Finance Research Letters 15 (2015) 175–186

Contents lists available at ScienceDirect

Finance Research Letters

journal homepage: www.elsevier.com/locate/frl

# Sample dependency during unconditional credit capital estimation☆

Alex Ferrer[a,*], José Casals[b], Sonia Sotoca[b]

[a] Financial Stability Department, Bank of Spain, Alcalá 48, 28014 Madrid, Spain
[b] Department of Quantitative Economics, Universidad Complutense de Madrid, Spain

ARTICLE INFO

*Article history:*
Received 3 July 2015
Accepted 8 September 2015
Available online 18 September 2015

*JEL Classification:*
C58
G21
G32

*Keywords:*
Charge-off
Credit risk
Unconditional capital
Unconditional credit loss distribution

ABSTRACT

The unconditional credit loss distribution is identified based on a long-term sample. This sample influences the capital estimate. In this study, we performed an empirical investigation of this sample dependency problem using charge-off data and by focusing on the influence of the Great Recession. The results demonstrated the significant dependency of the capital requirements on the homogeneity and cyclicality of the long-term sample. Thus, a sample containing only the Great Recession data produced lower capital requirements due to the homogeneity effect, whereas a mixed sample containing the Great Recession data produced higher capital requirements due to the cyclical effect.



## 1. Introduction

Banks tend to calculate the capital requirements of their credit portfolios using unconditional loss distributions, see Lee and Poon (2014), Wilson (1997a), Wilson (1997b), Jiménez and Mencía (2009), Rösch and Scheule (2010), Carey (2002) and Bangia et al. (2002). This type of distribution attempts to represent a long-term risk behavior instead of a specific economic scenario, i.e., either recession or expansion, with the aim of smoothing the capital requirements and mitigating procyclicality, see Drumond (2009) and Gordy and Howells (2006). The Basel regulatory capital formula for credit risk also rely on the

☆ This paper is the sole responsibility of its authors and the views represented here do not necessarily reflect those of the Bank of Spain.

* Corresponding author. Tel.: +34 91 338 57 56.
*E-mail addresses:* alejandro.ferrer@bde.es (A. Ferrer), jmcasals@ccee.ucm.es (J. Casals), sotoca@ccee.ucm.es (S. Sotoca).

http://dx.doi.org/10.1016/j.frl.2015.09.008
1544-6123/

unconditional loss distribution and they require that an unconditional capital ratio must be satisfied by banks, BCBS (2006) and BCBS (2011).

Modeling the unconditional loss distribution requires a long-term sample of loss data for the credit portfolio. This sample is related to a particular time window, which includes a certain number of recessions, expansions, and stagnation periods. Choosing a particular time window is subjective and the common non-stationary nature of credit losses leads to a sample-dependent problem, which has been studied by Bruche and González-Aguado (2010), Nickell et al. (2000), Lucas and Klaassen (2006), Pederzoli and Torricelli (2005) and Rodriguez and Trucharte (2007). In this note, we contribute to this research area by conducting a distinctive empirical analysis for six different portfolios based on three main features.

First, we employ a charge-off rate series as a proxy for losses instead of focusing solely on the probabilities of default or rating migrations. This choice also allows us to consider credit losses net of recoveries; thus, we model the final credit losses.

Second, we pay special attention to the Great Recession and its influence in the charge-off rate series, and thus the unconditional loss distribution that they generate. Loss data from the Great Recession period will be used for capital estimation in the years to come, so we consider that it is worthwhile studying their effects on the loss distribution.

Third, we study the sample dependency problem by comparing the capital requirements derived from different time windows with a clear economic meaning. Thus, instead of comparing recessions and expansions, we focus on different characterizations of a long-term scenario.

In the empirical analysis, we generate the unconditional loss distribution using the standard approach by aggregating conditional loss distributions related to different economic scenarios such as recession, expansion, and stagnation. We also employ Monte Carlo simulation to estimate the capital requirements. We conduct two comparisons. First, we compare a time window that only includes the Great Recession with a mixed time window that also includes expansion periods. We also compare two mixed time windows where only one includes the Great Recession.

Our results illustrate the following two points.

First, severe economic environments, such as the Great Recession, may produce lower capital requirements than mixed time windows that include both recessions and expansions. This is because the value-at-risk is higher in a recession-only scenario, but so is the expected loss, which means that the difference may actually decrease.

Second, the time window influences the unconditional capital through two effects: the homogeneity of the underlying economic scenario that it captures, which we call the "homogeneity effect," and the cyclicality of the variance of the conditional loss distributions that it includes, which we call the "cyclical effect."

The remainder of this paper is organized as follows. In Section 2, we state the analytical framework that underpins the study. In Section 3, we present the empirical analysis. First, we introduce the data, models, and portfolios used, before discussing the results obtained in both comparisons. Finally, we give our conclusions in Section 4.

## 2. Analytical framework

We employ a standard formulation for the credit loss model, see Frey and McNeil (2002), Gordy (2003) and Carey (2002). Our starting point is a continuous credit loss random variable $L$, $L \geq 0$. $L$ represents the loss generated by a credit portfolio during a given time horizon. For the sake of simplicity, we focus only on the stand-alone case, i.e., we do not consider the aggregated loss random variable for all the credit portfolios of the bank, although our analysis can easily be extended in this manner.

$L$ is given by the following expression:

$$L = eH, \tag{1}$$

where $e$ is the current total volume of credit exposure for the portfolio and $H$ is a charge-off rate random variable. $H$ represents the percentage of the portfolio exposure that defaults and it is not recovered during the time horizon. Therefore, $H$ comprises both the probability of default and the loss given default. $H$ has support in $(0\,1)$ because it models a charge-off rate, whereas $L$ has support in $(0\,e)$ because it models a charge-off loss.