Basel-2 capital adequacy: Computing the ‘fair’ capital charge for loan commitment ‘true’ credit risk

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Received 11 August 2003; accepted 19 December 2004
Available online 8 November 2005

Abstract

This research makes two contributions: (i) to price analytically put option and extension premium embedded in a borrower-extendible commitment, and (ii) to compute the ‘fair’ capital charge that corresponds to the commitment ‘true’ credit risk. In doing so, the procedure replaces the BIS accounting-based concepts of credit-conversion factor, principal-risk factor, and initial term to maturity of irrevocable commitments with the market-based concepts of exercise-cum-takedown proportion and put value implicit in the borrower-extendible commitment, respectively. Finally, the approach is developed one step further to account for the borrowers’ risk ratings by public credit agencies; this results in a two-dimensional (time-state of nature) risk-weighting system that applies to all commitment types.

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JEL classification: G13; G21
Keywords: Put option embedded in borrower-extendible commitments; Exercise-cum-takedown proportion; ‘Fair’ capital charge for commitment ‘true’ credit risk

1. Introduction

The purpose of this research is to compute the “fair” capital charge corresponding to the “true” credit risk of off-balance-sheet credit commitments. To do this, the credit-assessment parameters mandated in Basel-1 by the Bank of International Settlement (1988, the BIS) have to be first reset in the finance well-known framework of time and states of nature.

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1 Although the revised guidelines (Basel-2 [2004]) are not considered per se here, our market-based concepts remain relevant to Basel-2.

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Regarding the risk dimension, commitment credit risk is measured by the credit-conversion factor (0% or 50%) and the principal-risk factor (0% or 100%). On the time dimension, commitment duration is captured by only two initial terms to maturity for irrevocable commitments—those with an initial term to maturity up to 1 year or longer than 1 year. Not unexpectedly, the BIS accounting-based procedure yields a very coarse grid of credit-risk weights for off-balance-sheet loan commitments. There also are only two somewhat artificial values for both credit-conversion and principal-risk factors. With the result that the capital charge corresponding to the credit risk of longer-term irrevocable commitments is very substantial, while that for short-term irrevocable commitments, as well as all revocable commitments irrespective of their initial term to maturity, is nil.

The direct linkage of commitment credit risk to its capital charge is obtained by substituting three market-based concepts to the Basel-1 accounting-based coefficients. To start with, all commitments are construed as borrower-extendible commitments and differentiated on the basis of the duration of their extension period. This replaces the distinction between revocable and irrevocable commitments, with the latter ones being further split on the basis of their initial term to maturity. Next, the credit-conversion factor makes way for an empirically relevant exercise-cum-takedown proportion, namely the average amount of the credit line drawn down when the line is exercised. And finally, the principal-risk factor is replaced by the value of the put option embedded in borrower-extendible credit commitments. Valuing this implicit credit-risk derivative then raises three questions: Does the put option embedded in an extendible commitment capture its “true” credit risk? 2) Is this value more sensitive to the time or state-of-nature parameters? And 3) how is the “fair” capital charge for commitment “true” credit risk actually computed?

In recent years, Petersen and Rajan (1994), Ergungor (2001) or Kashyap, Rajan, and Stein (2002) among others have stressed the central role played by commitments in bank lending, and several researchers have derived alternative formulas for valuing credit-line commitments. Thakor, Hong, and Greenbaum (1981) and Ho and Saunders (1983) derived option-like values for fixed-rate straight commitments, Thakor (1982), Chateau (1990), and Chateau and Dufresne (2002) obtained put formulas for non-extendible variable-rate commitments, and Hawkins (1982) priced revolving credit lines. To the best of our knowledge, extendible or rollover commitments, namely those in which the initial commitment period is extended for another time period, have not yet been priced. Within the BIS regulatory framework, pricing borrower-extendible commitments has the advantage to circumvent the artificial dichotomy between irrevocable commitments with a 1-year initial term to maturity and those with an initial term to maturity longer than 1 year. Fortunately, there have been advances in research on derivatives with extendible maturities: Anathanarayanan and Schwartz (1980) and Athanassakos, Carayannopoulos, and Tian (1997) have priced extendible bonds, Longstaff (1990) European options with extendible maturities, and Hauser and Lauterbach (1996) extendible warrants. Here we propose a general closed-form value formula for single- or multiple-year extension premiums, of which the extendible put expression of Longstaff (1990, Eq. (12), p. 943) is but a particular case.

According to Thakor et al. (1981), when the interest rate on a commitment contract is lower than that on an equivalent spot loan, the borrower receives the credit-line face value but is only indebted for its lower marked-to-market value—henceforth referred to as the indebtedness value. More concretely, the borrower’s claim on the lending bank constitutes an embedded, yet valuable, commitment put option. It is thus sensible to determine the impact of this implicit liability on the bank’s regulatory capital at the BIS audit date. The aggregate
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