**Abstract**

As Social Economy financial institutions, credit unions have traditionally been considered less efficient than traditional banking entities. However, like banks and savings banks, they have to be as efficient and competitive as possible to survive in today's business environment, especially at times of crisis. To date, there have been very few studies on their efficiency and practically none for the crisis period. Moreover, almost all the existing studies assess only financial efficiency, without considering their social function. This study examines the levels of both financial and social efficiency in Spanish credit unions as well as their main determinants during the recent crisis. We apply the two-stage double bootstrap Data Envelopment Analysis (DEA) methodology based on panel data corresponding to all the credit unions active in Spain between 2008 and 2013. The empirical results indicate that financial and social efficiency achieved an acceptable level, although on average the former was slightly greater than the latter. We also find that both age and merger and acquisition activity were positively influential on the financial efficiency of credit unions, but had a significant negative effect on their social efficiency. Moreover, the regional location of such entities and the financial crisis were also crucial determinants of both types of efficiency. Our findings are therefore useful for all the stakeholders of credit unions to know if these entities have been efficient according to a double bottom-line accounting in the crisis period and hence to maintain successful social management that is compatible with satisfactory financial efficiency.

**Key words:** Credit unions; Crisis period; Financial efficiency; Social Economy financial institutions; Social efficiency

**Abbreviations:** DEA, Data Envelopment Analysis; UNACC, Unión Nacional de Cooperativas de Crédito (National Union of Credit Unions); SMEs, Small and Medium-sized Enterprises; SFA, Stochastic Frontier Analysis; DMU, Decision Making Unit; CRS, Constant Returns to Scale; VRS, Variable Returns to Scale; GDP, Gross Domestic Product; EMPL, Employees; BRAN, Branches; EQUI, Equity; LOAN, Loans; DEPO, Deposits; SECU, Security Investments; CSOC, Customer Socialization; FINC: Financial Inclusion; SOCF: Social Fund Contribution; MEMB: Membership: AGE, Age; M&A, Merger and Acquisition Activity; GROUP, Corporate Group; REG, Regional Location; CRISIS, Crisis.

**Introduction**

Social Economy enterprises adopt a market-based organisation in order to create social value (Miles et al., 2014). They are therefore hybrid organisations whose main mission is their social purpose so the concern for financial results stems more from the need to generate resources to support their social mission than from a desire to maximise profits (Santos et al., 2015). Nowadays these enterprises are attracting growing interest (Pache and Santos, 2013; Battilana et al., 2015; Ramus and Vaccaro, 2015), especially in the financial sector where the abuses and limitations of traditional commercial banking are leading to the development of what are known as "*Social Economy financial institutions*" (Martínez-Campillo et al., 2013; Cornée and Szafarz, 2014; Gutiérrez-Nieto et al., 2015).

Among the different types of Social Economy financial institutions, credit unions are becoming increasingly popular in the most developed countries in the world, and serve as a beacon of hope to many developing countries. These entities are self-help, cooperative financial institutions geared to achieving the economic and social aims of their members and wider local communities (Wyman, 2014). Thus, they have a dual nature: on the one hand, they are banking institutions and, on the other, they are cooperatives established for a social purpose (Ory and Lemzeri, 2012). The importance of credit unions lies not in their weight in the financial system, but in the type of activity they perform, financing a large set of social enterprises and hence helping to support employment and growth (Glass et al., 2014). Moreover, they contribute to the development of the financial sector by increasing free competition within it and by serving the needs of disadvantaged communities and individuals that are not covered by other banking intermediaries (Kalmi, 2012). They are therefore crucial for economic and social development and for financial inclusion in the territories where they work.

In Spain, in application of Law 13/1989 of 26 May on Credit Unions, the National Union of Credit Unions (UNACC) defines these entities as "*cooperative societies with their own legal status, whose social purpose is to meet the financial needs of their members and of third parties by performing activities related to credit entities*". In the recent crisis scenario, unlike the traditional banking institutions, Spanish credit unions have met the capitalization and solvency requirements imposed by the European Union, and none of them have needed to be bailed out. However, since 2008 an intensive restructuring process has been done voluntarily in the sector with the idea of making these entities more efficient and competitive. But have Spanish credit unions been really more efficient during the crisis period? This is the query this paper aims to answer.

Certain recent phenomena in the financial sector, such as market deregulation, regulatory changes, increasing disintermediation, technological innovation and, especially, smaller margins, have intensified competition across national boundaries. In this scenario, much attention has naturally focused on the efficiency of banking institutions as a way of better understanding their ability to survive in increasingly competitive environments (Worthington, 2010; Wanke and Barros, 2014; Moradi-Motlagh et al., 2015).

Credit unions have generally been considered less efficient than traditional financial institutions because of their social purpose (Kalmi, 2012; Ory and Lemzeri, 2012; Othman et al., 2014). But if they want to survive and thrive in the new international context, they have to be efficient and competitive, especially in times of crisis (Gutiérrez and Palomo, 2012). To our knowledge, empirical evidence on whether these entities are efficient is very limited, and only one study by Barra et al. (2013) focuses on the crisis period. Moreover, almost all the existing studies assess only their financial efficiency, without taking their social efficiency into account. Unfortunately, there is also very little research on the explanatory factors of financial efficiency in this sector and none on social efficiency. For these reasons, this study uses the two-stage double bootstrap Data Envelopment Analysis (DEA) methodology (Simar and Wilson, 2007) in order to examine financial and social efficiency in Spanish credit unions during the recent financial crisis (2008-2013) and its main determinants.

At the theoretical level, this paper makes three main contributions to the literature. *First*, this paper is relevant for the study of moral and ethical aspects of business because it, for the first time, constructs an indicator for estimating whether credit unions are socially efficient and evaluates their financial and social efficiency separately according to a double bottom-line accounting. The fact that their social mission affects multiple stakeholders –public authorities, private investors, service users and credit unions themselves– makes understanding and measuring their social impact a priority for them. As a result, all their stakeholders are showing growing interest in evaluating the social performance of these singular financial institutions, because information on their financial results alone gives an incomplete view of their global performance (Ory and Lemzeri, 2012; Jackson, 2015). So, unlike traditional financial institutions which work only towards a financial bottom-line, credit unions are also to be assessed with regard to their social performance. As with financial goals, these entities are more likely to successfully achieve social goals if they know how they progress towards them. Consequently, credit unions' social efficiency needs to be measured to determine their performance relative to their social mission so that this information can be used to increase their competitiveness in the new international context. *Second*, our study analyses, for the first time, the determining factors of both financial and social efficiency in credit unions in order to improve their management and help them survive in today's competitive environment (Kalmi, 2012). *Finally,* it explores efficiency in these entities during the recent Spanish crisis, providing new evidence for two stages of marked economic and social instability – the First Recession (2008-2010) and the Second Recession (2011-2013). At the methodological level, this paper is the first to use a two-stage double bootstrap DEA approach in this research line, offering more robust and meaningful findings than those drawn from traditional methods (Wijesiri et al., 2015).

The rest of the paper is structured as follows. Section 1 describes the situation of Spanish credit unions during the crisis period. Section 2 provides the conceptual and empirical background of the study. Section 3 covers the methodology used, and section 4 describes the sample and variables. Section 5 presents our results, and finally, section 6 discusses the main conclusions and implications.

**Spanish credit unions during the crisis period (2008-2013): an overview**

The Great Spanish Recession began in 2008 during the world financial crisis. Between 2008 and 2013, Spain underwent an important transformation process in two phases that clearly affected the performance of the national financial system: the *First Recession* (2008-2010), characterized by a significant employment crisis originated in both the wake of the international financial meltdown and the collapse of an enormous housing bubble in the construction sector; and the *Second Recession* (2011-2013), characterized by labour reform, control of public expenditure with cuts in public services, and a contractionary fiscal policy.

Until 2008, nobody doubted the strength and solvency of the three types of entities in the Spanish financial system: banks, saving banks and credit unions. However, the financial crisis showed that, in contrast to credit unions, most saving banks and some banks had been poorly managed, leading to a dramatic process of restructuring and recapitalisation with public funds. Table 1 shows that the Interest Income of credit unions fell to a lesser extent than that of banks and savings banks between 2008 and 2013. Specifically, it dropped by 34% in these entities compared to 46.5% in banks and 59.3% in saving banks. In addition, as their Interest Expenses were around the average of the Spanish financial sector, their Net Interest Margin fell to a lesser extent than in traditional banking entities, by 10% in comparison with 10.4% and 40.9% in banks and saving banks, respectively. Moreover, the trend in both Interest Income and Net Interest Margin in Spanish credit unions decreased during the First Recession and increased in the Second Recession. In contrast, Interest Expenses declined in both sub-periods.

**Table 1: Growth trend of Interest Income and Expenses in Spanish financial entities (2008-2013)\***

|  | Interest Income (1) | | | Interest Expenses (2) | | | Net Interest Margin (3) | | |
|---|---|---|---|---|---|---|---|---|---|
|  | Banks | Saving Banks | Credit Unions | Banks | Saving Banks | Credit Unions | Banks | Saving Banks | Credit Unions |
| **2008** | 100 | 100 | **100** | 100 | 100 | **100** | 100 | 100 | **100** |
| **2009** | 72.42 | 76.17 | **82.21** | 52.89 | 62.09 | **71.32** | 137.18 | 110.93 | **97.82** |
| **2010** | 56.39 | 47.56 | **62.03** | 38.70 | 37.24 | **51.55** | 115.05 | 73.03 | **77.02** |
| **2011** | 62.96 | 53.04 | **63.11** | 50.64 | 50.05 | **59.14** | 103.82 | 60.43 | **68.99** |
| **2012** | 65.45 | 49.92 | **68.34** | 50.65 | 42.53 | **54.78** | 114.52 | 68.15 | **88.04** |
| **2013** | 53.51 | 40.70 | **65.89** | 42.54 | 33.27 | **49.29** | 89.88 | 59.05 | **89.93** |

*Source*: Drawn up by the authors with data from Asociación Española de Banca (2008-2013), Confederación Española de Cajas de Ahorros (2008-2013) and UNACC (2008-2013). All data come from individual Financial Statements.

*The year 2008 was considered as the base (100) to facilitate comparisons among the different financial entities.

(1) Interest Income: The interest earned on cash temporarily held in savings accounts, deposit certificates, or other investments.
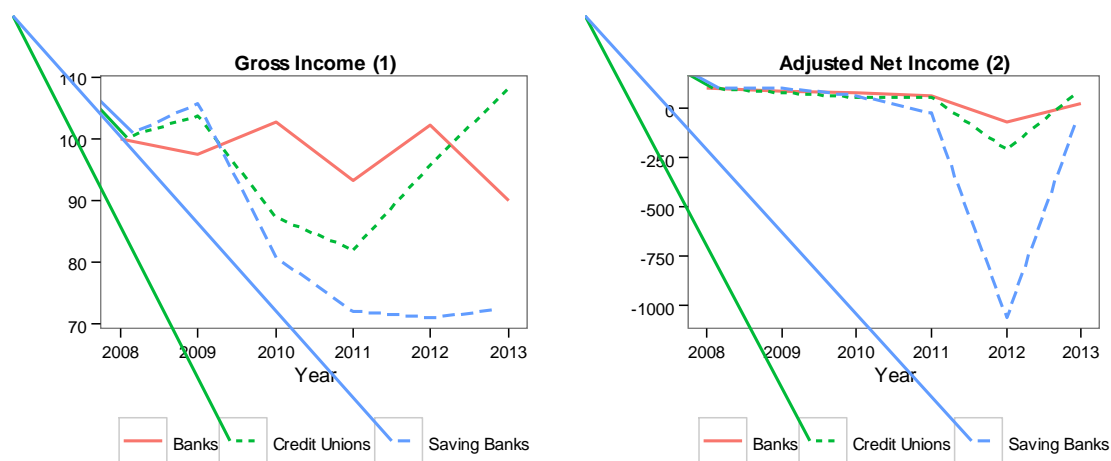(2) Interest Expenses:  The cost incurred by an entity for borrowed funds.
(3) Net Interest Margin: Interest Income - Interest Expenses.

Figure 1 points to a slight growth of 8.3% in the Gross Income of Spanish credit unions between 2008 and 2013 compared to reductions of 10% in banks and 27.6% in savings banks. For Adjusted Net Income, as they had smaller impairment losses of financial assets, a contraction of only 3.1% is shown in comparison with decreases of 72.3% and 101.3% for banks and savings banks, respectively. This explains

their greater capacity for recovery from the end of 2012. Again, the trend for both Gross Income and Adjusted Net Income in credit unions decreased during the First Recession and increased in the Second Recession.

**Figure 1: Growth trend of banking margins in Spanish financial entities (2008-2013)\***

Given their small size and new legal requirements to strengthen solvency and decrease risk exposure, Spanish credit unions carried out a voluntary concentration process (Figure 2), without losing their identity, to improve their efficiency and competitiveness in times of crisis. Consequently, the number of cooperatives dropped by almost 20% –from 81 to 65– between 2008 and 2013, with the resulting decrease in both employees (-9.69%) and branches (-9.53%), although the number of members increased by 32.48% (UNACC, 2008, 2013).

Spanish credit unions have some features that set them apart from other financial institutions (Zvolská and Olsson, 2012; Wyman, 2014). *First*, they have a strong commitment to the Social Economy and local development, so the very nature of credit unions implies socially responsible behaviour (Kalmi, 2012). In addition, at least 10% of their profits must be assigned every year to the Education and Promotion Fund, which is a special type of fund for the promotion of cooperative values and Corporate Social Responsibility. According to the UNACC, the percentage of net profits dedicated to this fund was 18.81% in 2013. *Second*, credit unions are specialised in their home territory, establishing branches close to their customers and thus helping to support employment and growth in that location. Furthermore, they work in geographical areas in which other credit entities do not offer services because of their sparse population, which helps to achieve financial inclusion for the whole population (Gutiérrez and Palomo, 2012). According to the UNACC, the percentage of branches in municipalities with less than 25,000 inhabitants to total branches was 59.4% in 2013. *Third*, credit unions develop traditional retail banking

especially for SMEs, self-employed workers and families (De Castro and Motellón, 2011), their main purpose being to meet the financial needs of their members. In 2013, loans to customers amounted to 65% of total assets negotiated as opposed to 52.2% in banks and 56.3% in savings banks, and on the liabilities side, deposits from customers reached 69.4% compared to 49.6% and 58.2% in banks and savings banks, respectively (Sierra and Sánchez, 2013). *Fourth*, credit unions are obliged to maximise value not for shareholders, but for the cooperative members and for the community in which they provide their services. More specifically, their governance model focuses on organization and management by their members and democratic participation and control at all levels (Zvolská and Olsson, 2012). According to the UNACC, more than 92% of their members are individuals, specifically 2,560,698 out of a total membership of 2,764,746 in 2013.

Although these features should have made Spanish credit unions more sensitive to the crisis than banks and savings banks, they showed greater resilience than traditional banking entities largely because of their governance model, which is based on both joint ownership and a commitment towards their members and society in general. Other factors that may explain their greater resistance to the crisis are their smaller size, less use of complex financial engineering instruments and a method of capital accumulation, which is less dependent on financial markets and is associated with both allocating surpluses to reserves and achieving balanced social and economic goals (Wyman, 2014).

**Figure 2: Diagram of the concentration process in Spanish credit unions (2008-2013)**

| 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|------|------|------|------|------|------|
| Caja Rural de Fuentepelayo<br>Caja Rural de Burgos<br>Caja Rural de Segovia<br>Caja Rural de San Fortunato, Castelldans | | | | | **Caja Rural de Burgos, Fuentepelayo, Segovia y Castelldans** |
| Caja Laboral Popular<br>Ipar Kutxa Rural | | | | | **Caja Laboral Popular** |
| Caja Rural de Ciudad Real<br>Caja Rural de Cuenca | | | **Caja Rural de Albacete, Ciudad Real y Cuenca, GLOBALCAJA** | | |
| Caja Rural de la Roda<br>Caja Rural de Albacete | | **Caja Rural de Albacete** | | | |
| Caja Rural Aragonesa y de Pirineos<br>Caixa dels Advocats | **Caja Rural Aragonesa y de los Pirineos** | | | | **Caja Rural de Aragón** |
| Caja Rural de Aragón | | | | | |
| Caixa Rural de Balears<br>Cajamar Caja Rural | | | **Cajamar Caja Rural** | **Caja Rurales Unidas** | **Cajas Rurales Unidas** |
| Caja Campo | | | | | |
| Caja Rural del Mediterráneo, Ruralcaja<br>Caja Rural Castellón San Isidro | | | | | |
| Caja Rural de Casinos<br>Caja Rural de Canarias<br>Crédit Valencia, Caja Rural | | | | | |
| 60 Spanish credit unions did not participate in any process of mergers and acquisitions between 2008 and 2013. | | | | | |

*Source*: Drawn up by the authors with data from UNACC (2008-2013).

**Conceptual background**

Three different definitions of efficiency can be used as a basis for study and practice (Farrell, 1957). Firstly, *technical efficiency* is the ability of a firm to use minimum inputs to produce a given quantity of outputs (input orientation) or to maximize outputs from a given set of inputs (output orientation). Secondly, *allocative efficiency* is the ability of a firm to use this set of inputs optimally given their prices. Finally, *cost efficiency* is the combination of both technical and allocative efficiencies. In particular, this study focuses on technical efficiency.

Within the financial sector, credit unions work towards a double financial and social bottom-line. Their technical efficiency is therefore associated with the physical relation between their financial and social outputs and the resources they use to provide such outputs (Worthington, 2010). Specifically, technical efficiency in their financial activity (hereinafter referred to as "*Financial Efficiency*") can be defined as the degree of optimisation achieved in the use of physical, human and monetary resources for providing different financial services (Piot-Lepetit and Nzongang, 2014). But credit unions are not only financial institutions. They also have an important social function, and technical efficiency in their social activity (hereinafter referred to as "*Social Efficiency*") has to do with how effectively these entities meet the social objectives of their members and local community from their inputs (Ory and Lemzeri, 2012). In particular, the social efficiency concept proposed by Gutiérrez-Nieto et al. (2009) is adopted in this study, which is based on the definition of technical efficiency of Farrell (1957) with the particularity that the former only considers a set of social outputs with an output orientation. So, as the objective is to evaluate the ability of credit unions to provide maximum financial and social outputs given the resources at their disposal, these Social Economy financial institutions are considered globally efficient when they generate more financial and social outputs without consuming more inputs (Ory and Lemzeri, 2012).

## Empirical background

Despite the growing popularity of credit unions, there have been few empirical studies measuring their efficiency. This gap in the literature stems from their small weight in financial systems, their small size and marked territorial dispersion, and the scarce information on them (Server and Capó-Vicedo, 2011). Moreover, assessing efficiency in these banking institutions is complex because, in addition to their financial activity, they also play an important social role (Ory and Lemzeri, 2012).

### *Measurement of financial efficiency in credit unions*

Little evidence has been found on the financial efficiency of credit unions. On an international level, most of the prior studies have been carried out in Australia. Firstly, Worthington (1998a, 1999) measured the efficiency of these entities in 1995. The first of these two studies applied the parametric methodology of Stochastic Frontier Analysis (SFA) to a sample of 150 credit unions, finding an average financial efficiency of 72%[1], while the second used the non-parametric DEA methodology to conclude that, on average, this indicator dropped to 54% when data from 233 entities were considered. Secondly, Brown et al. (1999) and Brown (2006) also applied DEA methodology to assess efficiency during the period 1993-

1995. Taking a sample of 94 entities in the State of Victoria, the former found that, on average, efficiency rose from 77% to 79% between 1993 and 1995, while the latter, considering a larger sample made up of 254 Australian credit unions, found average levels of 85% and 89%, respectively.

There are also interesting studies on the United States and Canada. In the former, applying a modification of the standard DEA model to a sample of 8,947 credit unions in 1990, Fried et al. (1993) obtained an average level of financial efficiency of 91%. In Canada, Fortin and Leclerc (2011) used the DEA methodology to assess the efficiency of 494 credit unions in 2007 and showed that, on average, these entities had an efficiency of 94.5%, that is, a relatively high rate for this type of entity.

In Asia, most studies have focused on credit unions in Japan, using DEA methodology to estimate financial efficiency. Taking a sample of 453 credit unions in 1992, Fukuyama (1996) found an average level of 83%, and Fukuyama et al. (1999), who analysed a larger sample during the period 1992-1996, concluded that efficiency had dropped during the study period from an average of 68% in 1992 to 56% in 1996. Finally, Glass et al. (2014), for a sample of Japanese credit unions during the period 1998-2009, showed that, on average, efficiency increased throughout the period, reaching an average value of 95%.

As far as we know, there has been very little research measuring the financial efficiency of credit unions in Europe. On the one hand, Barra et al. (2013), taking data on credit unions in Italy from 2006 to 2010, showed that their average efficiency dropped year by year, from 66.4% in 2006 to 60.7% in 2010, with an average value of 63%. On the other, there are two studies in Spain. The first, by Belmonte and Plaza (2008), showed that the average financial efficiency of a sample of 82 entities between 1995 and 2007 was almost 85%, rising from 79.8% in 1995 to 89.7% in 2007. A more recent study by Belmonte (2012) found an average efficiency of 91.5% in 2010 from a sample of 78 Spanish credit unions.

### Measurement of social efficiency in credit unions

To date, there have been no academic contributions, either international or national, assessing the efficiency of credit unions exclusively from the social point of view[2]. Social efficiency in these banking institutions, therefore, to the best of our knowledge, has not yet been measured. Only Belmonte and Plaza (2008) and Belmonte (2012) have considered their global efficiency, including both the financial and the social dimensions of their activity. Taking the same financial inputs and outputs, but with different specifications for social outputs, the former obtained an average global efficiency in Spanish credit unions of 88.1%, increasing from 86.4% in 1995 to 90.7% in 2007, while the latter, on average, obtained a global efficiency of 96.2% in 2010.

### Determinants of efficiency in credit unions

Empirical research on efficiency determinants in credit unions is limited. Moreover, the studies published to date only try to identify the factors that explain their financial efficiency (i.e. Worthington, 1998a,

1998b, 1999, 2001; Fried et al., 1993, 1999; Garden and Ralston, 1999; Ralston et al., 2001; Paxton, 2007; Glass et al., 2014; Othman et al., 2014), without providing any evidence on the determinants of their social efficiency. According to the review by Worthington (2010), five of the main environmental factors used to explain differences in credit union efficiency are the following:

- *Membership:* In theory, a larger number of members in credit unions implies more diversified membership and a greater contribution in terms of manpower, support and collective financial contributions towards their activities, resulting in a positive effect for efficiency. In contrast, a large number of members can be also considered to have a negative effect on the skill of the head office in promoting efficiency due to greater complexity in the organization (Mester, 1996). Empirically, some studies show that the number of members of credit unions affects their efficiency positively and significantly (Fried et al., 1993), while others find a negative relationship (Othman et al., 2014).

- *Age:* From a theoretical point of view, firm age can be taken as an indicator of the experience and the maturity of a credit union so its effect on its efficiency can be twofold (Wijesiri et al., 2015). On the one hand, efficiency can improve as credit unions become more mature due to higher operating costs during the early stage of their growth. Evidence for this has been found in some studies (Paxton, 2007). On the other hand, recently established credit unions may leapfrog the older institutions by acquiring the proven successful business model from their more mature counterparts. Some empirical studies confirm the existence of a negative, statistically significant relation (Hermes et al., 2011).

- *Merger and acquisition activity:* It can be assumed that efficiency is what motivates policy-makers and other parties concerned in merger and acquisition activities to undergo these processes in the first instance, and then the capture of the prospective efficiency benefits is used as a justification for them (Worthington, 2010). At an empirical level, the results have been mixed. While Garden and Ralston (1999), Brown et al. (1999) and Ralston et al. (2001) conclude that these processes do not increase the efficiency of credit unions relative to their unmerged counterparts, Worthington (2001) and Mcalevey et al. (2010) find that mergers raise the level of efficiency of credit unions.

- *Corporate Group:* Belonging to a corporate group can increase the potential of partner credit unions to improve their efficiency because such groups have a collaborative purpose and provide technical and financial support to member companies. In contrast, it has also been argued that groups of companies may reduce the efficiency of their partners as complex organizational forms or management structures may restrict their behaviour to varying degrees (Ory and Lemzeri, 2012). Empirical evidence shows that being member of a corporate group has a positive and significant effect on credit union efficiency (Worthington, 1999; Glass et al. 2014).

- *Regional location:* The heterogeneity existing among the different regions of a country, especially in terms of regulation and macroeconomic conditions, might also help explain the differences in efficiency of their credit unions. Several empirical studies have shown that there is a regional effect,

which suggests that the efficiency of these entities varies depending on their geographical location within a specific country (Worthington 1998b, 1999; Fried et al. 1993; Glass et al. 2014).

## Methodology

We apply a two-stage double bootstrap DEA approach, specifically, the Algorithm 2 developed by Simar and Wilson (2007)[3]. In the first stage, both efficiency scores and confidence intervals are calculated combining the DEA model with the homogeneous bootstrap procedure. In the second stage, efficiency estimates are regressed on a set of environmental variables using the truncated regression with bootstrap. A two-stage approach makes econometric sense only if the variables included in the second stage are exogenous, that is, they do not participate in the production function, but do affect efficiency.

### *First-stage: DEA efficiency estimates*

DEA is a non-parametric method based on linear programming that calculates the conventional efficiency score of a given organization (Decision Making Unit – DMU) relative to other homogeneous entities by constructing an efficient frontier. Therefore, inefficiency is measured by the distance between the DMU and the efficient frontier, so each DMU is assigned an efficiency score between 0 and 1, with higher scores indicating more efficient organization relative to other entities in the sample.

Efficiency can be estimated with either input or output orientation. Specifically, as in most empirical studies that apply DEA models to credit unions (for example, Fukuyama et al., 1999; Barra et al., 2013; Piot-Lepetit and Nzongang, 2014), we implement the output-oriented DEA model, since the objective is to evaluate the ability of credit unions to provide maximum output for their members and the society as a whole, given the resources at their disposal. Moreover, DEA can be implemented by assuming either constant returns to scale (CRS) or variable returns to scale (VRS)[4]. Following numerous studies on efficiency in credit unions (Fried et al., 1993, 1999; Worthington, 2001; Brown, 2006; Barra et al., 2013; Othman et al., 2014), we employ the VRS DEA model because it is more consistent with the environment of imperfect competition in which credit institutions operate.

The VRS output-oriented DEA efficiency estimator $\hat{\delta}_i$ can be obtained by solving the following programming problem:

$$\hat{\delta}_i = max_{\hat{\delta}_i,\lambda}\{\delta > 0 | \delta_i y_i \leq \sum_{i=1}^n y_i \lambda; x_i \geq \sum_{i=1}^n x_i \lambda; \sum_{i=1}^n \lambda_i = 1; \lambda \geq 0\}; \text{i=1, .., n DMUs} \quad \textbf{[1]}$$

where $y_i$ is a vector of outputs; $x_i$ is a vector of inputs; $\lambda$ is an $n$ x 1 vector of constants which measures the weights used to compute the location of an inefficient DMU with the objective of becoming efficient; and $\hat{\delta}_i$ is the efficiency or inefficiency score for the $i$th DMU under the VRS assumption. So, if $\hat{\delta}_i = 1$ indicates that the $i$th DMU is fully efficient and if $\hat{\delta}_i < 1$, the $i$th DMU is relatively inefficient. This linear programming problem must be solved $n$ times, one for each DMU in the sample.

The conventional DEA model presents the following advantages: a) it does not require the specification of a particular functional form; b) it can use multiple inputs and outputs at the same time; c) it does not need information about input or output prices; d) it provides information to improve the management of inefficient DMUs. However, it still suffers from several inherent constraints. One of the main limitations is that it has no statistical properties and consequently tends to generate biased DEA estimates. To mitigate this drawback, we take the route initiated by Simar and Wilson (2000) to adopt the homogeneous bootstrap algorithm in the first stage of the analysis, which combines the conventional DEA model with the bootstrap technique to infer statistical properties of efficiency scores. As a result, a set of bias-corrected efficiency scores is generated (denoted by $\hat{\hat{\delta}}_i$) together with confidence intervals and standard errors for the estimates. In this regard, Efron and Tibshirani (1993) indicate that bias correction may introduce additional noise. For this reason, Simar and Wilson (2000) advise that bias-corrected efficiency scores should only be used when the following ratio $r_i$ is well above unity,

$$r_i = \frac{1}{3}\left(\widehat{bias}_B^2[\hat{\delta}(x,y)]/\hat{\sigma}^2\right) \tag{2}$$

where $r_i$ is a statistical test value, which allows us to assess whether the bias correction might increase mean square error; $\hat{\sigma}^2$ is the variance of the bootstrap values; $B$ is the number of replications and $\hat{\delta}$ is the original efficiency estimate. This issue is also considered in our empirical study, so the resulting useful efficiency scores are denoted by $\tilde{\delta}$.

### Second-stage: Truncated regression

Though widely applied, the use of censored (Tobit) regression in the second stage of analysis has been criticized by Simar and Wilson (2007) because explanatory variables are correlated with the error term and input and output variables are correlated with explanatory variables. They address this issue following the bootstrap truncated regression procedure as DEA indices are bounded by 0 and 1, where the useful efficiency scores $\tilde{\delta}_i$ yielded in the first-stage of the analysis are regressed on a set of explanatory variables using the following regression model:

$$\tilde{\delta}_i = \alpha + \beta z_i + \varepsilon_i, \quad i = 1, \dots, n \tag{3}$$

where $\alpha$ is a constant term; $\beta$ is a vector of parameters to be estimated; $z_i$ is a vector of exogenous factors that are expected to affect the efficiency/inefficiency of the $i$th DMU; and $\varepsilon_i$ is an error term assumed to be $N(0, \sigma_\varepsilon^2)$ distributed with right truncation at $(1 - \alpha - \beta z_i)$.

## Data and variables

### Population and samples

This study takes all the Spanish credit unions registered in the UNACC between 2008, when the crisis began, and 2013, the last year with available data. As a result of the financial system restructuring process that took place in Spain during this period, the number of credit unions varies in each of the six years considered. So, after including new entities created and filtering out those that disappeared in each year, the sum of all active entities is 81 entities in 2008, 80 in 2009, 78 in 2010, 74 in 2011, 68 in 2012 and 65 in 2013, giving an unbalanced data panel with a total of 446 DMUs or observations.

The presence of atypical observations is considered particularly troublesome for DEA. Therefore, before evaluating efficiency, it is important to detect outliers and to treat them appropriately, since they can increase noise and distort the results (Brown, 2006). In our study, the method developed by Wilson (1993, 2010) is adopted to deal with outliers[5]. In particular, a total of 18 and 14 outliers are identified before estimating financial and social efficiency scores, respectively. Consequently, after eliminating atypical observations, the final sample for assessing financial efficiency in Spanish credit unions includes 428 DMUs, while the sample for studying their social efficiency includes 432 DMUs.

### Selection and measurement of input and output variables

One of the main challenges for any study on efficiency in the financial sector is to define the production function, which determines the selection of input and output variables. Berger and Humphrey (1997) distinguished between the "*intermediation approach*", in which financial entities are intermediaries between savers and investors, and the "*production approach*", in which they use a set of production factors (inputs) to offer services to their customers (outputs). The approach chosen depends on the context in which the study is performed. In this study, we choose the production approach for defining the production function of credit unions because, in addition to being financial institutions, such entities also have an important social function and only this approach allows the social outputs to be considered when estimating their efficiency (Fried et al., 1993, 1999; Ralston et al., 2001; Gutiérrez-Nieto et al. 2009).

Under the production approach, we use three *inputs* –employees, branches, and equity– which reflect the main human, physical and monetary resources used by credit unions for maintaining their daily financial and social activity. The input variables therefore are the same for both the financial and social efficiency models because they refer to resources that are shared by both activities. In contrast, the output variables vary. Specifically, *financial outputs* are loans, deposits, and security investments; and *social outputs* are customer socialisation, financial inclusion, and Social Fund contribution. The Statistical Yearbooks of Credit Unions published by UNACC (www.unacc.com) provide the annual information required to measure these variables as we explain below. Data in monetary units are deflated –at constant prices for 2008– using the GDP deflator, in order to avoid inflation-related distortion of the results.

*Input variables:*

- *Employees* (EMPL)*:* This variable refers to the total number of workers employed by credit unions for performing their activity (in units). Human resources are the main input in any banking activity and play a key role in customers' final decisions, especially in these entities, which mostly use a traditional distribution channel that is labour-intensive and involves direct relations between employees and customers, as opposed to new channels such as electronic and telephone banking.

- *Branches* (BRAN): This reflects the total number of service points that credit unions have for carrying out their activity (in units). Physical resources are another relevant input for the credit union business, which is based on a direct distribution model through a large number of branches.

- *Equity* (EQUI): This represents the capital funds accumulated by credit unions from members' shares and reserves (in thousands of euros). These monetary resources are eventually returned to customers through cheaper financial products.

*Financial output variables:*

- *Loans* (LOAN): This variable describes these institutions´ main banking activity as the provision of services to borrowers, and is measured by total loan values (in thousands of euros).

- *Deposits* (DEPO): This defines credit unions´ financial function as the provision of services to depositors, and is quantified by total deposit values (in thousands of euros).

- *Security Investments* (SECU): This represents permanent investments in securities as another output from the financial activity of credit unions (in thousands of euros).

*Social output variables:*

- *Customer Socialization* (CSOC): This variable reflects the orientation of credit unions´ asset operations towards their social mass, since these entities are distinguished from other financial institutions by the weight of member customers over total customers. It is defined as the ratio between loans to customers and the total number of members (in thousands of euros per member).

- *Financial Inclusion* (FINC): This variable makes it possible to assess the commitment of credit unions to fight against financial exclusion for customers in low-population districts in which other financial institutions do not operate. It is measured by the ratio between the number of branches in municipalities having less than 25,000 inhabitants and total branches (in %).

- *Social Fund Contribution* (SOCF): This is an indicator of the social contribution of credit unions based on their annual assignation to the Education and Promotion Fund, as measured by the proportion of net profits allocated to this fund (in %).

After specifying the input and output variables, two different models are drawn up to assess the efficiency of credit unions in each type of activity separately: a) the *Financial Efficiency* model; and b) the *Social Efficiency* model. According to Cooper et al. (2007), in order for the efficiency estimates to be robust and reliable, the number of DMUs must be at least the maximum between $m*s$ or $3*(m+s)$, with $m$ and $s$ being the number of input and output variables, respectively. In this study, both efficiency models to be estimated meet this requirement.

***Measurement of the efficiency determinants***

Following Worthington (2010), five explanatory variables are used for examining the determinants of efficiency/inefficiency in Spanish credit unions. They are also built from the Statistical Yearbooks of Credit Unions available on the website of UNACC (www.unacc.com):

- *Membership* (MEMB): This variable is measured by the total number of members in credit unions, applying logarithmic transformation for analysis (Fried et al., 1993; Othman et al., 2014).

- *Age* (AGE): This is quantified as the logarithm of the number of years since founding (Paxton, 2007; Hermes et al., 2011).

- *Merger and Acquisition Activity* (M&A): This is a dummy variable that captures the possible effect of concentration processes on efficiency of credit unions resulting from merger and acquisition activities. It takes a value of 1 in the year when the merger/acquisition was agreed and in the following years, and 0 otherwise (Ralston et al., 2001; Mcalevey et al., 2010).

- *Corporate Group* (GROUP): This is made operational by a dummy that takes the value of 1 when credit unions belong to a corporate group, and 0 otherwise (Worthington, 1999; Glass et al. 2014).

- *Regional Location* (REG): This study takes into account the credit unions´ location within Spain by including 14 regional dummy variables, since they are situated in 15 different Spanish regions.

Finally, one additional environmental variable is included in analyses. During the period of study (2008-2013), the crisis situation significantly affected the activity of Spanish banking institutions. In this context of intense competition and significant structural changes in operating methods, the improvement of credit union efficiency became essential. For this reason, this study also includes a variable for the evolution of the Spanish crisis as a possible factor determining credit union efficiency:

- *Crisis* (CRISIS): This is a dummy variable that takes a value of 1 in the years corresponding to the Second Spanish Recession (2011-2013), and 0 otherwise. The omitted First Spanish Recession (2008-2010) dummy becomes the reference category as it is possible to assume increasing pressure to improve efficiency as the crisis period progresses.

Two different truncated regression models – the *Financial Efficiency* model and the *Social Efficiency* model – are built from these variables in order to study the determinants of efficiency in each activity of credit unions separately. In both cases, the following specification is estimated:

$$\tilde{\delta}_i = \alpha + \beta_1 MEMB_{i,t} + \beta_2 \text{AGE}_{i,t} + \beta_3 \text{M\&A}_{i,t} + \beta_4 GROUP_{i,t} + \beta_5 REG_{i,t} + \beta_6 CRISIS_{i,n} + \varepsilon_i \quad \textbf{[4]}$$

where the dependent variable $\tilde{\delta}_i$ refers to the useful efficiency score from the first stage of the *i*th DMU; $\alpha$ is a constant term; $\beta_1, \beta_2, ... \beta_6$ are the parameters to be estimated; $MEMB_{i,t}$ is the number of members of the *i*th DMU in period *t*; $\text{AGE}_{i,t}$ is the firm age of the *i*th DMU in period *t*; $\text{M\&A}_{i,t}$ is the merger and acquisition activity of the *i*th DMU in period *t*; $GROUP_{i,t}$ is the membership to a corporate group of the *i*th DMU in period *t*; $REG_{i,t}$ is the regional location of the *i*th DMU in period *t*; $CRISIS_{i,t}$ indicates if period *t* is included in the Second Spanish Recession (2011-2013); and $\varepsilon_i$ is an error term.

**Empirical results**

Table 2 summarises the main descriptive statistics for both the input and output variables and the determinant variables considered in the study. Analysis of the variance inflation factors (available upon request) confirms that multicollinearity is not a problem.

**Table 2: Descriptive statistics**

| n = 446 observations | Mean | Std. Dev. | Minimum | Maximum |
|---|---|---|---|---|
| **Input variables** | | | | |
| EMPL | 270.48 | 678.56 | 4 | 6508 |
| BRAN | 66.55 | 147.43 | 1 | 1317 |
| EQUI | 125,694.85 | 342,121.50 | -985.10 | 3,139,476.89 |
| **Output variables** | | | | |
| *Financial Model* | | | | |
| LOAN | 1,371,341.08 | 3,813,910.87 | 6,230 | 33,325,504.41 |
| DEPO | 1,466,197.64 | 3,956,748.90 | 5,889 | 33,959,237.24 |
| SECU | 36,108.23 | 177603.93 | 0 | 2,508,410.21 |
| *Social Model* | | | | |
| CSOC | 338.75 | 1,831.53 | 6.85 | 19,146.03 |
| FINC | 64.65 | 37.28 | 0 | 100 |
| SOCF | 12.64 | 7.95 | -0.36 | 66.67 |
| **Efficiency determinants** | | | | |
| MEMB | 32,282.94 | 102,178.01 | 17 | 1,222,972 |
| AGE | 53.40 | 24.49 | 0 | 111 |
| M&A | 0.04 | 0.20 | 0 | 1 |
| GROUP | 0.25 | 0.43 | 0 | 1 |
| CRISIS | 0.46 | 0.50 | 0 | 1 |

EMPL: Employees (in units); BRAN: Branches (in units); EQUI: Equity (in thousands of euros); LOAN: Loans (in thousands of euros); DEPO: Deposits (in thousands of euros); SECU: Security Investments (in thousands of euros); CSOC: Customer Socialization (in thousands of euros/member); FINC: Financial Inclusion (in %); SOCF: Social Fund Contribution (in %); MEMB: Membership (in units): AGE: Age (in years); M&A: Merger and Acquisition Activity (dummy: 1=yes/0=no); GROUP: Corporate Group (dummy: 1=yes/0=no); CRISIS: Crisis (dummy: 1=2011-2013/0=2008-2010).

*First stage results: financial and social efficiency measures*

The bootstrap DEA methodology is applied by using 2,000 repetitions with a confidence level of 95%, so that in order to build a single efficient frontier, each credit union is treated as a separate, different observation in each year of the study period (Curi et al., 2012; Moradi-Motlagh et al., 2015). Table 3 shows mean and standard deviation of the original $(\hat{\delta})$, corrected $(\hat{\hat{\delta}})$, and useful $(\tilde{\delta})$ efficiency scores in the total period 2008-2013, in the two sub-periods 2008-2010 and 2011-2013, and in each of the years considered, for both the financial and social models (the last scores, being the closest to real efficiency, are the ones considered for interpreting the results)[6]. It also indicates the percentage of fully efficient DMUs in each case.

Regarding the total period, both financial and social efficiency of Spanish credit unions achieve an acceptable level although the mean score for the latter is slightly higher than that for the former. While social efficiency, on average, reaches a value of 72.02%, financial efficiency is 67.26%, both values being greater than 50%, the minimum tolerable value for estimates of technical efficiency (Cooper et al., 2007). To our knowledge, there has been no empirical research on the social efficiency of credit unions to compare results, but the study by Barra et al. (2013), also using a single efficient frontier during the period 2006-2010 and an output orientation, obtains a mean score for financial efficiency in Italian credit unions during the crisis situation of 63%, which is very similar to the 65.8% reached by Spanish entities.

Moreover, although 36.34% of the DMUs analysed (157 observations) are fully efficient from the social point of view $(\tilde{\delta} = 1)$, only 5.84% (25 observations) are totally efficient in their financial activity. Figure 3 represents the position taken by the total DMUs in the samples regarding the estimates for financial and social efficiency during the period 2008-2013. Specifically, it depicts the number of DMUs sorted from lowest to highest useful efficiency score. As the graph shows, financial and social efficiency are below 50% $(\tilde{\delta} < 0.5)$ in about 13.32% and 24.54% of the observations respectively, so they can be considered technically inefficient.

If the study focuses on the two sub-periods of the Spanish crisis, even though credit unions present greater mean values for their social efficiency, this decreases by 2.4% between the First Recession (2008-2010) and the Second Recession (2011-2013) –from 72.82% to 71.08%–, whereas financial efficiency rises by 7.2% –from 65.09% to 69.78 %–. Moreover, the number of credit unions that are fully efficient at a social level is around the total mean for the two sub-periods (36.05% and 36.68%, respectively), while this figure increases from 3.04% in 2008-2010 to 9.09% in 2011-2013 when financial efficiency is considered. Figure 4 presents the Kernel density distribution of financial and social efficiency for both crisis sub-periods. As is shown below, while a small number of Spanish credit unions is fully efficient in their banking activity in any of the two crisis sub-periods, most of them are quite close to those that optimise the social outputs obtained from the available resources. In addition, financial efficiency increases in the Second Recession, whilst social efficiency decreases.

**Table 3: DEA efficiency scores**

| | FINANCIAL MODEL | | | SOCIAL MODEL | | |
|---|---|---|---|---|---|---|
| | Original $\hat{\delta}$ | Corrected $\hat{\hat{\delta}}$ | Useful $\tilde{\delta}$ | Original $\hat{\delta}$ | Corrected $\hat{\hat{\delta}}$ | Useful $\tilde{\delta}$ |
| *2008-2013 (n=428 DMUs)* | | | | *2008-2013 (n=432 DMUs)* | | |
| **Mean** | 0.7114 | 0.6394 | 0.6726 | 0.7234 | 0.7062 | 0.7202 |
| **Std. Dev.** | 0.1684 | 0.1314 | 0.1628 | 0.2895 | 0.2843 | 0.2905 |
| **Fully efficient DMUs (%)** | 9.11% | 0.00% | 5.84% | 37.50% | 0.00% | 36.34% |
| *2008-2010 (n=230 DMUs)* | | | | *2008-2010 (n=233 DMUs)* | | |
| **Mean** | 0.6827 | 0.6288 | 0.6509 | 0.7312 | 0.7139 | 0.7282 |
| **Std. Dev.** | 0.1590 | 0.1354 | 0.1553 | 0.2770 | 0.2717 | 0.2785 |
| **Fully efficient DMUs (%)** | 4.35% | 0.00% | 3.04% | 36.91% | 0.00% | 36.05% |
| *2011-2013 (n=198 DMUs)* | | | | *2011-2013 (n=199 DMUs)* | | |
| **Mean** | 0.7448 | 0.6517 | 0.6978 | 0.7143 | 0.6972 | 0.7108 |
| **Std. Dev.** | 0.1732 | 0.1257 | 0.1680 | 0.3002 | 0.2953 | 0.3008 |
| **Fully efficient DMUs (%)** | 14.65% | 0.00% | 9.09% | 38.19% | 0.00% | 36.68% |
| *2008 (n=78 DMUs)* | | | | *2008 (n=79 DMUs)* | | |
| **Mean** | 0.6662 | 0.6165 | 0.6359 | 0.7241 | 0.7062 | 0.7197 |
| **Std. Dev.** | 0.1570 | 0.1359 | 0.1522 | 0.2841 | 0.2788 | 0.2846 |
| **Fully efficient DMUs (%)** | 2.56% | 0.00% | 1.28% | 36.71% | 0.00% | 35.44% |
| *2009 (n=77 DMUs)* | | | | *2009 (n=78 DMUs)* | | |
| **Mean** | 0.6889 | 0.6383 | 0.6590 | 0.7327 | 0.7165 | 0.7304 |
| **Std. Dev.** | 0.1627 | 0.1414 | 0.1611 | 0.2768 | 0.2720 | 0.2790 |
| **Fully efficient DMUs (%)** | 3.90% | 0.00% | 3.90% | 37.18% | 0.00% | 35.90% |
| *2010 (n=75 DMUs)* | | | | *2010 (n=76 DMUs)* | | |
| **Mean** | 0.6933 | 0.6319 | 0.6580 | 0.7371 | 0.7192 | 0.7347 |
| **Std. Dev.** | 0.1580 | 0.1294 | 0.1535 | 0.2731 | 0.2674 | 0.2750 |
| **Fully efficient DMUs (%)** | 6.67% | 0.00% | 4.00% | 36.84% | 0.00% | 36.84% |
| *2011 (n=71 DMUs)* | | | | *2011 (n=71 DMUs)* | | |
| **Mean** | 0.7187 | 0.6392 | 0.6751 | 0.7178 | 0.6984 | 0.7130 |
| **Std. Dev.** | 0.1694 | 0.1287 | 0.1630 | 0.2848 | 0.2794 | 0.2859 |
| **Fully efficient DMUs (%)** | 11.27% | 0.00% | 5.63% | 36.62% | 0.00% | 35.21% |
| *2012 (n=65 DMUs)* | | | | *2012 (n=65 DMUs)* | | |
| **Mean** | 0.7428 | 0.6465 | 0.6955 | 0.7270 | 0.7090 | 0.7244 |
| **Std. Dev.** | 0.1773 | 0.1302 | 0.1736 | 0.3086 | 0.3021 | 0.3085 |
| **Fully efficient DMUs (%)** | 12.31% | 0.00% | 9.23% | 40.00% | 0.00% | 38.46% |
| *2013 (n=62 DMUs)* | | | | *2013 (n=63 DMUs)* | | |
| **Mean** | 0.7769 | 0.6715 | 0.7262 | 0.6971 | 0.6837 | 0.6943 |
| **Std. Dev.** | 0.1706 | 0.1169 | 0.1661 | 0.3122 | 0.3096 | 0.3129 |
| **Fully efficient DMUs (%)** | 20.97% | 0.00% | 12.90% | 38.10% | 0.00% | 36.51% |

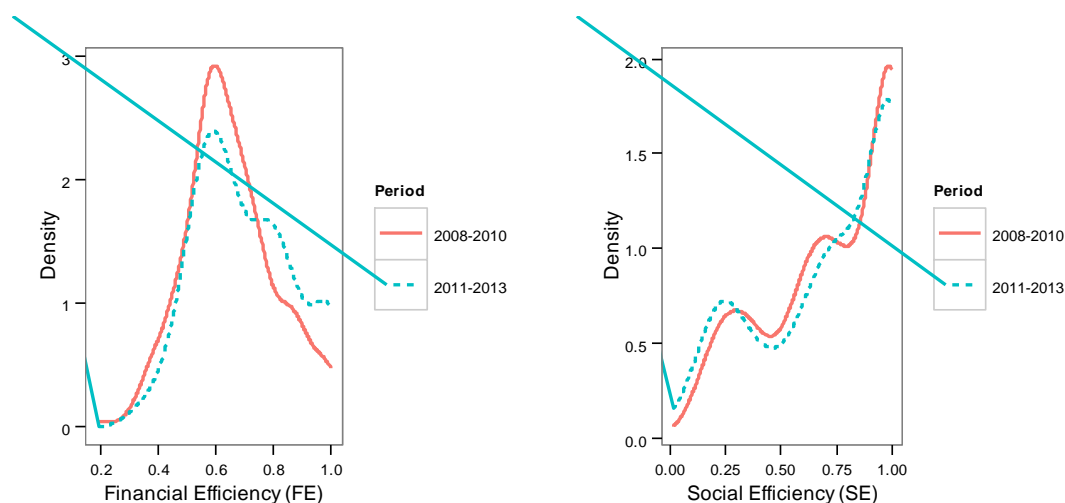$\hat{\delta}$: Original efficiency scores; $\hat{\hat{\delta}}$: Bias-corrected efficiency scores; $\tilde{\delta}$: Useful efficiency scores.

**Figure 3: Number of DMUs sorted by financial and social efficiency during the crisis period**
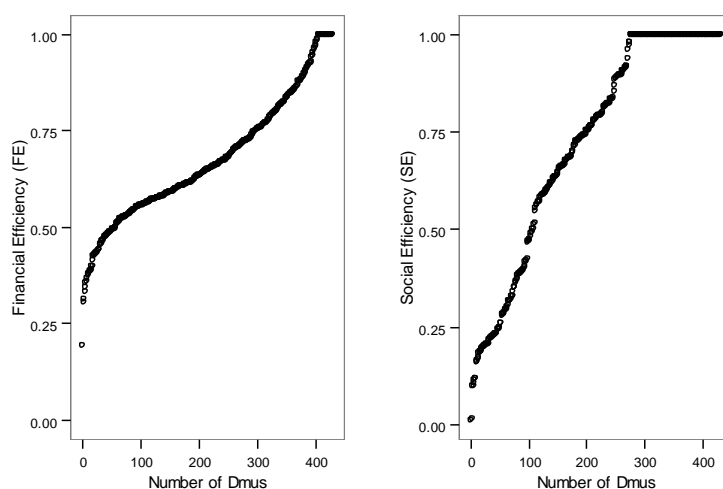


*Source*: Drawn up by the authors.

**Figure 4: Kernel density distribution of financial and social efficiency for the crisis sub-periods**



*Source*: Drawn up by the authors.

Finally, when the analysis is performed by years, the results indicate that Spanish credit unions improved their financial efficiency year after year. In fact, their mean score increased by 9.03 percentage points – almost 14.2%, from 63.59% in 2008 to 72.62% in 2013. Our result is therefore opposite to that of Barra et al. (2013), who found that the recent crisis seriously damaged the financial efficiency of Italian credit unions between 2006 and 2010. On a national level, Belmonte (2012) finds an average value of 91.5% in 2010 as opposed to 65.8% found in this study for that year. This difference is because, unlike our study, Belmonte (2012) estimates financial efficiency under an input orientation and with conventional DEA, uses other input and output variables, and only takes the DMUs for 2010 to build the efficient frontier[7]. Social efficiency, on the other hand, is more stable during the period studied and even shows a slight drop of 2.54 percentage points –about 3.53%, from 71.97% in 2008 to 69.43% in 2013. Regarding the DMUs

that are fully efficient $(\tilde{\delta} = 1)$, although the number of observations with maximum value for financial efficiency is small in any of the six years, there is constant growth from 1.28% in 2008 to 12.90% in 2013. In contrast, the proportion of totally efficient DMUs from the social point of view is more stable, changing from 35.44% to 36.51%.

*Second stage results: determinants of financial and social efficiency*

Table 4 presents the results from the bootstrap truncated regression for both financial and social models, where useful efficiency estimates in the period 2008-2013 are regressed on a set of explanatory variables.

**Table 4: Bootstrap truncated regression**

| Variable | FINANCIAL MODEL β (Bootstr. Stand. Error) | SOCIAL MODEL β (Bootstr. Stand. Error) |
|---|---|---|
| Constant (α) | 0.4430*** (0.0652) | 0.9495*** (0.2215) |
| MEMB | -0.0044 (0.0050) | 0.0057 (0.0188) |
| AGE | 0.0461*** (0.0142) | -0.1290*** (0.0262) |
| M&A | 0.1657** (0.0681) | -0.3343*** (0.0653) |
| GROUP | -0.0032 (0.0184) | 0.0793* (0.0437) |
| REG (Regional dummies) | Yes*** | Yes*** |
| CRISIS | 0.0427*** (0.0146) | -0.0559** (0.0280) |
| Sigma | 0.1254*** (0.0055) | 0.1972*** (0.0105) |
| Observations | 403 | 275 |
| Log likelihood | 284.6537 | 99.554125 |
| Wald $\chi^2$(19) | 621.66*** | 1,550.07*** |

MEMB: Membership (in units): AGE: Age (in years); M&A: Merger and Acquisition Activity (dummy: 1=yes/0=no); GROUP: Corporate Group (dummy: 1=yes/0=no); REG: Regional Location (14 regional dummies to control for the regional location within Spain); CRISIS: Crisis (dummy: 1=2011-2013/0=2008-2010).

Total number of repetitions = 2000.

*** Significant at the 1% level; ** Significant at the 5% level; * Significant at the 10% level.

The findings show that the coefficient for *AGE* remains positive and significant in the financial model implying that mature Spanish credit unions became more efficient in their banking activity during the crisis period. Thus, our result is consistent with Paxton (2007). In contrast, the effect of this variable on social efficiency is negative and significant suggesting that mature credit unions are less efficient in the social dimension. The coefficient for the relationship between merger and acquisition activity and financial efficiency (*M&A*) is also positive and statistically significant, indicating that the credit unions

engaged in concentration processes were better at achieving their financial goals with the available resources than their unmerged counterparts. Our result therefore corroborates previous findings by Worthington (2001) and Mcalevey et al. (2010). However, in the social model, this variable shows a negative and significant coefficient, suggesting that the resulting entities after these processes are less socially efficient. The *GROUP* coefficient is not statistically significant in the financial model but has a positive and significant effect on social efficiency, indicating that Spanish credit unions belonging to a corporate group manage their social activity better, obtaining a higher level of social outputs from the resources at their disposal.

In addition, a "regional effect" (*REG*) is observed in both the financial and social models, with statistically significant coefficients for the dummies associated with some Spanish regions. For example, the recent processes of concentration in the sector, which have mostly taken place in Andalusia, Aragon, the Basque Country and Navarre, might explain the higher level of financial efficiency of the entities located there, while the regulatory and institutional framework of Castile and León, the Canary Islands and Madrid might enable their credit unions to be more efficient socially. In addition, there are three regions in which the credit unions are simultaneously efficient in one activity and inefficient in the other. For example, credit unions in Catalonia are characterised by higher levels of financial efficiency and lower levels of social efficiency, possibly because there is a high presence of rural savings banks that act like any other credit entity. In Galicia and the Balearic Islands, on the other hand, credit unions are less financially efficient and more socially efficient, which may be because of the shortage of such entities in both these regions. Therefore, consistent with several previous studies (Worthington, 1998b, 1999; Fried et al., 1993; Glass et al., 2014), our findings suggest that both the financial and social efficiency of credit unions varies according to the region in which they are located within a single country.

Finally, regarding the *CRISIS* variable, our results show that Spanish credit unions were significantly more financially efficient in the Second Recession (2011-2013) than in the First (2008-2010), suggesting that the efficiency of their banking activity improved as the crisis progressed. In contrast, the crisis had a negative impact on their capacity to optimise the social outputs obtained from their human and capital inputs.

**Conclusions and implications**

*Conclusions*

The efficiency of a country's financial sector affects economic growth, so it is an issue of major interest for policy-makers, regulators, investors, customers, and the general public, especially in times of crisis. This paper aims to find out more about the efficiency of the banking system in Spain and, more specifically, of its credit unions during the recent economic-financial crisis. In particular, it sets two goals: first, to estimate the relative levels of financial and social efficiency in Spanish credit unions

between 2008 and 2013; and, second, to analyse the main determinants of both types of efficiency. The main conclusions are given below.

Regarding the *first goal*, our findings show that, on average, Spanish credit unions achieved a relative level of financial efficiency of 67% between 2008 and 2013. That is, they generated 33% less than the maximum level of financial outputs that might be expected if they had used their human and capital inputs better. Similarly, the relative level of social efficiency in Spanish credit unions reached a mean score of 72% so, to be fully efficient, such entities should have increased their social outputs from available resources by 28%. Consequently, during the crisis, Spanish credit unions managed both their banking activity and their social function relatively well. So, as the debate over the value of Social Economy financial institutions intensifies, it remains apparent that the Spanish cooperative banking model has performed reasonably well in both dimensions of its activity since the beginning of the crisis. Consequently, credit unions can look forward to continuing to help "build a better world" since they can be a driving force for a more sustainable economy and society even in crisis periods.

However, although Spanish credit unions managed their social function a bit better than their banking activity –possibly because their main mission is not to maximise profits but to achieve a social purpose–, their financial efficiency showed a rising trend over the crisis period, while their social efficiency remained practically constant and even dropped slightly between 2008 and 2013. As credit unions create a range of social impacts beyond their financial performance, they are subject to tensions and conflicts that traditional banking entities do not face. Growing pressure to prove their financial efficiency led Spanish credit unions to adopt "business-like" practices, which increased their capacity to optimise the financial outputs obtained from their inputs as the crisis progressed. But these practices seem also to have eroded their social performance to some extent. Although in general these entities were socially efficient during the crisis years, their efficiency scores dropped slightly over the period, so it is crucial that they preserve and build on their distinctive characteristics to avoid further deterioration of their social efficiency.

Regarding the *second goal*, there are several factors that may affect the relation between the inputs and outputs of the production process of credit unions, significantly determining their levels of efficiency. More specifically, our results show that age and merger and acquisition activity are positively influential on financial efficiency, but have a negative effect on social efficiency. This might be due to the classic "mission drift" problem: on the one hand, as credit unions get older, they tend to diversify their portfolio towards types of customer other than the initially targeted ones –primarily their members and the families and firms in the small towns where they tend to be situated–; and on the other hand, the  process of concentration undergone in the sector to boost competitiveness during the crisis period focused on improving the management of its financial activity to the detriment of its social activity.

Moreover, belonging to corporate groups has a favourable effect on the social efficiency of credit unions, benefiting all their stakeholders. A possible explanation could be that such groups have a collaborative goal and a marked social purpose, which would imply greater potential for member credit unions to be

socially efficient. In addition, both types of efficiency –financial and social– vary significantly depending on the regional location of credit unions in Spain. In most of the regions, these entities are efficient in one of the two types of activity. Our findings with regard to the regional effect therefore show that financial and social efficiency tend to be substitutive rather than complementary because there is no Spanish region in which credit unions are simultaneously efficient in both the financial and social aspects of their activity.

Finally, the recent financial crisis has also had a significant influence on Spanish credit unions' efficiency. Specifically, as a logical consequence of a context characterized by intense competition and extensive structural transformations, our results show improved financial efficiency in the Second Recession (2011-2013) compared to the First Recession (2008-2010), while social efficiency worsened as the crisis period progressed.

*Implications*

Since any inefficiency means a sub-optimal level of output from available resources and, therefore, lower performance than might be possible, it is difficult to imagine that inefficient credit unions might become successful. Even though Spanish entities have maintained an acceptable level of financial and social efficiency during the crisis period, it is essential for them to show maximum competitiveness in both dimensions of their activity if they are to continue to perform their important economic and social functions in the new international context (Kalmi, 2012). So, in the light of our findings, a number of recommendations can be made for both credit union managers and governments in order to reduce inefficiencies and to maintain successful social management that is compatible with satisfactory financial efficiency.

*Managerial implications:* Our findings indicate that Spanish credit unions had relative financial and social inefficiencies of 33% and 28%, respectively, during the crisis period, which cannot be ignored if they want to improve their global performance in the near future. It would therefore be advisable for their governing bodies to adopt measures to resolve these inefficiencies and to simultaneously improve the financial and social dimensions of their activity, such as: (a) managing financial restrictions to continue supporting local economies through a more sophisticated decision-making process regarding the distribution of limited resources; (b) emphasising the cooperative difference by increasing the percentage of customers who are members of credit unions, by advertising their social value using double bottom-line accounting, and by providing new sources of financing; and (c) employing new technologies to complement and revitalise physical branches.

*Political implications:* Spanish credit unions proved to be independent, sound, and viable financial entities in the recent crisis. In addition, according to our findings, they were also quite efficient on financial and social levels. This is therefore a type of socially responsible banking that is necessary for the country's economic and social development because it helps finance the real economy and returns a part

of its profits to society. However, the financial system restructuring process that took place in Spain during this period –whereby some credit unions have evolved into specific, universal banks and the remainder are now treated like banking institutions that are in competition with commercial banks– could lead them to disappear, negatively affecting the recovery of the Spanish economy. Thus, it would be advisable for policy-makers to try to consolidate their original position. To help achieve this, they could take the following measures to simultaneously improve both types of efficiency in Spanish credit unions: (a) since merger and acquisition activities improved their financial efficiency but deteriorated their social efficiency, governments could promote strategic alliances in the sector as a means of coping with the process of economic globalisation and the requirements of the market and the European Union, while maintaining their nature as socially responsible local banks. Such strategies would enable credit unions to access complementary resources and capabilities to better meet the present and future needs of all their members and customers; (b) governments could enable the creation of central service structures, allowing the sector to achieve economies of scale without losing local responsibility; c) since in none of the Spanish regions are the credit unions both financially and socially efficient, regional governments could adopt regulatory and institutional measures to improve both dimensions of efficiency, such as ensuring that banking regulation takes into account their particular capital structure, or allocating public funds to them for their support and promotion based on a criterion of good financial and social management.

### Limitations and future lines of research

In spite of its contributions, this study has some limitations: a) the complexity involved in choosing the input and output variables of the production process of credit unions, because of the limited data available in Spain; b) the difficulties of quantifying financial outputs and, especially, social outputs, because of their intangibility; and c) the lack of indicators measuring qualitative aspects of the financial and social activity of such entities.

All this means that, for future research, we are considering the use of more and better input and output variables, wherever possible, so that estimates of the efficiency of Spanish credit unions reflects their production process better. Moreover, it would be extremely interesting to learn more about the determinants of their financial and social efficiency by adding new exogenous variables that may improve the relation between the inputs and outputs of such entities. It might also be of interest to perform a study of productivity change in Spanish credit unions during the crisis period in order to determine if it was the result of variations in efficiency and/or technological change. Finally, it would also be useful to apply a network DEA model to take into account the internal structure of credit unions and to evaluate the impact of division-specific inefficiencies on their overall efficiency.

### Notes

[1] The minimum acceptable value for technical efficiency indicators is 50% (Cooper et al., 2007).

[2] Paradoxically, although there is no empirical evidence on the social efficiency of credit unions in developed countries, there have been many recent studies on this subject for microfinance institutions –

MFIs – working in developing countries (Servin et al., 2012; Piot-Lepetit and Nzongang, 2014; Wijesiri et al., 2015, among others). Microfinance institutions are credit entities that also have an important social role, mainly in poorly-developed countries where they give loans to social groups that are excluded from the traditional financial system. It is precisely the loans policy of such entities that prevents the existing evidence on their social efficiency from being transferred to credit unions.

[3] This procedure is performed using *FEAR* software (Wilson, 2008).

[4] The "*constant returns to scale (CRS) DEA model*" was proposed by Charnes et al. (1978) and is only appropriate when all organizations operate at an optimal scale, which is difficult because of the existence of imperfect competition, government regulations, constraints on finance, etc. For this reason, Banker et al. (1984) proposed the "*variable returns to scale (VRS) DEA model*".

[5] See Wilson (1993, 2010) for details.

[6] Conventional DEA, which is applied in all prior studies on the efficiency of credit unions, gives the values for original efficiency without taking into account any sample noise in the estimates, so the results may be misleading.

[7] We also estimated the efficiency score for 2010 using a single efficient frontier for that year, obtaining an average value of 78.2% in comparison with 91.5% obtained by Belmonte (2012). However, the relative estimates obtained in our study by building a single efficient frontier for the six-year study period project a more realistic and reliable image of the efficiency of Spanish credit unions during the recent crisis period.

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