



## Interfaces with Other Disciplines

## A methodology based on profitability criteria for defining the partial defection of customers in non-contractual settings

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## ABSTRACT

The defection or churn of customers represents an important concern for any company and a central matter of interest in customer base analysis. An additional complication arises in non-contractual settings, where the characteristics that should be observed to saying that a customer has totally or partially defected are not clearly defined. As a matter of fact, different definitions of the churn situation could be used in this context. Focusing on non-contractual settings, in this paper we propose a methodology for evaluating the short-time economic effects that using a certain definition of churn would have on a company. With this aim, we have defined two efficiency measures for the economic results of a marketing campaign implemented against churn, and these measures have been computed using a set of definitions of partial defection. Our methodology finds that definition maximizing both efficiency measures and moreover, the monetary amount that the company should invest per customer in the campaign for achieving the optimal solution. This has been modelled as a multiobjective optimization problem that we solved using compromise programming. Numerical results using real data from a Spanish retailing company are presented and discussed in order to show the performance and validity of our proposal.

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## 1. Introduction and background

## 1.1. Introduction

The fact of a customer ending his commercial relations with a company is usually known as *defection* or *churn*. For any firm, it has become a critical issue knowing beforehand which of their customers are more likely to become churners. Why is it so important to anticipate the defection of a customer? Reichheld and Sasser (1990) and Zeithaml, Berry, and Parasuraman (1996) (among others) have analyzed the negative impact of customer defections on a company profits. The loss of customers not only entails opportunity costs due to reduced sales, but also leads to an increased need to attract new customers, which is 5–6 times more expensive than selling to the existing customers (see also Bhattacharya, 1998 or Dyché, 2002).

Churn has been extensively treated in the recent literature related to customer-base analysis. In this sense, a distinction between contractual and non-contractual business settings is fundamental, because it is completely inappropriate to apply a model developed for a contractual setting in a non-contractual setting (see for example Reinartz & Kumar, 2000). Contractual environments are characterized by the existence of a contract between the firm and the customer; in such a case, the date of churn is clearly known and it matches up with the contract cancellation date. However, in a non-contractual setting there is no agreement or affiliation between the buyer and seller. In most cases, the customers can change their pattern of purchases without informing the seller. The difficulty lies in defining analytically when a customer becomes effectively inactive in an environment that is not governed by a contract between both parts.

## 1.2. Previous definitions of churn in non-contractual settings

There is relatively little literature dealing with churn definition in non-contractual settings. Most of the papers related to this case propose probability models; Fader and Hardie (2009) provide a review of such models that are well-suited for forward-looking projections in customer-base analysis. Probability models assume

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an underlying probability distribution for the buying behaviour of customers and this is used for estimating at any time  $T$  the probability of a customer being “alive” or active, the customer lifetime value or the expected future number of purchases. The negative binomial distribution (NBD) model by Ehrenberg (1959) was the starting point for modelling the repeated purchase behaviour. One of the first references proposing a NBD model is the work by Schmittlein, Morrison, and Colombo (1987); extensions and empirical validations of this model can be found in Schmittlein and Peterson (1994) or Fader, Hardie, and Lee (2005), while applications can be found for example in Reinartz and Kumar (2000), Reinartz and Kumar (2003) and Hopmann and Thede (2005). Also with a stochastic approach, Netzer, Lattin, and Srinivasan (2008) apply a Hidden Markov model in order to capture the dynamics of the behaviour of the customers (donors of several universities). Apart from these probability models, most definitions of churn use the product activity of a customer and a threshold fixed by a business rule. Following this line, Buckinx and Van den Poel (2005) used real data from a company in the retailing sector in order to propose an analytical definition of churners based basically on the mean frequency of purchases and on the interpurchase time. We will refer to the approach of Buckinx and Van den Poel (2005) in more detail later, when we formally define the class of churn definitions. Also in the retailing sector, Miguéis, Van den Poel, Camanho, and Falcão e Cunha (2012) and Miguéis, Camanho, and Falcão e Cunha (2013) classify those customers who, from a certain period, did not buy anything else and those who in all subsequent periods spent less than a fixed threshold as churners. On the other hand, Gladly, Baesens, and Croux (2009) proposed instead to define churners as those customers with a decreasing future customer lifetime value, and for whom a retention action is profitable.

### 1.3. Aims and scope

As we can see, different definitions of churn in non-contractual settings have been (and could be) established. Which one is more appropriate? or more precisely, how to evaluate the adequacy of a churn definition? That is the main question that we address in this study. Because most companies rely on performance criteria in making their decisions, we recommend selecting a churn definition based on economic parameters.

In this paper, we propose a comprehensive methodology based on economic arguments in order to build a definition for the partial defection of customers in a non-contractual setting. Despite being a vital aspect, there are very few references in the literature from this economical point of view. We claim that our objective is not exactly to establish a single definition of churn but to provide with a tool aimed to evaluate any churn definition and to decide if its implementation would be economically convenient for the company.

First of all, in Section 2 we propose a formal way to generate different definitions of partial defection, which we will use in this paper. Section 3 includes our proposal for evaluating economically a definition of churn; we propose to take into account the gains and losses that the execution of marketing actions to avoid customer's defection would mean for the company. Our methodology for choosing the most convenient (from the economic point of view) among several definitions is presented in Section 4; our proposal consists of maximizing both profits and return due to the campaign based on the churn definition, and this appears to be a multiobjective programming problem. In order to analyze the benefits of our methodology, in Sections 5 and 6 we present and discuss numerical results using real data provided by a

company of commercial retail distribution in Spain. For comparison purposes, we have used the work of Buckinx and Van den Poel (2005), due to the similarities of our environments and data. Conclusions of the paper are shown in Section 7.

## 2. Defining churn

In this section, we present a new family of definitions of churn. Similarly to Buckinx and Van den Poel (2005), we will focus on partial defection and we consider it as a change in the status of a customer. How do you define this change, is the first question. The fact of this definition being or not profitable, is a different one that we will face separately in a subsequent section.

In their paper, Buckinx and Van den Poel (2005) propose focusing only on the best customers of the company in order to study partial defection. At some specific point in time  $T$ , they define two segments of clients (loyal and unloyal customers) based on their behavioural attributes. A customer is classified into the loyal segment if he/she satisfies the following two conditions during a period of 5 months before  $T$ : (a) frequency of purchases is above average and; (b) coefficient of variation of the interpurchase time is below average. That is, loyal customers are those who shop frequently and exhibit a regular buying pattern; the rest of customers are considered to be unloyal. Their objective is to determine which behaviourally loyal clients in the database at time  $T$  may partially switch their purchases to another store after  $T$ . Thus, they classify a customer as partially defective if he has moved from the loyal segment before  $T$  to the unloyal segment during the 5 months after  $T$ .

### 2.1. The class of ad-hoc definitions of churn

We propose a generalization of the definition of churn of Buckinx and Van den Poel (2005). In the following, at a time  $T$  we will call *period of observation* to the period of  $k$  months before  $T$  and *period of evolution* to the period of  $k$  months after  $T$ , for  $k \geq 1$ .

Let us consider a set  $X(c,j)$  of behavioural variables in the database, each variable in this set measured monthly during a period  $j$  for each customer  $c$ . Moreover, consider a set of pairs  $\{(v_i(X(c,j)), t_i), i = 1, \dots, h\}$ ,  $h \geq 1$ , where each  $v_i(X(c,j))$  is an univariate function of the variables in  $X(c,j)$ . We will call *loyal segment* at the period  $j$  to the group of customers for which  $v_i(X(c,j)) \geq t_i$  for all  $i$ , and *improvable segment* to the group formed by the rest of customers, for  $j = 0$  (period of observation), 1 (period of evolution). Then, the partial defection of a customer can be formally defined as follows.

**Definition 1.** Given a temporal length  $k$  and a loyalty segmentation defined by  $\{(v_i(X(c,j)), t_i), i = 1, \dots, h\}$ , we say that a customer has partially defected at the time  $T + k$  if he belonged to the loyal segment during  $j = 0$  and he has moved to the improvable segment in  $j = 1$ .

In the following, we will say that a churn definition belongs to the *ad-hoc class* of definitions,  $C_{Ad}$ , if a loyalty segmentation of the customers defined by  $\{(v_i(X(c,j)), t_i), i = 1, \dots, h\}$  is available and the partial defection of a customer is established using Definition 1. We point out that  $C_{Ad}$  includes a wide range of definitions, differing in the length  $k$  and in the set  $\{(v_i(X(c,j)), t_i), i = 1, \dots, h\}$ . In fact, the definition of churn by Buckinx and Van den Poel (2005) belongs also to this general class.

Later in Section 4.1 we will propose a selection of loyalty segmentation variables  $v_i$  with their corresponding thresholds  $t_i$  to

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