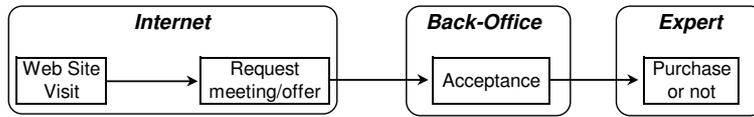
Figure 1: Process of an online mortgage loan application

cess between complex services and products like books, that is, customers first provide an indication of interest before engaging in a purchase. In Figure 1 we graphically show the process of an online mortgage loan application at this company.

To acquire a complex service, like a mortgage loan, customers visit the web site and state their interest for a loan by filling out an application form. On the web site consumers make a choice between applying for an offer or applying for a meeting with an expert, which may be followed by an offer. Information required for both requests is usually similar, although a request for an offer requires more information from the applicant on mortgage loan specifications.

After submission of the application, the applicant is sent a confirmation email. The application is then forwarded to the back-office. The back-office decides, based on certain criteria, whether the application will be processed, and if so, it forwards the application to an expert for further processing. The expert will contact the applicants and will provide the applicant with an offer or will arrange a meeting, depending on the type of application chosen by the applicant. Subsequently, the expert and applicant try to settle an agreement on mortgage loan specifications, which eventually may lead to a purchase.

This process of purchasing a mortgage loan using the Internet generates three sources of data. First, the behavior of the consumer on the web site

is monitored (clickstream data). Second, information provided on the application form is stored. And third, information whether the application is processed, and whether it eventually led to a purchase is stored as well. We use the information that is available directly after acceptance of the application by the back-office, to analyze the occurrence and properties of eventual purchases.

*Mortgage loan application data*

The data we acquired consist of all mortgage loan applications during the period April 2001 until December 2002. After some basic screening, we have 6487 mortgage loan applications. Due to confidentiality we cannot provide the exact number of purchases. In addition, we have access to clickstream data of all mortgage loan applicants in our sample. Of the 6487 applications we acquired, 6016 are requests for an offer and the remaining 471 are requests for a meeting with an expert. On average the mortgage loan applicant is 37 years of age, has an annual income of € 55,382 and desires a mortgage loan of € 192,263.

## 3.2 Measurements of purchase determinants

In Table 1 we provide an overview of the determinants of purchases of complex services on the Internet and our measures of these determinants. Note that these measures arise from the customer database and serve as indicators of the theoretical constructs discussed in Section 2. We elaborate on each measure below.

*Online search behavior*

All customers are monitored during their visit of the web site. In the pre-

vious section we mentioned that two search strategies can be displayed at a web site of a complex service; a search/deliberation strategy and a knowledge building strategy. We use two measures as indicators of the search/delibration strategy. The first measure is a dummy variable indicating (1) whether the customer directly visited the mortgage loan web site or (0) followed a web link[1]. We expect that consumers with an intention of purchase will directly visit our web site.

Our second measure for online search behavior is the fraction of time spent on the mortgage loan section, which is defined as the ratio between the time spent on the mortgage loan section and the total time spent on the web site. This ratio will be 1 if the customer only focused on the mortgage loan section. Customers displaying goal-directed search behavior will have a value of 1 or close to 1. We expect both measures to have a positive relationship with purchase.

*Competitive search behavior*

The application form for a mortgage loan, that needs to be filled out, provides us with information on different topics, including competitors. To measure competitive search behavior we obtained information whether the applicant already had been in contact with a competitor and therefore already obtained an offer or had a meeting with an expert. If indeed this is the case, it is likely that the online service is used for a second opinion, which negatively influences the likelihood of a purchase.

*Trust/privacy*

Applicants may refrain from providing personal information or they may

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[1]A direct visit to a web site is a visit for which the consumer directly typed the web site's address (URL) into the address bar of the web browser.

Table 1: Explanatory variables for purchases of mortgage loans using the Internet

| Measurement of purchase determinants | Variable | Expected effect |
|---|---|---|
| *Online search behavior* | | |
| Directly to web site (1) or not (0) | DIRECT | + |
| Fraction of time spent on mortgage loan section | TIME | + |
| | | |
| *Competitive search behavior* | | |
| Applicant had been in contact with competitor (1) or not (0) | COMP | − |
| | | |
| *Trust/privacy* | | |
| Income is not correctly provided (1) or correctly (0) | DINC | − |
| | | |
| *Product knowledge* | | |
| Application is *not* for first mortgage loan (1) or it is (0) | PURPOSE | + |
| The number of sub-mortgages | NUMSUB | + |
| Request for a meeting with an expert (0) or an offer (1) | REQUEST | +/− |

even provide erroneous information, due to the issue of privacy. This last notion provides an opportunity to construct an indirect measure of trust. In general, consumers in the Netherlands are very reluctant to provide information on their income level. We check if the applicants reported a reasonable income level, that is, above the € 20,000 and below € 150.000. We use a dummy variable to indicate that information on income did not satisfy this criteria (1) or it did (0). Concerns about privacy, demonstrated by erroneous data and measured by this dummy variable will negatively influence purchase of a mortgage loan.

*Product knowledge*

The request for a mortgage loan may be for financing the purchase of a house for the first time, for the second time or to change specifications of the existing mortgage loan, among other reasons. These purposes of an mortgage loan application provide us with information on service familiarity, that is, previous purchases of mortgage loans. In case the application is for a mortgage loan acquired for the first time, our product familiarity dummy will indicate this with the value of 0, that is, there is no experience based on previous purchases. In all other cases a mortgage loan has previously been acquired. For this variable we expect a positive relation with purchase.

A customer may demonstrate his or her expertise on a product by choosing more advanced mortgage loan specifications. For example, one may decide to split up a loan into certain 'sub-mortgages', differing on, for example, how and when each sub-mortgage will be paid off. This is a feature that requires good understanding of the principles of mortgage loans. Therefore, the variable indicating the number of sub-mortgages, as an indicator of expertise, will positively influence the likelihood of purchase.

In addition, expertise may also be demonstrated via the type of request made. Customers have two possibilities when applying for a mortgage loan. That is, the customer may request an offer or a meeting with an expert. It is difficult to define which of the two indicates a higher level of expertise. One may argue that a request for an offer is an indication of a higher level of expertise. The customer is aware of all specifications and is willing to close a deal. However, the same argument may also hold for a request for a meeting with an expert. As both requests can be indicators of a higher level of expertise, we refrain from stating an expected effect on purchase for this measure.

*Socio-demographics*

In addition to the measures mentioned above, we include socio-demographic variables. It is difficult to define the characteristics of an Internet buyer, but see Ratchford *et al.* (2003) and Degeratu *et al.* (2000) for some relevant insights. The purchase decision on a mortgage loan, is a decision where much is at stake. In case the applicant has a spouse it is likely that she or he will be involved in the decision-making process. Therefore, we include a dummy variable that indicates if the applicant has a spouse (1) or not (0) (see Su *et al.*, 2003, for a study on the effect of spouse on family purchase decision making). Furthermore, we include information on the level of income, next to the dummy income used as an indicator of trust, and age.

## 4  Empirical results

The aim of the previous two sections was to introduce four sets of determinants of purchase and specify the components of these determinants in context of the data we acquired. We incorporate the measurements as de-

Table 2: Summary estimation results of the logit model

| Variable | Expected | Estimate[1] | St. error |
|---|---|---|---|
| *Online search behavior* | | | |
| DIRECT | + | 0.358*** | 0.107 |
| TIME | + | 1.321** | 0.554 |
| *Competitive search behavior* | | | |
| COMP | − | -0.106* | 0.063 |
| *Trust/privacy* | | | |
| DINC | − | -0.608* | 0.369 |
| *Product knowledge* | | | |
| PURPOSE | + | 0.306** | 0.121 |
| NUMSUB | + | 0.537*** | 0.096 |
| REQUEST | +/− | -1.309*** | 0.143 |
| | | | |
| SPOUSE | | -0.258** | 0.127 |
| INCOME | | -0.002 | 0.002 |
| AGE | | 0.031*** | 0.006 |
| | | | |
| McFadden $R^2$ | 0.050 | | |

[1] level of significance: * 10%, ** 5%, *** 1%

fined in the previous section into a model to explain purchase. As purchase is a binary variable (yes=1), we use the logit model (see Franses and Paap, 2001, among others). Estimation results of our model are shown in Table 2.

The two measures 'fraction of time on mortgage loan section' [TIME],

and 'direct to mortgage loan web site' [DIRECT] were introduced to give an indication of the search/deliberation strategy, and subsequently purchase. Both measures have indeed the expected positive effect, see Table 2, which is in line with the findings of Moe (2003). This indicates that online search behavior can also provide valuable insights into purchase behavior of complex services using the Internet.

In addition to these findings we now will discuss findings more specific for complex services, especially mortgage loan applications. In the set of search behavior we defined competitive search behavior, next to online search behavior. Indeed, but at a 10 per cent significance level, the measure for competitive search behavior [COMP] negatively influences purchase. This gives an indication that it is relevant to consider information on activities of competitors as a determinant of purchase.

We used information on the reported level of income, to investigate if privacy considerations negatively influence purchase [DINC]. Indeed, as can be seen in Table 2 the expected effect is present, but only at a 10 per cent significance level. Applicants providing erroneous information on income are less likely to purchase.

We determined product familiarity using the purpose of the application [PURPOSE]. From Table 2 we can conclude that, in line with findings in the literature on other types of products, service familiarity obtained via previous purchases positively influences the purchase of complex services using the Internet. In addition, we also distinguished service expertise obtained via information search. The first measure we used is the variable that indicates the number of sub-mortgages [NUMSUB]. In line with our expectations we find that applicants requesting a mortgage loan divided in multiple parts have a higher incentive to purchase a mortgage loan using

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the service on the Internet. The second measure used as indicator of product expertise, is the 'type of request' [REQUEST] . Clearly, this measure has a negative effect on purchase, indicating that customers applying for an offer have a lower incentive of purchase. Consequently, customers applying for a meeting, a process involving more effort than an offer, are more likely to purchase. This indicates that the online service is often used for quick information gathering, that is, a second opinion.

We included the demographic variables age, income, and spouse into our model as well. The reported level of income has an insignificant effect. As discussed above, the issue of correctly providing this information is of greater importance. The finding on age is that older applicants are more likely to be involved in the purchase of a mortgage loan. The finding on spouse is that having a spouse negatively influences purchase probabilities. There is much at stake when acquiring a mortgage loan and the spouse might demand to be involved in the decision-making process and accordingly influence the decision making. Furthermore having a spouse involves two persons that have to obtain enough trust in the Internet as a transaction channel. Therefore, the Internet may be rejected for acquiring mortgage loans.

## 5  Managerial application of the model

One important application of our study and model is customer selection. Using some form of selection, the company can handle those customers that have the highest purchase probability. This may lead to a substantial decrease in costs and a higher level of efficiency. To this end, the outcome of the logit model can be interpreted as the probability of purchase, conditional on explanatory variables. These outcomes can directly be used for

the selection of applicants, for example, by declining all applications below a certain threshold level (Bult and Wansbeek, 1995). To illustrate the effect of such a selection rule, we apply it to the sample of applications available to us. Furthermore, we also demonstrate the effect of another popular selection rule, that is, selecting based on expected revenue.

In Figure 2 we demonstrate the effect of the probabilistic selection rule on profit and the number of selected successful cases. On the x-axis we give the fraction of cases selected. The left y-axis shows the fraction of successes that are in the sample given the fraction of selected cases. Furthermore, we define profit as one per cent of the mortgage loan amount minus € 150 fixed costs. Although these hypothetical values are a simplification of the revenue and cost structure, it is sufficient to demonstrate the effect of the selection rule. The right y-axis shows the profit obtained given the percentage of selected cases and the corresponding percentage of selected successes. For example, one may set the threshold on the probability of success such that 20 per cent of the applications will be processed. Correspondingly, we see that the selection rule is able to select 35 per cent of all the successes in our sample. Furthermore, this 35 per cent of successes, as part of the 20 per cent processed cases, yields a (hypothetical) profit of € 77,615.

From Figure 2 it is directly clear that it is not optimal to process all applications. This will result in a loss of € -267,368. Two points are of main interest to us. First, at about 12 per cent of the selected cases, a maximum profit of € 113,190 is obtained. This profit is obtained with 28 per cent of the successful applications. Second, the break-even point, of importance to start-up companies, is obtained at a point of 45 per cent selected cases with a corresponding 61 per cent of the successes selected.

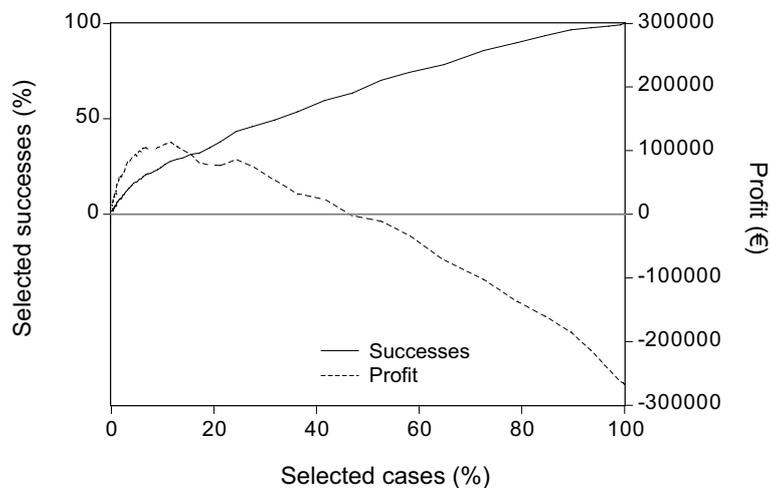Figure 3 shows the effect of an expected revenue-based selection rule.

Figure 2: Probability based selection of mortgage loan applications

That is, we define for each application the expected profit based on probability of purchase and profit as defined above. Applications will be selected at the level of expected revenue. Figure 3 is similar to Figure 2, however closer examination shows some differences. The expected revenue based selection rule yields a maximum profit of € 134,900, with 9 per cent selected cases and 19 per cent selected successes. Furthermore, the break-even point is obtained with 58 per cent of selected cases and 63 per cent selected successes.

We summarize the results of the two selection rules in Table 3. As expected, the probability rule selects more successful applications, whereas the expected revenue rule selects more profitable cases. As a result, a selection rule needs to be chosen that best fits managerial objectives.

Table 3: Summary of effects of the probability based and the expected revenue based selection rule

| | Processed | Successes selected[1] | Profit |
|---|---|---|---|
| *Current practice* | | | |
| All cases | 100% | 100% | € -267368 |
| | | | |
| *Profit maximization* | | | |
| | Processed | Successes selected | Profit |
| Probability based selection | 12% | 28% | € 113190 |
| Expected revenue based selection | 9% | 19% | € 134900 |
| | | | |
| *Break-even* | | | |
| | Processed | Successes selected | Profit |
| Probability based selection | 45% | 61% | € 0 |
| Expected revenue based selection | 58% | 63% | € 0 |

[1] The fraction of applications that lead to a purchase, and that are selected given the fraction of applications selected to be processed.
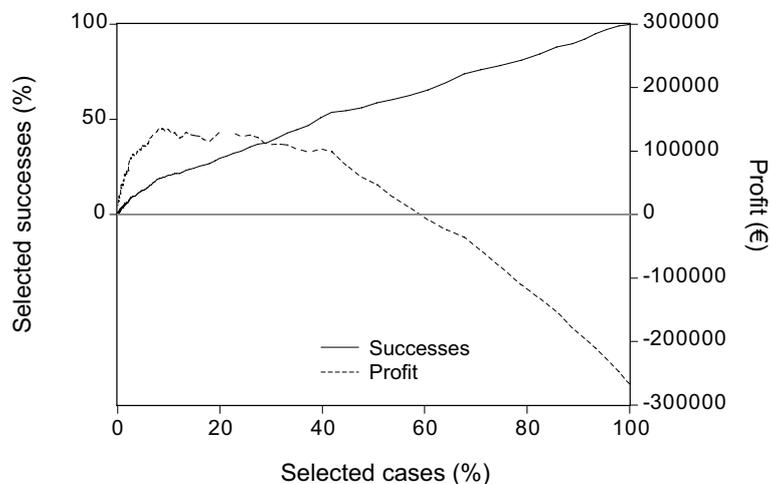
Figure 3: Expected revenue based selection of mortgage loan applications

# 6 Conclusion

We investigated the purchase of online complex services using the Internet. These services clearly differ from common online products like compact discs and books. Especially, the expected level of effort required from both consumer and retailer, in an environment trying to minimize this effort, makes this topic an interesting research topic. We focused on the acquisition of mortgage loans using the Internet.

We specified four determinants of purchase, namely, search behavior, trust, product knowledge and socio-demographics. In addition we decomposed search behavior into two parts, that are, online search behavior and competitive search behavior. We acquired data from a Dutch online service provider offering mortgage loans. The data indicated that our sets of determinants provide a useful framework to investigate purchases of complex services using the Internet. Especially, information on product search, competitive search and product knowledge provided useful information.

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An interesting phenomenon is our finding on privacy. We used indicators of erroneous data as a measure for potential worries about privacy, which is derived from trust. Indeed our dummy variable, as an indicator of privacy concerns, has a significant effect, however only at a 10 per cent significance level. Further research should indicate if indeed missing or erroneous data are indeed useful for measuring trust.

Finally, we discussed managerial implications of our findings. Based on the outcomes of the model, one can construct selection rules. We demonstrated the effect of selection using two popular selection rules, that are, selection based on probability of success and selection based on expected revenue.

Some limitations of our study include that we have no information on previous web site visits of applicants. According to the study of Moe and Fader (2003), these previous visits may be very informative to explain purchases. In our setting however, the number of such visits may be limited. We also have no information on the phase between submission of the mortgage and eventual purchase. To gain a better understanding of purchase this information may be very valuable.

An issue for further research includes a study on the benefits of offering mortgage loans online. A direct comparison with offline intermediaries should indicate if the Internet can indeed reduce effort and costs for both consumer and intermediary. More specific, studies should indicate if the decision-making process for acquiring mortgage loans is more efficient when the Internet is used.

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