



Stress testing credit risk: The Great Depression scenario

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ARTICLE INFO

Article history:

Received 30 December 2010

Accepted 2 October 2011

Available online 8 October 2011

JEL classification:

G11

G21

G22

G28

G32

Keywords:

Credit risk

Financial crisis

Stress testing

Basel 3

ABSTRACT

By employing Moody's corporate default and rating transition data spanning the last 90 years we explore how much capital banks should hold against their corporate loan portfolios to withstand historical stress scenarios. Specifically, we will focus on the worst case scenario over the observation period, the Great Depression. We find that migration risk and the length of the investment horizon are critical factors when determining bank capital needs in a crisis. We show that capital may need to rise more than three times when the horizon is increased from 1 year, as required by current and future regulation, to 3 years. Increases are still important but of a lower magnitude when migration risk is introduced in the analysis. Further, we find that the new bank capital requirements under the so-called Basel 3 agreement would enable banks to absorb Great Depression-style losses. But, such losses would dent regulatory capital considerably and far beyond the capital buffers that have been proposed to ensure that banks survive crisis periods without government support.

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1. Introduction

The financial crisis that began in 2007 has highlighted how market events can be both extreme and difficult to predict. The inability of risk measurement models to forecast such events is often ascribed to their short-term focus. Popular conditional volatility models adopted in commercial risk management software tend to give more weight to recent observations under the assumption that the recent past is more informative in predicting the future.¹ Although this may be true under normal market conditions, it may not apply in periods of market turmoil. Acharya et al. (2009) point out that capital markets before the crisis were characterised by a fundamental mispricing of risk as “risk premiums were too low and long-term volatility reflected a false belief that future short-term volatility would stay at its current low levels.” As a result, regulators have recently re-emphasized the need to couple standard risk measurement tools with stress tests designed to capture crisis scenarios.² These should be severe but plausible. Hypothetical stress tests can be designed to simulate rare events but, typically, under assumptions about the distribution of future outcomes and/or the factors influencing such outcomes. It is often questionable to what

extent extreme hypothetical scenarios may reflect realistic occurrences. An alternative to hypothetical stress testing is historically-based stress scenarios that aim to reproduce specific past crisis events. Historical stress tests are incorporated in current and proposed regulations of bank capital.³ Among the main advantages of historical scenarios is the fact that they are plausible, if only because they have occurred before, and are not as sensitive to model risk as hypothetical scenarios. Their main limitation is that often the history of relevant events is relatively short. Short histories are sometimes the result of a modeller's choice in order to avoid structural breaks that are produced by changing regulatory, legal and business environments and by financial innovation (Alexander and Sheedy, 2008). Haldane (2009) however, convincingly argues that the “realism” or “plausibility” of a crisis, and by extension of a stress test, crucially depends on a long observation period. Indeed the sheer abnormality of the recent crisis – when analysed within the context of short term pre-crisis indicators – becomes far more plausible when put into a longer historical context. Similarly, Giesecke et al. (2009) conclude that “in coming to grips with the current financial market situation which has been termed a ‘historic crisis’ or ‘the worst financial crisis since the Great Depression,’ nothing is so valuable as actually having a long-term historical perspective.”

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¹ See, for example, JPMorgan/Reuters (1996).

² See, Basel Committee on Banking Supervision (2009a,b,c), Committee of European Banking Supervisors (2009) and Financial Services Authority (2009).

³ Nout Wellink, former chairman of the Basel Committee on Banking Supervision recently stated that “[a]ny analysis of appropriate minimum [capital] levels must recognise that to be credible they need to cover historically severe losses.” See Wellink (2010, p. 5).

In this study, we estimate credit losses for (1) individual corporate exposures of different credit quality and (2) representative bank portfolios. The losses are derived through historical stress tests that take into account a period of almost 90 years. For the purpose, we use Moody's corporate default and rating transition data, which is the longest on record and includes the most severe credit event in recent history, the Great Depression. Such a scenario, which would probably have been considered irrelevant before the default of Lehman Brothers in 2008, has become more relevant since. As noted by Eichengreen and O'Rourke (2009), while the crisis was unfolding it bore remarkable similarities with the experience in the 1930s. In addition, according to Moody's, the 2009 aggregate default rate at 5.36% was the third worst since the record began in 1920, behind 1933 (8.42%) and 1932 (5.43%). More remarkably, the default rate of speculative grade assets in 2009 was 12.97% of total issuers, second only to that observed in 1933 (15.39%). As a result, anecdotal evidence suggests that the Great Depression as a central stress scenario may be gaining popularity in the industry.⁴

The Basel Committee has recently issued a consultative document (Basel Committee on Banking Supervision (BCBS), 2009c) that highlights principles for sound stress testing in the attempt to address the shortcomings of pre-crisis practices. Among the chief weaknesses identified by the Committee are (1) low severity and short-lived scenarios compared with the magnitude and time persistence of the crisis; (2) underestimation of correlation across and within asset classes; (3) the fact that system-wide interactions (i.e. systemic risk) and feedback effects were largely ignored. Considering the Great Depression scenario allows us to address these concerns in that: (i) The Depression was both severe and long lasting; and (ii) by deriving credit losses on the basis of historical default rates, correlation and feedback effects are automatically taken into account.

Carey (2002) derives the default loss distribution of a "numeraire" portfolio, specified by the Basel Committee, under several stress scenarios, including the Great Depression. He then obtains the minimum levels of capital that banks should hold to survive a Great Depression scenario at various confidence levels. With a simpler framework and a focus on the worst case scenario, we extend Carey's work in several ways: (1) we generalize Carey's default-mode approach by including in our analysis migration risk, which is consistent with current and proposed regulation; (2) we investigate the loss experience under stress for representative bank portfolios with different credit profiles; (3) we derive counter-cyclical capital buffers based on the Great Depression scenario and illustrate their behaviour over the 1921–2009 sample period; and (4) we compare our stress test estimates of credit risk capital with Basel 2 and Basel 3 regulation.

Historical stress scenarios have recently been proposed to quantify the capital buffers that would help banks to withstand a severe financial crisis (Financial Services Authority, 2009; Committee of European Banking Supervisors (CEBS), 2009). Risk sensitive capital requirements tend to decrease in booms when risk falls (or is underestimated) and increase in recessions. In recessions, banks also face higher losses which may erode existing capital reserves. This, combined with higher capital requirements, may lead to a capital shortage. As a result, banks may be forced to cut down on lending in a downturn, thus causing or exacerbating a credit crunch.⁵ This

pro-cyclical effect of risk sensitive regulatory capital has led researchers to investigate how banks manage the buffer that they normally keep in excess of the regulatory minimum. If banks built buffers in boom periods and decreased them in recessions, then the pro-cyclicality of capital requirements could be partially or completely offset. This, in turn, would help to reduce the potential impact of capital regulation on the length and severity of recessions. Evidence in the literature about the relationship between capital buffers and the business cycle is mixed. Fonseca and González (2010) find that buffers are cycle-neutral in 58 of the 70 countries they have analysed. However, they are pro-cyclical (i.e. there is a significant negative relationship between buffers and GDP growth) in seven countries including the US and the UK, and counter-cyclical in the remaining five countries. Ayuso et al. (2004) find that for a large sample of Spanish banks, capital buffers are adjusted in a pro-cyclical fashion and Jokipii and Milne (2008) observe that buffers behave pro-cyclically in EU15 countries and in commercial, saving and large banks, while in EU accession countries and small and cooperative banks they are counter-cyclical. To contrast the pro-cyclicality of minimum regulatory capital and, often, of unregulated buffers, Basel 3 has introduced the additional requirement of counter-cyclical buffers.⁶ In this paper, we determine the counter-cyclical buffers that would protect banks from Great Depression-style losses and show to what extent Basel 3 buffers should be adjusted to provide the same level of protection.

There is a growing literature on stress testing as applied to credit risk. This has been partly motivated by (1) the increased emphasis on stress testing in Basel regulation; (2) the renewed effort in this area by central banks and regulators following the introduction of the IMF and World Bank's Financial Sector Assessment Programs in 1999; and (3) increasing academic interest as a result of the recent crisis. Bangia et al. (2002) Pesaran et al. (2006), Jokivuolle et al. (2008) and Huang et al. (2009), among others, as well as central banks and national regulators⁷ have proposed models that seek to explain credit risk indicators using macroeconomic variables. Credit stress scenarios are then introduced through shocks to these variables. However, the complexity of the interactions and feedback effects among the real economy and the financial sector may easily lead to substantial model risk which is difficult to quantify ex-ante (Alfaro and Drehmann, 2009). By employing historically observed credit risk indicators, such as default rates and migration rates, we do not specify their formal relationship with macro-variables. Instead, we exploit the implicit relationship embedded in the historical data.

Corporate debt defaults have increased substantially during the recent crisis and led to such high profile cases as Lehman, GMAC and Washington Mutual in the financial sector and General Motors, Ford, Lyondell and Charter Communications among non-financials. Small and medium enterprises also suffered.⁸ Given the substantial exposure of banks to the corporate sector,⁹ it is important to investigate how much capital they should hold against their corporate loan book in order to survive crisis scenarios. When deriving adequate capital levels, we find that two critical factors are the holding period assumption and migration risk. The holding period in current and proposed regulation, and in popular credit risk models used in the industry, is set at 1 year. This implies that, in a crisis, banks would be able to stop losses or recapitalize within that time frame.

⁶ Specifically, Basel 3 introduces a "conservation" buffer and a "counter-cyclical" buffer. However, both are designed to behave in a counter-cyclical way.

⁷ See Foglia (2008) for a comprehensive survey of the macro credit risk models adopted by several national authorities.

⁸ For example, in the heat of the crisis a loan guarantee scheme offered by the UK government to small and medium enterprises experienced a default rate of 28% (in "UK unveils support plan for small businesses," Financial Times, January 12, 2009).

⁹ In 2009 the IMF reported that corporate loan exposures accounted for 15%, 49%, 43% and 27% of total bank loan exposures in the US, UK, Europe and Asia respectively (International Monetary Fund, 2009, Table 1.13, p. 69).

⁴ For instance, on October 21st 2008, Mark Tucker, chief executive of Prudential, a global insurance company, in an interview with the Financial Times stated that the Great Depression is one of the stress scenarios Prudential considers in order to test the resilience of their capital position.

⁵ "The concern that write-downs would gradually deplete capital buffers has materialised leaving a number of institutions with a need for external capital injections. The recessionary phase increases the likelihood that capital requirements shoot up as a consequence of borrowers' downgrades, possibly leading to a credit crunch" CEBS, 2009.

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