Leveraging data rich environments using marketing analytics
Holtrop, Niels

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Chapter 1

Introduction
In the past decades, marketing has moved from a product-centric to a customer-centric discipline. Many firms have embraced the principles of customer centricity, while others are still in transition (Shah et al. 2006). The overall objective of customer-centric firms is to establish long-term, profitable relationships with their customers. These relationships lead to a dual value creation paradigm: Firms create value for their customers, and in return firms can capture value from their customers (Shah et al. 2006).

As with any established paradigm, changing trends and insights shed new light on existing aspects of the paradigm, with sometimes dramatic consequences. An important trend of the past decade has been the widespread increase in the availability and depth of data, giving rise to what is commonly known as ‘big data’ (Mcafee and Brynjolfsson 2012). Not only has this led to tremendous increases in the richness of data, it has also increased attention for analyzing the available data. This is generally referred to as marketing analytics, a “technology-enabled and model-supported approach to harness customer and market data to enhance marketing decision making” (Lilien 2011).

In this dissertation we explore several opportunities and challenges firms face in a world that is changed by the increasing amounts of data and the associated analysis thereof, and show how they can leverage marketing analytics to create additional value to the firm. Given the large number of areas that are affected by this trend (see e.g. Leeflang et al. 2014) we limit ourselves to the implications on the firm value side in this dissertation. We do so because Germann, Lilien and Rangaswamy (2013) show that the deployment of marketing analytics can create the most impact at the organizational level. For the impact on the customer value side of the dual value creation paradigm we refer to Verhoef, Kooge and Walk (2016).

Value to the firm can be created at three levels: The market/category level, the brand level and the customer level (Verhoef, Kooge and Walk 2016, p. 20). Depending on the performance at each of these levels, the total value to the firm can differ (see Figure 1-1). In this dissertation we focus on the brand level implications of data richness (Chapter 2) and the customer level implications of data richness (Chapter 3 and Chapter 4). We do so because the research areas associated with these levels, customer relationship management (CRM) at the customer level and the marketing mix at the brand level, have been identified as key areas affected by data richness, as they require both data and marketing analytics in order to generate insights (Wedel and Kannan 2016). Across the chapters, we focus on model-based analyses using the available data to
guide and improve managerial decision making in the face of changing market circumstances. This is in line with the definition of marketing analytics given previously. Below we first outline the identified opportunities and challenges, and next we discuss how each chapter links these to either of the three performance dimensions. The central question this dissertation tries to answer across the three chapters can be formulated as follows: 

*How can firms maintain or improve the value to their firm of their marketing activities through the use of marketing analytics in the face of increasing data richness?*

**Figure 1-1: Overview of dissertation**

Changing environments give rise to many opportunities. The first opportunity we discuss is the ability to gain a broader understanding of market behavior, not just at the own firm, but also at competing firms. Many marketing applications are inward focused due to the usage of internal databases, and lack insights on competition (Kamakura et al. 2005). However, advances in data collection can lead to deeper insights in market behavior than before, which firms can leverage and transform into value to the firm (Leefflang et al. 2014). In the case of FMCG products for example, this advance has already been made by the introduction of scanner data, yielding rich insights on own and competitive market behavior (for an overview, see Hanssens
In a digital setting, Ilhan, Pauwels and Kübler (2016) show that social media interactions with a firm are not only driven by content relating to that firm, but also by competitive content. Ignoring such competitive interactions clouds the overall image of a firm’s online marketing effectiveness. As another example, Du and Kamakura (2012) show how firms can leverage own and competitive social media information to identify market trends. Such trends can be used to infer consumer interests and guide new product development. Expanding on these insights by developing modeling approaches that appropriately capture the full effects of the marketing mix on own and competitive actions is necessary, as indicated by their inclusion in the Marketing Science Institute’s research priorities (Marketing Science Institute 2016) and as an important area affected by data richness (Wedel and Kannan 2016).

At the customer level, another way to improve the value to the firm is to retain customers, next to acquiring new customers and developing existing customers (Verhoef, Kooge and Walk 2016, p. 55). Firms already use a wide selection of methods to leverage customer-level information in order to direct retention efforts (e.g. Ascarza and Hardie 2013; Neslin et al. 2006). A challenge that firms face herein is that of customer privacy (Kumar and Reinartz 2016). As stated in the research priorities of the Marketing Science Institute, due to increasing awareness of customers with regard to firm activities using their data, concerns about their privacy has increased (Marketing Science Institute 2016). Firms therefore face a trade-off between using personal information for marketing purposes, and conserving customer privacy (MSI 2016; Rust and Chung 2006; Rust and Huang 2014). It is often suggested that preserving customer privacy comes at the cost of a firms’ marketing capabilities, and will therefore negatively affect the value to the firm (Blattberg, Kim and Neslin 2008, p.78; Wedel and Kannan 2016). However, economic predictions also suggest that firms can benefit from preserving customer privacy as customers derive utility from firms that respect privacy (Rust, Kannan and Peng 2002). Hence, the challenge for firms is to preserve customer privacy without damaging their marketing capabilities. This way, firms can maintain or increase the value to the firm of their activities, while also having an incentive to implement privacy preserving measures in practice.

A second opportunity that arises, which is also mentioned as a research priority by the Marketing Science Institute (Marketing Science Institute 2016), is the possibility to engage in real-time decision making by combining richer data with methodological advances. The value of such an approach lies in the possibility to engage with customers at points in time when
opportunities to influence one of the three value creation pillars (the customer level) arise, making such actions more relevant and directed (e.g. Goldenberg 2008). In turn, the potential customer-level performance improvement can enhance the value to the firm.

Each of the studies in this dissertation deals with one of these opportunities or challenges. In Table 1-1 we compare all the studies in this dissertation along multiple dimensions. The studies cover a variety of industries, showing the widespread reach that data richness and the associated deployment of marketing analytics has. Furthermore, the studies cover both contractual and non-contractual settings, where the latter setting provides additional challenges as it is hard to determine who are active customers and who are not. Finally, as noted before, all the studies use a model-based perspective for their analysis. This is consistent with the goal to provide marketing analytics driven answers to the research questions posed in each chapter, and is required to take advantage of the opportunities of data richness, and to mitigate the challenges. Below we provide a more in-depth overview of each study.

1.1 Competitive reactions to strategic and tactical marketing actions

The first study leverages rich and detailed data on own and competitive market behavior to shed light on how competitive interactions play out in the marketplace. Markets are shaped by the interplay of firms that engage in a seemingly endless series of moves and countermoves at the brand level vying for a favorable position. Successful (or unsuccessful) moves directly affect the performance of firms involved (Chen 1996; Porter 1980). This gives rise to a complex interplay of actions and reactions by firms, the consequences of which are not always clearly known. To inform and improve managerial decision making, it is important that brand managers know what the various consequences of their decisions will be (Montgomery, Moore and Urbany 2005). Therefore, marketing science has seen a long tradition of researchers investigating the impact of such competitive effects on for example firm performance (see e.g. Leeflang and Wittink 1992, 1996, 2001; Nijs et al. 2001; Steenkamp et al. 2005).
<table>
<thead>
<tr>
<th>Study 1/Chapter 2</th>
<th>Level of analysis</th>
<th>Data type</th>
<th>Industry</th>
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<tr>
<td></td>
<td>Brand level</td>
<td>Time series</td>
<td>Pharmaceutical</td>
<td>Non-contractual</td>
<td>B2B</td>
<td>Seemingly unrelated error-correction model</td>
<td>Investigate the impact of strategic and tactical actions on competitive reactions and firm performance</td>
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<tr>
<td>Study 2/Chapter 3</td>
<td>Customer level</td>
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<td>Healthcare insurance + Internet service provider</td>
<td>Contractual</td>
<td>B2C</td>
<td>Generalized mixture of kalman filters</td>
<td>Develop a method for efficient churn prediction while preserving customer privacy</td>
</tr>
<tr>
<td>Study 3/Chapter 4</td>
<td>Customer level</td>
<td>Panel data</td>
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<td>Non-contractual</td>
<td>B2C</td>
<td>Control chart</td>
<td>Develop a method for real-time targeting of marketing actions</td>
</tr>
</tbody>
</table>
An ignored aspect in the marketing literature that has seen widespread attention in the strategy literature is that some actions may carry more weight than other actions. This research stream distinguishes between strategic and tactical actions, and seeks to understand the difference in impact of these actions (e.g. Chen, Smith and Grimm 1992; Porter 1980; Smith et al. 1991). In this study we investigate the impact of both strategic and tactical actions on competition using marketing instruments, in particular personal selling.

Using a unique and rich panel data set of 1502 British physicians covering 20 years of prescriptions and personal selling effort targeted at these physicians across 14 distinct drug categories, we investigate how firms react to each other at the strategic and tactical level. Moreover, we also consider the effects these reactions have on the sales of both firms, i.e. whether these actions affect sales at all, and if so whether this effect is positive or negative. This way we are also able to judge whether these actions were justified, or that there was no need for firms to react to competing firms’ actions. Moreover, hereby we explicitly capture the value to the firm generated by these actions. By applying seemingly unrelated error-correction models (SURECM), we are able to capture the full extent of competitive interactions between all the firms in a particular category, and account for all causal paths of competitive interaction.

Our findings suggest that the competitive response to firms’ strategic actions is significantly stronger than those to firms’ tactical actions, in both the short- and long-run. Furthermore, we find that while strategic actions are deployed mostly effectively and lead to no loss of or even increased sales, in about 50% of the cases for tactical actions the sales effects of reactions to competitors are negative. Moreover, the managers in charge of taking tactical actions (i.e. more junior management) have a narrower competitive focus when making these decisions compared to higher management. This suggests that for these managers, improvements in their decision making are possible. We suggest some of the options that firms can take to improve this process.

1.2 Predicting churn in the face of customer privacy

In the second study we show how the management of customer churn (the opposite side of retention) is affected by customers’ desire for privacy. Customer retention is one of the three drivers of customer level performance of a firm, besides customer acquisition and customer development (Verhoef, Kooge and Walk 2016). Moreover, it is also the most cost-effective way
to increase performance at the customer level (Gupta, Lehmann and Stuart 2004). Before customers can be retained, it is necessary to identify which customers are likely to leave the firm, also known as churn. The identification of at-risk customers is often done using statistical methods, which generate churn propensities for each customer in the customer base (e.g. Ascarza, Iyengar and Schleicher 2016; Lemmens and Gupta 2013). Recent advances in the literature have suggested that using panel data, which enables the identification of dynamic effects and between-customer heterogeneity, can improve churn predictions (Ascarza and Hardie 2013). However, such methods are becoming infeasible as firms increasingly react to customers’ demand for privacy. Spurred by legislative changes, firms often ‘self-police’ by reducing the amount of data they collect and disposing of unneeded data (*data minimization*, Wedel and Kannan 2016), while also making sure data cannot be connected to specific individuals (*data anonymization*, Wedel and Kannan 2016). As a consequence, the analytical capabilities of firms are potentially diminished (Blattberg, Kim and Neslin 2008, p. 78; Verhoef, Kooge and Walk 2016). In this study we introduce a new method that respects the principles of data minimization and data anonymization, and show that preserving these principles does not need to lead to diminished analytical capabilities. Applications in the health care insurance industry (~1 million customers across the period 2004-2012) and the Internet service provider industry (~300k customers from four quarters in 2006) show that our approach, which we call a generalized mixture of Kalman filters (GMOK) model, provides similar predictive performance compared to advanced methods (e.g. Ascarza and Hardie 2013). Importantly, these improvements remain when data from the past is unavailable due to data minimization, which renders advanced methods inestimable. Compared to simpler benchmark models, our approach shows strong improvements in all settings. Therefore, we find that privacy conservation does not need to come at the cost of analytical capabilities, and that potential negative consequences on value to the firm can be avoided by applying a suitable method for churn prediction.

**1.3 Real-time target marketing using control charts**

Finally, the third study of this dissertation turns to the opportunity of engaging in real-time marketing. Firms try to retain customers by deploying marketing actions (Bijmolt et al. 2010). In an attempt to optimize the effectiveness of such marketing actions and achieve an improved customer level performance, firms select specific customers to target. To target such
actions, firms monitor the behavior of customers during their tenure at the firm. Subsequently, they select those customers they think are worth targeting, but also decide on which customers are better left alone. Behavior can be monitored by tracking the usage of a product or service, which has been shown to be predictive of churn in a contractual setting (Ascarza and Hardie 2013). More challenging is a non-contractual setting, where it is often unsure who still is a customer of the firm, and whether they will buy again. Measures such a recency, frequency, monetary value, and clumpiness (Blattberg, Kim and Neslin 2008; Zhang, Bradlow and Small 2014) can and have been used to describe customer behavior, and select relevant customers by relating them to their CLV. While these measures focus on the average behavior of a customer, they do not consider the variability herein, which is important for accurate targeting (e.g. Rust, Kumar and Venkatesan 2011; McCarthy et al. 2014).

In this chapter we therefore focus on a method that firms can use to direct marketing actions, taking into account the variability in customer behavior. An additional advantage of our proposed approach is that the methodology can be used in real-time. This provides an extra dimension on which to enhance the relevance of targeting, as it does not only consider which customers to target, but also when to target them (Goldenberg 2008).

The development of our approach follows from the statistical quality control literature, which is concerned with tracking processes that exhibit process variance. We use the control chart (Montgomery 2009) as a way to monitor the mean and variation in an individual’s purchase process, and determine when a firm should interfere in the process, and when not. An application in the greetings and gifts industry, which concerns 373,521 customers who placed 1,963,446 orders across the period 2012-2014, illustrates the potential gains from this approach. In this setting we are concerned with determining the time at which a firm should sent a reactivation e-mail to customers that might have become inactive. While the current firm policy is to send such an e-mail after eight weeks of inactiveness, our approach suggests to decrease the mean time to five weeks. However, for 31.9% of the cases this should be later than the current eight weeks. Moreover, when customers are targeted too soon (i.e. before they are expected to purchase again), the response to the reactivation e-mail drops by 25%, and the value of the subsequent purchase is 5% to 8% lower compared to the case the customer was targeted on time. Hence, more precise and timely targeting can improve the value to the firm of such actions by avoiding the negative value implications of untimely targeting.
1.4 Outline of the dissertation

In sum, in this dissertation we show how firms can leverage marketing analytics to deal with the opportunities and challenges offered by the changing marketing environment of the 21st century. In particular, across three studies we investigate two opportunities and one challenge. The first opportunity we investigate is that of richer insights on own and competitive marketing actions aimed at customer acquisition and development, and their consequences. This is done in the second chapter, where we investigate the difference between firms’ strategic and tactical actions in this respect. We find that strategic marketing actions elicit stronger competitive response than tactical marketing actions. Furthermore, while the decision to react for strategic actions is always justified, this is not the case in 50% of the cases for tactical actions. Finally, we find that the junior managers in charge of taking tactical actions have a more narrow competitive focus than higher managers do.

In the second study, which is described in chapter three, we show how churn management is affected by the challenge of increased demand for customer privacy, and the subsequent limitations on the deployment of marketing analytics. We show that preserving customer privacy does not have to come at the cost of analytical capabilities, provided a suitable method is used. To that end we develop the GMOK model, and show its improved predictive power over current models when past customer data is not available.

The second opportunity, which we discuss in the fourth chapter of this dissertation, is that of real-time marketing. We introduce a control chart approach that firms can use to target marketing actions to develop and retain customers, operating in real-time. This makes such actions more relevant, as they do not only consider which customers to target, but also when to target them. We show that the use of this method can increase the response to marketing actions, and increase the value of purchases in relation to these marketing actions.

To conclude, the fifth chapter of this dissertation provides a summary of the findings of the preceding chapters, gives several managerial recommendations, and provides directions for further research.