



## Analysing user trust in electronic banking using data mining methods



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### ABSTRACT

The potential fraud problems, international economic crisis and the crisis of trust in markets have affected financial institutions, which have tried to maintain customer trust in many different ways. To maintain these levels of trust they have been forced to make significant adjustments to economic structures, in efforts to recoup their investments and maintain the loyalty of their customers. To achieve these objectives, the implementation of electronic banking for customers has been considered a successful strategy. The use of electronic banking in Spain in the last decade has been fostered due to its many advantages, giving rise to real integration of channels in financial institutions. This paper reviews different methods and techniques to determine which variables could be the most important to financial institutions in order to predict the likely levels of trust among electronic banking users including socio-demographic, economic, financial and behavioural strategic variables that entities have in their databases. To do so, the most recent advances in machine learning and soft-computing have been used, including a new selection operator for multiobjective genetic algorithms. The results obtained by the algorithms were validated by an expert committee, ranking the quality of them. The new methodology proposed, obtained the best results in terms of optimisation as well as the highest punctuation given by the experts.

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### 1. Introduction: The economic crisis and trust in the financial sector

The behaviour of the financial system against the economic crisis has been different among the countries within the European Union. While many international institutions focused their interest on credit and risk transfer, neglecting customer service, the banking sector continued to have an extensive network of offices through which to distribute financial products and to foster close client relationships. This very competitive environment forced banks to strictly control costs, which has made the financial system one of the world's most efficient (spsacctoremoveAPAÁlvarez, 2008). Despite these advantages, the Spanish financial system was also in a precarious position particularly due to its exposure in real estate. In the latter part of the 90's and in the early part of the last decade there was an excess supply of real estate and therefore a large demand for financing. This situation forced financial institutions to go to wholesale markets since domestic markets did not have the resources to cover as much investment as was being generated. Due to this and the pressing international crisis, the government and the Central Bank had to intervene different economies, among them, the Spanish (Liébana-Cabanillas et al., 2011).

The Spanish financial sector has already started to change as a result of this situation thanks to the Bank Restructuring Fund (FROB<sup>1</sup>), and new regulations which will be introduced in 2013 with the advent of Basilea III<sup>2</sup> and more recently the Royal Decree for restructuring of the Spanish Savings Banks. According to the latest report on "Individual Financial Behaviour in Spain 2009" developed by Inmark (2009), 55.1% of the sample says their trust in the Spanish financial sector has worsened compared with 0.9% stating that it has improved and 40.1% who say there has been no change. In this complicated situation, the Spanish financial system has had to make technological improvements to reduce costs and optimize investments. Of all the available tools used to achieve these objectives, electronic banking has been the most widely implemented.

Traditionally, financial products and services have been distributed through bank branches due to their proximity to customers, the large number of services they perform, the added value that the client receives at the branch, and the important role bank branches play in decisions made by customers. In spite of this,

<sup>1</sup> The Bank Restructuring Fund was established by Royal Decree-Law 9/ 2009 of June 26, 2009, restructuring banks and strengthening the resources of credit institutions. The objective of this Fund is to manage bank restructuring processes and help strengthen their resources. The initial funding provided for this Fund is 9,000 million euros.

<sup>2</sup> Basilea III requires financial institutions to increase reserves to 7% of their of holding to be able to handle crisis situations.

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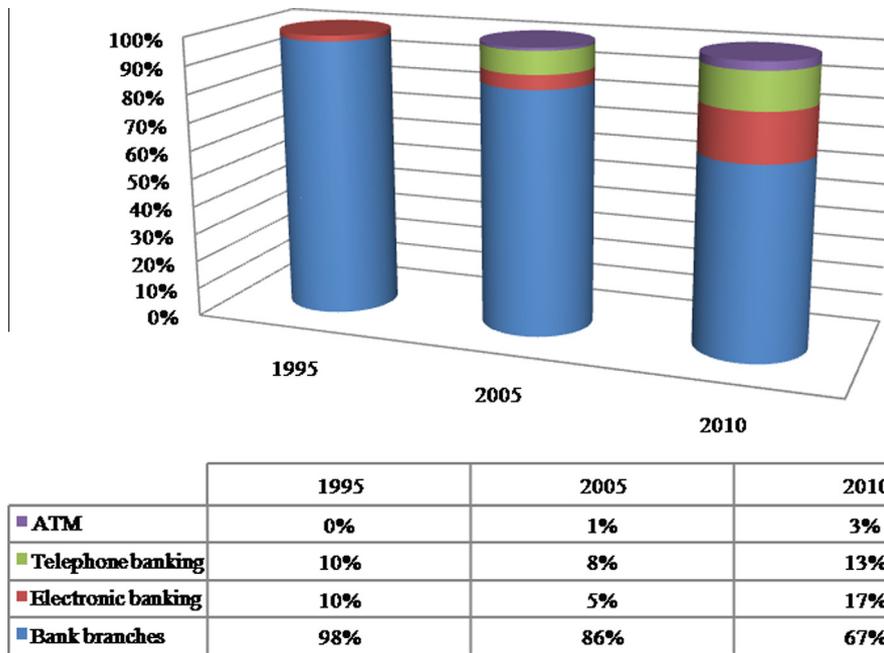


Fig. 1. Percentage of use of the main channels for banking operations. Source: World Retail Banking Report.

however, this conventional channel has begun to be replaced by a more agile and dynamic channel as reflected in the data of the World Retail Banking Report<sup>3</sup> (2010) on the percentage of use of the main channels (see Fig. 1).

From the 90s to the present, electronic banking has become the distribution channel with the greatest potential for financial institutions (Karjalainen et al., 2002). Currently, the majority of companies offer their customers access to most of their services through this channel. Therefore, electronic banking has become a crucial service by which to gain customer satisfaction and loyalty and establish closer customer relationships, thereby meeting user expectations (Azcorra et al., 2001; Berrocal, 2009; Climent and Mompalao, 2006; Hsu, 2008).

Thus, the primary alternative channel to the traditional bank branch is electronic banking as it has many advantages for customers including convenience, global access, availability, cost and time-savings, information transparency, choice and comparison, customization, and financial innovation (Delgado and Nieto, 2002; Muñoz-Leiva, 2008). However, this service also has some drawbacks, mainly related to trust and security. But trust, together with satisfaction, is considered one of the key elements in building long-term relationships, a fundamental business strategy in the current economic situation (García et al., 2008b; Lam et al., 2004).

In this context, this paper reviews different methods and techniques to determine which variables could be the most important to financial institutions in order to predict the likely levels of trust among electronic banking users including socio-demographic, economic, financial and behavioural strategic variables that entities have in their database.

This paper is organized as follows. Section 2 describes the Electronic Banking at the European Union as well as the concept of customer trust. Section 3 introduces the research methodology, the data description, and the models and algorithms used to analyse the data. Then, Section 4, presents the results of the analysis and its validation by a set of expert. Finally, Section 5, draws the conclusions from a business management perspective and further work.

## 2. Effect of the trust crisis in electronic banking and fraud problems

### 2.1. The electronic banking sector

A recent study by Orange Foundation (Fundación Orange, 2011) demonstrates the importance of the technological innovations taking place in the financial sector and how Internet banking continues to be one of the on-line tools most commonly used by the Spanish. According to the Orange Foundation the percentage of Spanish people using on-line banking compared to the percentage of people using Internet is growing is growing faster than the EU average as can be seen in the Fig. 2.

Despite this increase, Fig. 2 demonstrates that Internet penetration in general is still below the average for the European Union (EU), indicating there is still significant growth potential in the Spanish Internet banking sector for it to reach EU levels. An analysis of the evolution of e-banking compared to other uses of the Internet shows that it is used far less than other Internet services (Fundación Orange, 2011) (see Fig. 3) such as e-mail with an 85% rate of use in Spain and 89% on average in other EU countries in 2010; Internet searches (85% and 81% respectively in Spain and in the EU in 2009); and in downloading and reading newspapers (62% and 50% respectively). On the other hand, the percentage of users downloading software (33% and 31% respectively), doing job searches, making telephone calls and having video conferences (24.5% and 22% respectively) is higher in Spain than in the EU.

In addition to this data, the last study published in October 2010 by the company comScore<sup>4</sup>, revealed that Spain has become the eighth country in the world in terms of e-banking penetration after Canada, Holland, France, Sweden, the United Kingdom, New Zealand and Belgium, beating the United States and Australia (Fig. 3).

This report differs from prior data (Fundación Orange, 2011) which placed the penetration rate in Spain in 42% and the EU average at 52%.

<sup>4</sup> <http://www.comscore.com/2010/10/top-10-countries-by-online-bankingpenetration>.

<sup>3</sup> Available in <http://www.capgemini.com>.

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