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Pricing of commercial real estate securities during the 2007–2009 financial crisis[☆]

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ABSTRACT

We study the relative and absolute pricing of CMBX contracts (commercial real estate derivatives) during the recent financial crisis. Using a structural CMBX pricing model, we find little systematic mispricing relative to REIT equity and options. We do find short-term deviations from this relative pricing relationship that are statistically and economically significant. In particular, the CMBX market temporarily overreacts to news announcements. We provide evidence that this temporary mispricing is caused by price pressure due to hedging activities. Finally, an absolute pricing analysis provides no substantial evidence that CMBX contracts traded at fire sale levels during the crisis.

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1. Introduction

In this paper we provide a detailed analysis of the pricing of CMBX contracts, which are credit default swaps on a portfolio of Commercial Mortgage-Backed Securities (CMBS). In particular, we study to what extent this asset-backed securities market was affected by the recent financial crisis. While it is well documented how the market for residential mortgage-backed securities has collapsed, with these securities trading at fire sale levels, there is less work on the performance of the market for commercial real estate derivatives during the crisis period. In addition, we study whether investors overpriced senior CMBX tranches before the crisis. Coval, Jurek, and Stafford (2009a) argue that investors overpriced tranched securities because they relied on credit ratings instead of systematic risk.

We address these issues in two ways. First, we perform a relative pricing exercise. In contrast to residential mortgage-backed derivatives (like ABX contracts), for CMBX contracts there is a closely related and liquid asset class, Real Estate Investment Trusts (REITs), with both stock and option data. Given that we have reliable daily CMBX price data, this makes the commercial real estate market an ideal place to study the pricing of mortgage-backed securities. We therefore develop a pricing model to evaluate CMBX prices relative to stock and option prices of REITs

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and the Standard & Poor's (S&P) 500 index, and use this model to empirically test for the existence of relative mispricing. Our relative pricing exercise allows us to test for both long-term and short-term mispricing in the CMBX market, most importantly by analyzing whether CMBX and REIT returns can be predicted by the degree of relative mispricing and by studying mispricing around news announcements.

Of course, it is possible that CMBX and REITs are priced "correctly" relative to each other, even when both assets are mispriced in terms of their absolute price levels. Therefore, our second analysis focuses on the absolute pricing of CMBX contracts. To this end, we adjust our CMBX pricing model for potential mispricing of REITs. We do this by using NAVs (net asset values) of REITs as input to the pricing model, instead of equity market values of REITs. In an additional exercise, we study the commercial mortgage default rates that are implied by CMBX prices and compare these to historical default rates.

To illustrate the contracts and pricing, consider Fig. 1. The price of a CMBX contract is quoted as $100 minus the price of protection on $100 notional, and Fig. 1 plots the price for the CMBX 1 AA index, which references a portfolio of 25 CMBS tranches which insure losses between 10.5% and 12.5% on the underlying portfolio. At the lowest price of $19.60 on April 15, 2009, it cost $80.40 per $100 notional to insure losses on the CMBS bonds.

The first key result of this paper is that we find little evidence for persistent relative mispricing between CMBX contracts and REITs. Actual CMBX price levels are, overall, reasonably in line with prices implied by an option-based CMBX pricing model, calibrated to equity and option prices for REITs and the S&P 500 index. For the AA tranche this is illustrated by the dashed line in Fig. 1. In particular, we neither find evidence that investors overpriced these high-rated securities before the crisis nor that fire sales led to prices that were too low during the crisis.

The second key result of this paper is that our pricing model shows that over shorter horizons, there are temporary deviations from this relative pricing relation: the CMBX mispricing predicts subsequent CMBX returns, and a trading strategy that exploits this temporary mispricing earns abnormal returns that are statistically and economically significant. We show that this evidence of short-term inefficiencies is robust to various parameter settings for the pricing model. We also provide evidence that suggests that this temporary CMBX mispricing is due to hedging pressure by banks hedging their commercial real estate exposure.

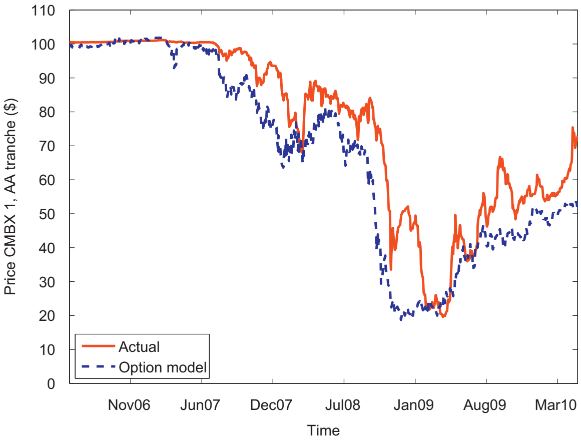

Fig. 1. Actual and model price CMBX 1, AA tranche. The figure shows the actual prices for the CMBX 1, AA tranche from May 31, 2006 to April 29, 2010. It also shows prices based on our CMBX pricing model, using REIT equity market prices. The CMBX 1 series was introduced March 7, 2006. We lack the data for the first two-and-a-half months.

Our third key result is that we do not find evidence for substantial absolute mispricing. This conclusion is reached on the basis of two analyses. First, instead of inserting REIT equity prices into our CMBX pricing model, we use net asset values (NAVs) of REIT equity (as reported by Green Street Advisors). These NAVs are supposed to measure the "fundamental" value of REIT equity, and differ from market prices if REIT equity is mispriced in the market. We find that using the NAV instead of REIT equity prices as input to the model does not lead to very different model prices. The NAV and REIT equity prices do differ substantially during the peak of the crisis, but in this period the model price of the CMBX tranches considered is not very sensitive to the REIT asset value, in a similar way that an out-of-the money option is not very sensitive to changes in the underlying price (low delta).

In addition to this NAV-based analysis, we study default rates implied by CMBX prices and find that these are not excessively high compared to historical default rates. In sum, although CMBX prices went down substantially during the crisis period, it does not seem to be the case that these contracts traded at fire sale prices. Interestingly, Stanton and Wallace (2011) study derivatives based on subprime residential mortgage-backed securities (ABX indexes) and find strong evidence that actual prices were too low and inconsistent with any reasonable choice of mortgage default rates.

Our model is set up as follows. The value of a commercial property is driven by exposure to stock market returns, sector-level property returns, and idiosyncratic shocks. The model includes the three main commercial property sectors: retail, apartment, and office. Defaults on commercial mortgage loans occur whenever the property value is below a default threshold at maturity (hence, for simplicity, we abstract from term defaults). We calibrate the model each day to data on stock index (S&P 500) returns and option prices, and REIT equity returns and option prices for 15 REITs in the different sectors. Our calibration approach extends the standard way of calibrating Merton's (1974) firm value model to equity values and volatilities (see, for example, Vassalou and Xing, 2004). We do not use data on the underlying CMBS contracts since these are not liquidly traded. We then price the CMBX contracts. Importantly, we do not calibrate any parameters to the CMBX prices, which allows for a clean and transparent analysis of relative pricing. CMBX contracts are priced by simulating property values for the pool of loans and assessing the loss distribution due to loan defaults. We recalibrate the latent property values, volatilities, correlations, and stock-market exposure each day.

We focus our empirical analysis on three liquid CMBX series 1 tranches: the AJ tranche, which insures portfolio

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