



## Understanding multi-channel banking customers

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### ABSTRACT

This paper contributes to the knowledge of the impact of the multi-channel strategy by analyzing its effects on one key aspect of the behavior of financial services customers. We analyze the factors influencing the extent of multi-channel shopping. Using a customer database, the study estimates one latent class regression model to control for heterogeneity, finding that customers' acquisition of diverse financial products and services and the total number of financial services are antecedents of multi-channel behavior. The study contributes a new measure to better assess the level of multi-channel consumer behavior.

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### 1. Introduction

The development of new communication and information technologies, the Internet in particular, is changing the way in which companies and service providers interact with consumers and customers. This situation force firms to turn themselves into multi-channel organizations, retailing simultaneously through various channels to better serve their consumers (Sousa and Voss, 2006). A firm is using a multi-channel strategy when its products get to the market through two or more distribution channels (Coelho and Easingwood, 2008). The financial sector in particular has a long history of developing new ways to interact with customers and has therefore been employing multi-channel strategies for a long time (Easingwood and Storey, 1996; Pikkarainen et al., 2004) so financial services users are already familiar with multi-channel strategies. Offering multiple complementary channels provides a greater and deeper mix of customer service, thereby enhancing the seller's overall value proposition (Wallace et al., 2004) as different customers may have different needs requiring a mix of channels. A multi-channel strategy may therefore enable superior market segmentation.

Nevertheless, some firms go a step further by trying to manage their different channels jointly with a multi-channel Customer Management (MCM) system. MCM "is the use of more than one channel or medium to manage customers in a way that is consistent and coordinated across all the channels or media used" (Stone et al.,

2002). As Neslin and Shankar (2009) point out "multi-channel customer management is the design, deployment and evaluation of channels to enhance customer value through effective customer acquisition, retention and development." Such management provides customers, via this approach, with a consistent experience, whatever channel they use. This consistency is important because many customers have no single favourite channel for dealing with the firm but have instead become multi-channel users (Ansari et al., 2008; Dholakia et al., 2005; DoubleClick Inc, 2004; among others). More specifically, more and more financial sector customers regularly use a combination of channels (Liao and Cheung, 2002; Sathye, 1999).

The study of these multi-channel customers is therefore important for firms because effective MCM strategy design depends critically on knowing who to target and who your multi-channel customers are. Nevertheless, the majority of the financial services literature has centred on internet banking and not on the study of the multi-channel customer. Aladwani (2001); Bradley and Stewart (2003); Liao, Shao, Wang, and Chen (1999); Martínez, Ortega, and Román (2007); Yiu, Grant, and Edgar (2007), have focused on antecedents of the online banking adoption decision, but neglect the effect on other channels.

In other contexts, Kumar and Venkatesan, 2005 and Venkatesan, Kumar, and Ravishanker (2007) have defined multi-channel customers are those who make a purchase in more than one channel in the observed time period. This definition has its weaknesses, however. As we have argued, most financial service customers already use more than one channel. Thus, according to the definition, they are all multi-channel customers so analyzing their behavior should be a trivial matter (We thank the anonymous reviewer who pointed this out). Albesa (2007) investigates consumer channel preferences in the financial sector and the motives that induce consumers to use a particular channel but he also measures "consumer behavior" using dichotomous variables that assess the use or non-use of different channels. Furthermore, all of this

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previous research has a rather narrow focus in terms of data sources, since the authors use information gathered in surveys or interviews or focus groups, rather than actual customer behavior.

The main purpose of this study is to explain the drivers of a given level of multi-channel behavior in a particular customer, thereby addressing two important limitations of previous research in the retail banking field. Firstly, our empirical contributions involve real data. We use actual consumer behavior data from a financial institution and not merely individual channel usage intention or preferences. Secondly, we use a new measure of multi-channel consumer behavior, the entropy concept, which accommodates different levels of such behavior.

## 2. Conceptual framework and hypothesis

Schoenbachler and Gordon (2002) propose a conceptual model to explain the relative probability of a consumer making a purchase through a single channel (online, retail, or catalogue) or taking the multi-channel option, and Nickolson, Clarke, and Blakemare (2002) use case studies to investigate the influence of situational factors in multi-channel usage by the customers of a fashion outlet. The issues that have generated most interest include the analysis of customer migration between channels (Ansari et al. 2008), the complementarity or substitution of information and/or purchase channels (Dholakia et al. 2005; Verhoef et al., 2007), channel choice (Black et al. 2002; Boehm and Gensler, 2006; Patricio et al., 2003) and the effect of customers' multi-channel behavior on the supplier–customer relationship (Ansari et al., 2008; Kumar and Venkatesan, 2005; Thomas and Sullivan, 2005; Venkatesan et al., 2007). While the first studies to be published are centred on multi-channel behavior in bank customers, this is not a predominant theme in current research.

### 2.1. Multi-channel behavior and financial services

The inherent characteristics of each channel condition the level and means of delivery of service outputs. The development of information and communications technology has increased the number of ways in which customers are able to interact with service providers. For example, Froehle and Roth (2004) classify banking channel technology by customer interface mode, that is, “Face-to-Face” or “Face-to-Screen”.

Financial services is a product category with wide variation in terms of product purchase and management, customer involvement levels and perceived risk, all of which may influence consumer choice and multi-channel behavior (Akinci et al., 2004; Black et al., 2002; Patricio et al., 2003). These authors contend that, with low-involvement financial services, such as information requests or routine banking procedures, consumers are content to use technology-based channels because the amount information and assistance they provide is sufficient to satisfy their requirements. In the case of more complex, higher involvement, services, such as loan requirements or financial investments, however, the customers show a preference for face-to-face service because the complexity of the product calls for more detailed service and a more intense and continuous flow of communication (Buclin et al., 1996). In financial service companies, the only channel where face-to-face contact is possible is at the physical branch, but technology-based channels are more numerous. Therefore, customers needing to carry out a large number of low-involvement transactions have more channels available to them and, possibly, display higher multi-channel behavior.

**Hypothesis 1.** A positive relationship exists between the number of low-involvement transactions carried out and the degree multi-channel behavior.

In addition, different financial products offer customers different product management options. In the context of financial services

companies, customers are able to manage different financial products for themselves through several technology-based channels while some products can only be managed online. These customers acquiring products that are only manageable online are therefore highly familiar with new technology. They tend to use the different technology-related channels wherever and whenever it suits them, and will overall show a higher degree of multi-channel behavior.

**Hypothesis 2.** A positive relationship exists between acquisition of online-managed financial products and multi-channel behavior.

Likewise, the acquisition of products that can be self-managed through a greater number of channels will probably increase the degree of multi-channel behavior.

**Hypothesis 3.** Acquisition of customer-managed financial products relates positively with multi-channel behavior.

Finally, given the importance attached in previous research to the influence of socio-demographic indicators on multi-channel behavior, this study also includes some variables of this nature. A number of studies provide profiles of online banking users. For example, young people (between the ages of 18 and 35) are the most likely to use direct channels because they tend to be open to new technology. Adults show less interest in new banking channels due to a preference for personal interaction and mistrust of new technology (Akinci et al., 2004; Lemaître, 1997). Mattila, Karjaluoto, and Pento (2003) suggest that occupation plays a significant role with people in steady employment emerging as major users of online banking services. Coelho and Easingwood (2008) find strong empirical evidence to suggest that sophisticated (high income/education) target markets have a higher demand for technology-intensive channels, and that this, in turn, drives multi-channel usage. Again, young people and the stably employed (with a stable income) use the wide range of technology-intensive channels that financial services companies make available to customers as a means to contact these companies at any time or place.

**Hypothesis 4.** A positive relationship exists between being young and in steady employment and using multi-channel banking and financial services.

## 3. Empirical application

### 3.1. Database

This study uses the customer database of a financial institution operating in Spain and is centred on the finance industry for a number of reasons. Firstly, the fact that this industry was among the first to introduce the new channels and actively encourage their use means that their customers are already quite familiar with them. Secondly, financial institutions have made a great and constant effort to manage their customers efficiently through various channels. They therefore have a strong need for fully integrated databases to enable them to track and monitor customer activity. Thirdly, the nature of the ties between customers and financial institutions creates more opportunities for multi-channel interaction than is the case in other sectors.

A random sample from this customer database provides information on 455 customers at the various branches spread across the company's geographical reach. The firm made available aggregated data on the transactions carried out by each of these customers over the past year and the evolution of these data through time, along with some socio-demographic data and the information about each customer's use of the various channels provided over a one-year period (September 2005–September 2006).

The following section describes the operationalization and descriptive statistics of the variables used to analyze multi-channel behavior.

### 3.2. Variables

#### 3.2.1. Multi-channel behavior

Table 1 shows the channel usage and multi-channel behavior variables. The number of transactions carried out by customers over the last year has a great variation, the average number of transactions through the four channels offered being 104. In average percentage terms, the channel most frequently used for consumers' transactions were ATMs, followed by branch offices. A customer made an average 7% of the transactions over the Internet, and the channel least used was telebanking, with an average of 0.5 transactions per customer per year. This low usage of telebanking is consistent with the findings of Patricio et al. (2003) or Wan, Luk, and Chow (2005), where telebanking plays a predominantly complementary role, as a sporadic or emergency option.

The number of channels customers use is one of the indicators that describes multi-channel behavior (Kumar and Venkatesan 2005; Sousa and Voss, 2006). As Table 1 shows, customers use an average of more than two of the four possible channels in their relationship with the financial institution (average 2.5). The findings for this variable suggest a high level of mixed channel usage, the most frequently used combinations of channels being physical branch–ATM (51.87%), physical branch–ATM–Internet (30.77%) and, to a lesser extent, the four-channel option (9.89%). Only 2.86% of customers had used one channel only, i.e., either physical branch or ATM. This finding is in line with the results of Liao and Cheung (2002) and Sathye (1999), indicating that, for the sake of convenience, financial customers usually use a combination of channels.

As we have already argued, measuring the variable in this way has, however, a drawback since it fails to take into account different degrees of this behavior. Theoretically, an individual who has used three different channels is described according to this measuring scale as displaying a high level of multi-channel behavior, despite the fact that she may carry out 98% of her transactions through a single channel and distribute the remaining 2% equally over the other two. To overcome this problem, some authors propose minimum usage thresholds for each channel to define an individual as a multi-channel purchaser. In an effort to explain channel migration behavior in consumers, Ansari et al. (2008) class customers as catalogue-loyal or Internet-loyal if they have used the channel in question for more than 95% of their purchases and class all others as multi-channel purchasers. Easingwood and Coelho (2003) consider different heuristics to classify firms as multi-channel strategists or otherwise. One of their criteria is the retailing of goods or services through more than one channel, another is checking for sales percentages above certain thresholds (5%, 10%, 15%...), finally adopting the 15% threshold. Applying these criteria to the case in hand, 89.67% of the customers

would class as multi-channel users according to Ansari et al. (2008) and 58.90% according to Easingwood and Coelho (2003).

As the above reveals, these heuristics do not provide a universally valid criterion. Therefore, this study proposes an entropy measure for multi-channel behavior. Entropy is a concept that was first applied in thermodynamics, statistical mechanics and information theory. Researchers use the concept in other contexts to measure dispersion in a dataset: for example, to measure spatial dispersion (González and González, 2000), assortment variety (Van Herpen and Pieters, 2002) or the dispersion of conversations across locations (Godes and Mayzlin, 2004). Management literature concerning diversification strategy specially applies this measure (Hoskisson et al., 1993; Jacquemin and Berry, 1979, between others). As multi-channel behavior can be seen as a diversification strategy on the part of the customer, this measure is particularly suitable for the present purpose.

Formally, entropy is defined as:

$$Ent = -\sum P_k \ln(P_k) \quad (1)$$

where  $P_k$  denotes the ratio of the number of times an event  $k$  occurs to the total number,  $K$ , of possibilities. In this case,  $P_k$  is the proportion of transactions performed through each type of channel.

Entropy increases as the ratios of the various events become more uniform and reaches its maximum value when the ratios are equal. Thus, the entropy value is at its lowest (0) for single channel users, and reaches its highest value (the natural log of the number of channels) for customers whose transactions are evenly distributed over all the channels, resulting in the highest possible level of multi-channel behavior. Entropy increases with the customer's probability of using various different channels for equal ratios of transactions, which means that the entropy value provides a continuous, increasing measure of the degree to which the transactions of a given customer are distributed over the different channels.

As Table 1 shows, average entropy is 0.55, reaching a maximum of 1.25 compared with a theoretically possible value of 1.38. The statistically significant  $Z$  value yielded by the Kolmogorov–Smirnov test on this variable for a normal distribution of 0.437 makes it impossible to reject the null hypothesis that the entropy is normally distributed. This means that distribution of multi-channel behavior among customers has no observable thresholds that would enable the detection of homogeneous customer segments. For an accurate description, therefore, researchers must take into account the distribution as a whole, which reinforces the importance of the contribution of this study.

#### 3.2.2. Characteristics of customers' product portfolios

Table 2 describes the different variables relating to customers' product portfolios and their use of the bank's services. These are, namely, acquisition/non-acquisition of liability products designed to be managed online, such as current accounts and fixed-term savings accounts: Approximately 7.5% have an online current account and 2% an online savings account. Customers can manage these fixed-term savings accounts exclusively online but they can also manage current accounts at the physical branch and through telebanking.

Acquisition/non-acquisition of other liability financial products, such as current accounts, fixed-term savings accounts, pension funds, investment funds, treasury bonds, stocks, other savings products (a home buyer's account, etc.), demand deposit accounts and asset products, such as mortgage loans, personal loans and deferred payment products. Practically all the customers have at least one current account. Approximately 22% have pension funds and 19% other savings products. These customers have 2.33 liability products on average. Almost 42% have at least one mortgage loan and 20% at least one personal loan. Customers can only manage the current accounts and personal loans through all four channels, while they can manage fixed-term savings accounts and treasury bonds only through physical branches.

**Table 1**  
Multi-channel behavior.

	Variable	N	Min.	Max.	Mean	St.dev.
Customer's operational profile	Number of transactions	455	2	703	104.17	71.81
	% Transactions at physical branches	455	0	100	20.67	20.29
	% Transactions through ATMs	455	0	100	71.47	22.69
	% Transactions via the Internet	455	0	76	7.36	12.62
	% Telebanking transactions	455	0	28	0.51	1.97
Multi-channel behavior	Number of channels	455	1	4	2.51	0.71
	Entropy (Ent <sub>i</sub> )	455	0	1.25	0.55	0.28

**Table 2**  
Products and services.

Financial products	N	% Contracted			Number of channels
Online current accounts (OCa)	455	7.47			3
Online fixed-term savings accounts (OSa)	455	1.98			1
Current accounts (Ca)	455	99.78			4
Mortgage loans (MI)	455	41.98			3
Pension funds (Pf)	455	22.20			3
Personal loans (Pl)	455	19.78			4
Other savings plans (Sp)	455	19.12			2
Fixed-term savings accounts (Sa)	455	8.57			1
Stocks (S)	455	7.91			3
Investment funds (If)	455	7.47			3
Treasury bonds (Tb)	455	3.52			1
Deferred payment loans (Dp)	455	0.88			3
Financial Services	N	Min.	Max.	Mean	St.dev.
Number of bank cards (Bc)	455	0	6	1.60	0.80
Number of insurance policies (Ip)	455	0	1	0.43	0.50
Number of transfers (Tr)	455	0	32	1.07	2.41
Number of bills (Bi)	455	0	95	20.62	16.50
Number of taxes (Tax)	455	0	6	0.19	0.74
Number of cheques (Ch)	455	0	6	0.13	0.54

Services customers use: This study takes into account the number of bank cards and number of insurance policies, number of transfers made, number of cheques deposited, number of bills paid, and number of taxes paid by means other than a standing order in the last quarter of the study period. While owning an average of 1.6 bank cards, the customers had taken out an average of only 0.43 insurance policies. Over the last quarter, the customers had made on average one transfer and paid approximately 21 bills, the rest of their business being in the form of sporadic transactions.

### 3.2.3. Socio-demographic characteristics

As Table 3 shows, the average age of the sample is 50 years and the average length of the relationship with the bank is 14 years. Most of the customers were salaried workers or students at the onset of their relationship with the bank.

### 3.3. Empirical models

The primary aim of this study is to describe the antecedents of multi-channel behavior, that is, the factors that make customers more likely to use several different channels in their dealings with the bank. In this case, the dependent variable is the entropy measure, a continuous measure with a possible range of 0 to 1.38.

**Table 3**  
Socio-demographic characteristics.

	N	Min.	Max.	Mean	St. dev.
Age of customer (Age)	455	21	83	50.03	14.23
Length of relationship with bank in years	455	0	40	14.42	9.15
Customer's economic activity	Frequency		%		
Homemaker/pensioner	17	3.74			
Unemployed (Unemployed)	13	2.86			
Student (Student)	52	11.43			
Permanent salaried worker (Permanent)	303	66.59			
Temporarily employed (Temporarily)	36	7.91			
Permanent self-employed (Self-employed)	34	7.47			

In this case the model to be estimated is:

$$Ent_i = \alpha_1 + \beta_1 OCa + \beta_2 OSa + \beta_3 Ca + \beta_4 MI + \beta_5 Pf + \beta_6 Pl + \beta_7 Sp + \beta_8 Sa + \beta_9 S + \beta_{10} If + \beta_{11} Tb + \beta_{12} Dp + \beta_{13} Bc + \beta_{14} Ip + \beta_{15} Tr + \beta_{16} Bi + \beta_{17} Tax + \beta_{18} Ch + \beta_{19} Age + \beta_{20} Unemployed + \beta_{21} Student + \beta_{22} Permanent + \beta_{23} Temporal + \beta_{24} Self-employed$$

where: Ent<sub>i</sub>: entropy; α<sub>1</sub>: constant

Acquisition/non-acquisition of liability products designed to be managed online

OCa acquisition/non-acquisition of online current accounts  
OSa acquisition/non-acquisition of fixed-term online savings accounts

Acquisition/non-acquisition of other financial products

Ca holds/does not hold current accounts  
MI acquisition/non-acquisition of mortgage-guaranteed loans  
Pf acquisition/non-acquisition of pension funds  
Pl acquisition/non-acquisition of personal guaranteed loans  
Sp acquisition/non-acquisition of other savings plans  
Sa acquisition/non-acquisition of fixed-term savings accounts  
S acquisition/non-acquisition of stocks  
If acquisition/non-acquisition of investment funds  
Tb acquisition/non-acquisition of Treasury bonds  
Dp acquisition/non-acquisition of deferred payment products

Financial services:

Bc number of bank cards  
Ip number of insurance policies  
Tr number of bank transfers performed  
Bi number of bills paid  
Tax number of taxes paid by means other than standing order  
Ch number of cheques deposited

Socio-demographic characteristics:

Age customer's age  
Unemployed if customer is out of work

Student if customer is a student  
 Permanent if customer is a permanent salaried worker  
 Temporarily if customer is temporarily employed  
 Self-employed if customer is permanently self-employed  
 $\beta_n$  parameters to be estimated

Although this model could be estimated by means of a linear regression, estimation is based on the assumption of the lack of heterogeneity between the individuals that make up the sample. When estimating explanatory models in marketing research, however, the assumption of customer homogeneity is rather restrictive. This assumption may lead to biases in parameter estimates and thus give distortions in viewing reality, leading to erroneous conclusions (Jedidi et al., 1997; Kamakura and Russell, 1989; Wedel and Kamakura, 2000).

Latent class models have two advantages: they allow, first, for the control of heterogeneity, thus avoiding biased parameters and, second, for the detection of customer segments, thus providing greater interpretative richness. In these models, the parameters are assumed to follow a discrete distribution function, such that there exists an indeterminate number of customer segments that share these parameters. To describe this new distribution function, therefore, estimates are made of the probability of each customer belonging to each segment and the parameter means for each segment. In this case, the number of segments to be estimated must be defined, and this usually depends on model fit. This type of segmentation is being profusely analyzed and applied in recent marketing research (for example, Swait and Adamowicz, 2001; Varki and Chintagunta, 2004).

#### 4. Results: multi-channel behavior

As Table 4 shows, the AIC and BIC fit indices obtained by iteratively estimating the model controlling for sample heterogeneity point out that the best fit is obtained with the last model used for the grouped sample (lower BIC and AIC). In this case, the model fit improvement obtained by allowing inter-segment variations is not worth the increase in the number of model parameters.

Table 5 presents the results of the estimation of the model of multi-channel behavior for the full sample and, strictly for illustrative purposes, the parameter estimates for the two-segment model. Results show that the owners of liability products that can only be managed through the Internet (the owners of online current accounts and the owners of fixed-term online savings accounts) have a higher tendency to distribute transactions across the different available channels, thus confirming hypothesis 2. In terms of asset products, although customers with mortgage-guaranteed loans display a higher level of multi-channel behavior, we are not able to confirm hypothesis 3. In terms of contracted services, entropy also increases with the number of transfers made. To conclude with a word on the influence of socio-demographic variables, the age variable has no significant impact on multi-channel behavior, and only the permanently self-employed show high entropy values. This finding is an unexpected result that could be due to the fact that these people, despite being classed as private customers rather than businesses, also use their accounts for some of their business transactions. Thus, given their need to perform large numbers of transactions, multi-channelling helps them to save time.

**Table 4**  
 Goodness of fit of the segmentation results.

	BIC	AIC
General	11.287	11.179
2 classes	208.400	64.189
3 classes	241.151	63.978
4 classes	211.144	50.452

Nevertheless, these findings must be interpreted with caution because of a potential problem with the data. The bank collect the socio-demographic customer data at the beginning of the customer's relationship, and branch staff subsequently update the data as the customer's situation changes. The bank records customer's age as the date of birth and therefore this variable never requires updating, but employment details may change and employment data may therefore be less accurate. This might explain the lack of significance of the other variables.

These results show that multi-channel banking is more frequent in customers carrying out large numbers of routine banking transactions, such as transfers. Customers with the type of liability contracts that can be customer-managed on the Internet also show higher multi-channel banking. This confirms the predictions of hypotheses 1 and 2 that there is positive correlation between low-involvement/customer-manageable banking products and services and multi-channel behavior. Contrary to hypothesis 4, however, data show no evidence to confirm that age plays a role in multi-channel customer behavior, given that, of all the socio-demographic variables considered, only self-employment increases the tendency to use more than one channel.

#### 5. Conclusions and implications

One of the most dramatic market changes arising from the advent of the new technologies is the increase in the number of product information and distribution channels through which customers are able to interact with firms. In this context of multiple forms of interaction between firms and their customers, success depends closely on an understanding of how to handle customers who use or demand several different channels in their relationship with a given firm, that is, so-called multi-channel shoppers, whose behavior needs to be closely studied if the firm wants to achieve customer satisfaction and loyalty.

The main aim of this study is to analyze the role played by the number and range of products purchased and services used by consumers to explain multi-channel behavior.

The results show that practically all the bank's customers (97%) display some form of multi-channel behavior. 52% of the customers use physical banks and ATMs and approximately one third more use the online channel in addition to the two mentioned above. The entropy value is low, nevertheless. In other words, despite using different channels to do their banking, customers tend to use one channel, usually the ATM, more than any other. This is verified by the usage percentages of the various channels.

The customers of this bank make infrequent use of the online channel. Despite the fact that banks have been quick to adopt the new information technologies, apparently, certain sectors of the population have not become sufficiently familiar with them as to have overcome their reticence to use them for their banking transactions.

The estimation of the multi-channel behavior model fails to identify clearly differentiated customer segments. Customers who have products that can only be managed through the Internet, those with deferred payment products, and those needing to make transfers display highest level of multi-channel behavior. Furthermore, such customers are largely self-employed.

This leads to several implications both for marketing strategists in banking organizations and for researchers at the theoretical level. In light of its customers' multi-channel behavior, the bank might try to increase efficiency and thus encourage customers to continue banking through the various self-service channels through several ways. Given that customers purchasing customer-manageable or low-involvement products show a greater tendency towards multi-channel banking, banks should enhance functionality, to enable customers, as far as the inherent characteristics of the channel will allow, making 100% use of the operational possibilities provided through the different channels. This might include allowing customers access to instant credit or

**Table 5**  
Antecedents of multi-channel behavior.

	General model		1st segment		2nd segment	
	Coeff	t-ratio	Coeff	t-ratio	Coeff	t-ratio
Constant	0.27	1.02	-0.08	-0.63	<b>0.63</b>	<b>5.60</b>
<i>Online-managed financial products</i>						
Online current accounts (OCa)	<b>0.15</b>	<b>3.18</b>	<b>0.10</b>	<b>2.39</b>	<b>0.28</b>	<b>3.42</b>
Online fixed-term savings accounts (OSa)	<b>0.21</b>	<b>2.33</b>	0.17	1.84	<b>-0.36</b>	<b>-2.99</b>
<i>Acquisition of financial products</i>						
Current accounts (Ca)	0.09	0.34	<b>0.28</b>	<b>3.79</b>	-0.06	-1.26
Mortgage loans (Ml)	<b>0.28</b>	<b>2.22</b>	<b>0.25</b>	<b>4.14</b>	<b>0.25</b>	<b>4.14</b>
Pension funds (Pf)	0.01	0.42	0.04	1.04	0.04	1.04
Personal loans (Pl)	-0.02	-0.55	-0.02	-0.78	-0.02	-0.78
Other savings plans (Sp)	-0.02	-0.31	-0.04	-0.91	0.06	1.06
Fixed-term savings accounts (Sa)	-0.03	-0.62	-0.02	-0.50	-0.02	-0.50
Stocks (S)	0.08	1.25	0.10	1.23	0.10	1.23
Investment funds (If)	0.01	0.39	<b>0.12</b>	<b>2.39</b>	-0.02	-0.58
Treasury bonds (Tb)	0.03	0.69	0.03	0.93	0.03	0.93
Deferred payment loans (Dp)	0.02	0.79	0.00	0.03	0.00	0.03
<i>Financial services</i>						
Number of bank cards (Bc)	0.03	1.73	0.03	0.83	<b>0.05</b>	<b>2.86</b>
Number of insurance policies (Ip)	0.01	0.23	0.02	0.57	0.02	0.57
Number of transfers (Tr)	<b>0.03</b>	<b>6.72</b>	<b>0.03</b>	<b>3.28</b>	<b>0.03</b>	<b>3.28</b>
Number of bills (Bi)	-0.02	-1.05	-0.02	-0.93	-0.02	-0.93
Number of taxes (Tax)	0.02	0.67	<b>0.06</b>	<b>3.11</b>	<b>0.06</b>	<b>3.11</b>
Number of cheques (Ch)	0.00	1.06	0.00	1.32	0.00	1.32
<i>Socio-demographic characteristics</i>						
Age (Age)	0.00	-0.63	0.00	-1.42	0.00	-1.42
Homemaker/pensioner	-	-	-	-	-	-
Unemployed (Unemployed)	0.09	0.97	0.02	0.25	0.02	0.25
Student (Student)	0.07	0.93	0.03	0.53	0.03	0.53
Permanent salaried worker (Permanent)	0.10	1.57	<b>0.46</b>	<b>8.08</b>	<b>-0.29</b>	<b>-3.42</b>
Temporarily employed (Temporarily)	0.08	1.01	0.06	0.98	0.06	0.98
Permanent self-employed (Self-employed)	<b>0.19</b>	<b>2.51</b>	0.14	1.71	0.14	1.71
Number of observations	455		217		238	
Parameters	25		35			
R <sup>2</sup>	0.21		0.68		0.60	
AIC	11,179		64,189			
BIC	11,287		208,400			
Log (likelihood)	-5,563.955		-10.888			

Bold values indicate t-ratio value higher than 2.

mortgages, for example, or allowing them to manage their fixed-term accounts, pension plans or investment funds, or link debit and credit cards to any of them. Furthermore, banks could do this by incorporating more added-value services, such as the payment or return of bills, acceptance of cheques, the booking of courses or workshops organised by the bank or the sale of local transport cards through ATMs. In the case of the online channel, banks could create a more user-friendly web site and interface, providing customers with personalisation options and improving security. For full effectiveness, managers would need to design a communication strategy using different means to explain to customers the advantages, ease of use or level of security of the different channels. Such a strategy translates into marketing actions that managers should tailor to the needs of different segments. They should also use clear and accessible language throughout.

Secondly, despite the newly emerging channels, customers have not ceased to use physical branches. Over the next few years physical distribution networks will continue to be a key way of capturing customers and the main means of selling them high value-added products. Nevertheless, physical branches also need to begin a transformation process to convert them from customer advisory and transaction processing centres into service centres. This might even include turning them into venues for a wide variety of activities, to bring added value to the supplier–customer relationship.

Finally, with respect to multi-channel customer management, firms must make an effort to increase marketing intelligence from the individual client data collected through the various channels used.

Another essential requirement will be to avoid any inconsistency in the information offered to customers through these channels.

The dependent variable used to measure multi-channel behavior, labelled entropy, has greater capacity to capture different levels of multi-channel behavior than others used in previous research (the number of channels, for instance) which have led to less accurate estimations.

## 6. Limitations and future research

This research has some limitations mainly related with data availability. Firstly, the unavailability of longitudinal data precludes any illustration of the dynamics of the effects of strategic marketing actions. The use of cross-sectional data rules out the possibility of measuring customer behavior over a time period or estimating the complementarity or substitutability of the channels. Secondly, notwithstanding the advantages the researchers can gain from examining secondary data (customer data), primary data might have helped in assessing the consumers' view of the motivations for multi-channel behavior. Furthermore, the data used in this study covers only the financial transactions carried out by the customer and not the consultations made with the bank, which is another area in which multi-channel management presents multiple opportunities and challenges. Exploring the effect of perceptions, attitudes or motivations in multi-channel behavior is a fruitful area for future research and thus might complete the primary data analysis.

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