



Distance to default and the financial crisis



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ABSTRACT

This paper analyses contingent-claims based measures of distance to default (D2D) for the 41 largest global banking institutions over the period 2006H2 to 20011H2. D2D falls from end-2006 through to end-2008. Cross-sectional differences in D2D prior to the crisis do not predict either bank failure or bank share prices decline, but D2D measured in mid-2008 does have some predictive value for failure by end-year. The 'option value' of the bank safety net remains small except at the height of the crisis and there is little indication of bank shareholders consciously using the safety net to shift risk onto taxpayers.

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1. Introduction

More than five years have passed since August of 2007, when problems in US sub-prime mortgage lending first spread internationally and initiated the global financial crisis. A large and growing body of subsequent research has examined the reasons for this sudden and unexpected emergence of systemic risk. Contributory factors have been identified amongst individual institutions, in specific markets and at the level of the system as a whole.

This paper uses data from the crisis on the largest 41 global banks, documenting the evolution of one standard market-based risk measure – 'distance to default' – through the crisis and examining its performance in cross-sectional econometric models of bank share price performance and for the prediction of bank failure.

The central questions addressed here are far from new: these are (i) whether this particular market based measure of risk provide useful information on the likelihood of future bank failure; (ii)

whether it can perform better as a forecasting indicator than regulatory and accounting based measures of prudential risk; and (iii) what does the contingent-claims analysis that underpins the measurement of distance to default tell us about the value of the put option embedded in the bank safety net and the extent to which bank shareholders exploit the bank safety net in order to shift risk onto tax payers?

The global financial crisis provides a strong motivation for revisiting these questions. It is possible, had regulators paid greater attention to market based signals of risk such as the 'distance to default' on which this paper focuses, that they might have done more and earlier to mitigate the extent and impact of the crisis. Better understanding of what drove events during the crisis should also help identify how financial regulation and supervision could have been better designed so as to more effectively incentivize banks to behave in prudent manner.

This paper addresses these key questions by applying a standard one-period contingent-claims model of bank debt and equity pricing to data from the crisis period. This standard model allows calibration of the distance between the current market-implied value of bank assets and the level which would trigger bank failure.

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It also allows calculation of the value of the put-option offered to bank shareholders by the bank safety net, since distance to default provides a measure of the extent to which this put option provided to shareholders by the bank safety net is 'out of the money' (when distance to default is many standard deviations) or 'on the money' (when distance to default falls close to zero).

Doing this it turns out that, while distance to default is a convenient and intuitive risk measure, it was of only of very limited value as a forward looking predictor of bank share price performance and failure during the crisis. It is only with the full onset of the crisis, for relatively short six month ahead prediction window from 2008H1 to the end of the year, that a low value of distance to default had value as a signal of future financial failure.

This investigation of 'distance to default' also offers some insight into the extent to which bank shareholders were able to exploit the put option created by the bank safety net, taking the opportunity to create value for themselves by shifting risk onto tax payers through increased leverage and risk-taking. This mechanism has been proposed as the major driver of the recent crisis, for example by (Sinn, 2010) page 87¹:

"It cannot be stressed enough that the explanation of the banks' gambling is not primarily the false incentives of the bank executives but the false incentives of shareholders. After all, it is the shareholders who benefit from limited liability. They demand from their banks risky and profitable business models that only function because they entail the advantage of socializing the risk of losses that exceed equity. The problem was not that bank managers did not act in the interest of shareholders, but that shareholders gambled with the money of creditors and taxpayers."

Despite this strong claim, it is far from clear that bank shareholders did in fact recognise the scale of risk to which they were exposed or that they deliberately courted large scale risk prior to the crisis in order to maximise the value of tax payer support. Virtually all reports in the financial press suggest that the scale of losses during the crisis has been very much greater than either bank management or bank investors had conceived possible prior to the event. In short, it remains an open issue as to whether a major cause of the crisis was indeed pressure by shareholders on banks to take large risks with their solvency.

It is true that prior to the crisis banks did enjoy very low funding spreads (relative to risk free government securities) in both money and long term debt markets. These low spreads are consistent with the 'Sinn hypothesis', they indicate that banks were not being penalised by investors (in terms of higher funding costs) for the degree of risk they were taking on. But these low levels of spreads are equally consistent with an alternative: that banks and other market participants were simply unaware of the level of risks they were taking. In particular that bank management, bank shareholders and other investors may simply have grossly underestimated the shortcomings of their own risk models and of their processes of internal control; or of the potential for 'endogenous' magnification of risk as investors withdrew from markets and reduced available credit and liquidity.²

The results reported here help distinguish these two hypotheses. They reveal that the Sinn hypothesis is inconsistent with the standard one-period contingent claims analysis of bank liabilities.

The implied value of the put option held by bank shareholders prior to the crisis has been far too small to compensate for the losses subsequently experienced by shareholders. If shareholders were deliberately 'risk shifting' the risks they were transferring to tax-payers were not the normal business and financial risks that materialise gradually over time and hence can be measured by observations on fluctuations of bank share prices over a horizon of a few months.

It may of course be that this simple one-period contingent claims model is itself not appropriate for capturing risk shifting. A different model – for example one in which risk materialises suddenly and catastrophically rather than gradually over time – might be consistent with risk-shifting by banks prior to the crisis. But this in turn suggests that to contain bank risk shifting, regulators should focus their attention not on containing normal business and market risks (the focus of both Basel II and subsequently of Basel III) but on addressing the readiness of banks to withstand sudden catastrophe.

The paper is organised as follows. Section 2 reviews prior literature. Many previous studies have explored the analogy between put option and the bank safety net. Indeed this analogy is one of the major insights offered by economists into the design of banking regulation. There certainly are circumstances where the provision of tax payer support creates an opportunity to take risk, for example in the 'gamble for resurrection' undertaken by many US Savings and Loans in the 1980s once their solvency had been undermined by their exposures to interest rate risk. But there are other offsetting incentives that can lead banks to limit their risk taking, most notably the loss of franchise or charter value in the event of bank failure. There is also a substantial econometric literature, some of which employs a similar contingent claims framework as that used in the present paper, considering how market based information can be used as an indicator of bank fragility and for quantifying the incentives for risk shifting.

Section 3 examines the behaviour of distance to default for the largest global banks during the crisis. It first describes the calculation of distance to default, and the data based used for this purpose covering the 41 largest global banks and credit institutions, as of end-2006. It then presents a summary descriptive analysis of the resulting measures of distance to default, considering how it evolved over the years of the crisis, and reporting the value of the 'put option' as implied by the contingent claims model.

Section 4 presents some simple econometric tests of the ability of distance to default to predict problems during the crisis. This finds that, based on information available in 2006 or in 2007, distance to default has little forecasting value in cross-sectional regressions of either share price declines or of bank failure. But using more recent information from the first half of 2008 then distance to default is a significant predictor of default in the second half of the year. Section 5 draws conclusions, arguing that attributing the global financial crisis to incentives on shareholders is an oversimplification. A full account of the crisis cannot of course ignore incentives on bank managers and shareholders, but it also has to take account of the system wide interactions which so unexpectedly magnified the crisis and which, inevitably, are not included in a single bank risk measure such as distance to default.

2. Market based measures of bank risk: theory, evidence and relevance to the recent crisis

This section reviews the literature on the contingent claims model of bank assets and liabilities and of the use of market based indicators of bank risk, in particular distance to default, as a measure of bank risk exposure and a predictor of financial distress.

¹ Sinn (2010) also attributes the crisis to other causes, notably to poor standards of credit assessment in US sub-prime mortgage lending and to failures of both regulators and rating agencies to identify the scale of prospective risks.

² Such mechanisms are stressed in other accounts, for example (Brunnermeier, 2009; Milne, 2009).

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