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The Low-Rated CMBS Market: Mortgage REIT, Financial Innovation and Policy  
Lessons from the Asian and Russian Financial Crisis

By

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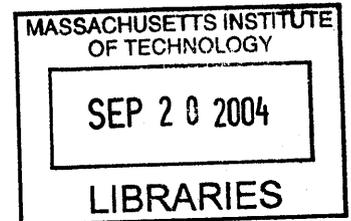
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Development and Master of Science in Urban Studies and Planning

**ABSTRACT**

As one of the most important financial innovations in 1990s, Commercial Mortgage-Backed Securities (CMBS) have provided significant amounts of financing for commercial real estate. However, when the Asian and Russian financial crisis hit in 1998, the low rated CMBS market almost dried up and one of the dominant investors Criimi Mae went to Chapter 11 for protection. This study investigates the events systematically from the perspectives of market structure and product development in the context of financial crisis. We found that the private and illiquid market structure and the short term marked-to-market repo financing together resulted in the disequilibrium of the low rated CMBS market during the financial crisis. Information efficiency and more resilient financing mechanism are needed to mitigate the conflicting interest between issuers/underwriters and investors of low rated CMBS.

Thesis Advisor: William C. Wheaton  
Title: Professor of Economics

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This thesis is dedicated to my parents who have provided me with never ending support.

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## **1. INTRODUCTION**

### **1.1 RESEARCH OBJECTIVES**

This study focuses on the development of low rated CMBS (Commercial Mortgage-Backed Securities) market and its relationship with the dominant buyers on that market – mortgage REIT. Some mortgage REITs were created by investment banks who underwrote and issued CMBS and also provided repurchase (repo) debt for those mortgage REITs to buy the low rated CMBS. This mechanism did help the development of the low rated CMBS because these securities, unlike the investment grade CMBS, are highly risky and hard to be marketed to traditional investors due to information asymmetry. Although there is still difference between market yields of equally rated, equal-maturity CMBS and corporate bond, the yield spreads tend to narrow gradually over time. However, the financing linkage between the investment banks and mortgage REITs through the short term repo debt turned out to be very fragile during the Asian and Russian financial crisis. The financial crisis resulted in a general “flight to quality” on the capital market, which in turn led to dramatic yield increase on bond and CMBS market. In particular, the yield spreads between the low rated bond and CMBS widened most and the low rated CMBS market almost dried up. CMM, the biggest mortgage REIT on the low rated CMBS market, incurred so much losses that it had to apply for Chapter 11 protection.

This study attempts to investigate and analyze the events systematically. There are three major objectives: 1) empirically test the cointegration relationship between CMBS market and bond market and the impacts of Asian and Russian financial crisis; 2)

examine if there is granger causality relationship between the CMBS product market and financing market during the Asian and Russian financial crisis; 3) analyze the conflicting interest between the investment banks and the mortgage REITs and derive economic and policy lessons from the financial crisis accompanied by proposed suggestions.

## 1.2 CMBS DEVELOPMENT AND REAL ESTATE MARKET

As one of the most important financial innovations in 1990s, CMBS has experienced explosive growth by not only providing capital and liquidity to the commercial real estate market but also creating structured financial instruments for heterogeneous real estate investors. Its significant role in financing commercial real estate can be illustrated in the following four quadrant table.

Table 1: Financing Sources of Commercial Real Estate in the U.S

	Equity	Debt
Private	<ul style="list-style-type: none"> <li>▪ Direct property investment</li> <li>▪ Pooled funds Co-investments</li> <li>▪ (Pension funds, Life co's)</li> <li>▪ Approximately \$3~4 trillion</li> </ul>	<ul style="list-style-type: none"> <li>▪ Mortgages</li> <li>▪ (Commercial Banks, Life Co's, Savings)</li> <li>▪ Approximately \$1.5 trillion</li> </ul>
Public	<ul style="list-style-type: none"> <li>▪ REITs</li> <li>▪ Real estate operating co's</li> <li>▪ Market cap \$223 billion*</li> </ul>	<ul style="list-style-type: none"> <li>▪ Secured CMBS \$275 billion</li> <li>▪ Unsecured REIT debt \$50 billion</li> <li>▪ Market cap \$325 billion</li> </ul>

Source: CSFB, 2003;\* NAREIT (www.nareit.com)

The CMBS market was developed in the 1990s in response to overbuilding in the commercial property markets. Many of the mortgages secured by commercial real estate were financially distressed and owned by institutional investors who demanded liquidity. CMBS, whose cash flows are derived from a pool of mortgages, provided an exit. The idea with CMBS is to create securities and allocate cash flows from the mortgage pool in such a way that credit risk is shifted away from certain securities and toward other securities. The lower-risk/higher credit-rated (investment-grade) securities are relatively easy to market, since they are less information-sensitive and are eligible for consideration by institutional investors such as pension funds. However, the higher-risk/lower credit-rated securities are highly information-sensitive and difficult to market to outside investors. Finding a ready market for these securities was crucial to the continued development and success of this highly profitable financial innovation, since substitute markets existed for mortgage product and security issuer/underwriters did not wish to retain the high-risk tranches. Mortgage REITs, which is supposed to have real estate mortgage expertise, became the dominant players on the low rated CMBS market. With the assignment of ratings from rating agencies to CMBS with different levels of risk, the pool of potential CMBS investors expanded greatly. The rapid growth and development of CMBS market is illustrated in Figure 1. The CMBS issuance has increased from \$5 billion in 1990 to about \$100 billion in 2001 and 2002. The total amount of CMBS is over \$300 billion up to date.

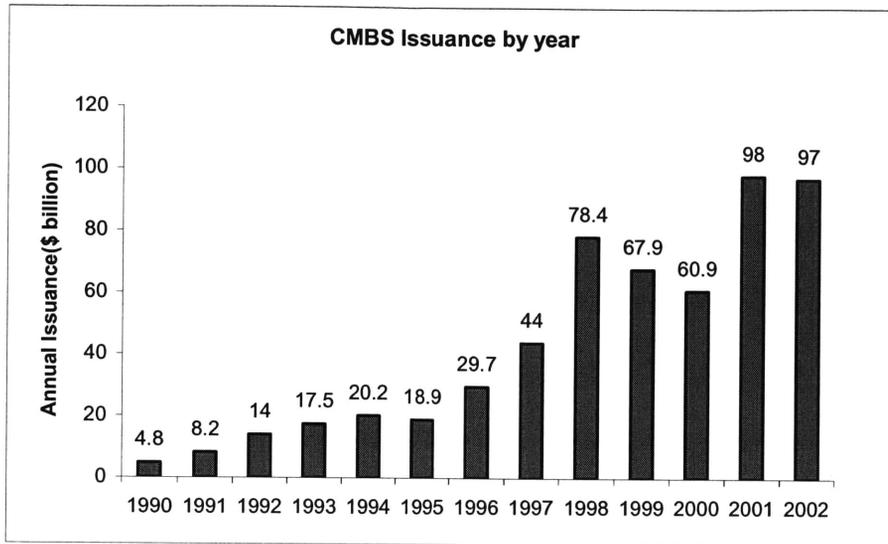


Figure 1: CMBS issuance 1990-2002

### 1.3 ASIAN AND RUSSIAN FINANCIAL CRISIS

Asian and Russian financial crisis in 1997~1998 is regarded as the most disastrous financial shock to the world economy in 1990s. The stock and bond market in the US were affected as the contagion spread quickly throughout the world. As we can see from the following figures, the S&P 500 index dropped dramatically in August 1998 and S&P industrial bond spreads soared at the same time. Obviously, the lower rated the bond, the higher jump there was. However, the stock market went back to its original booming trend at the end of 1998. It took a bit longer for the low-rated bond market to recover but even the spreads of BB- and B industrial bond started to drop immediately after the shock in August 1998 and went back to pre-crisis levels before the mid of 1999.

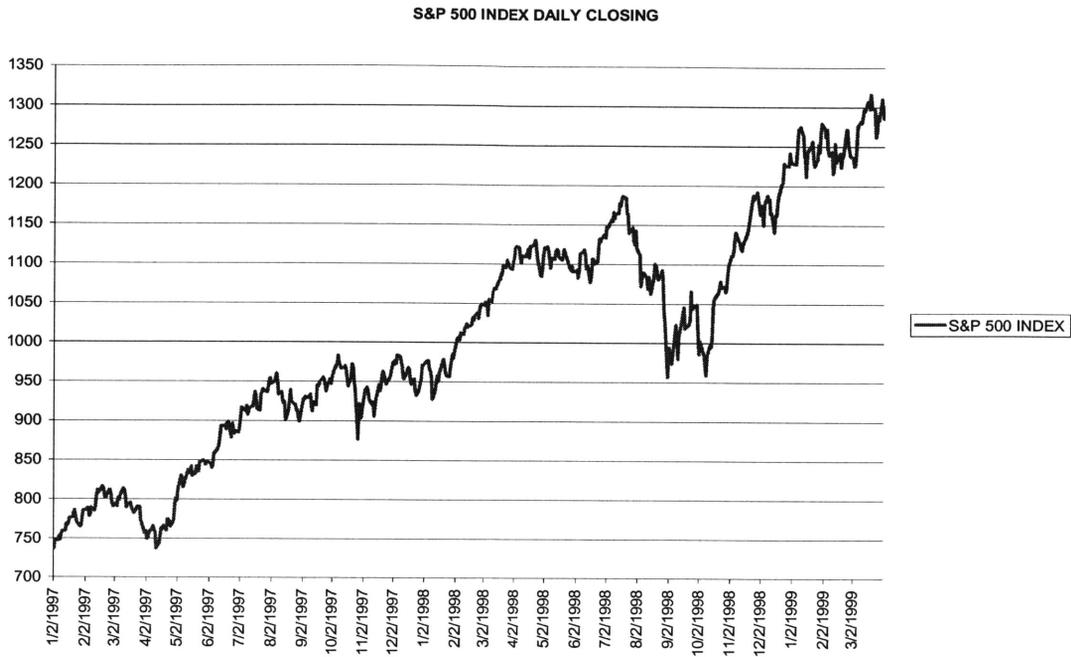


Figure 2: S&P 500 Index (Daily Closing)

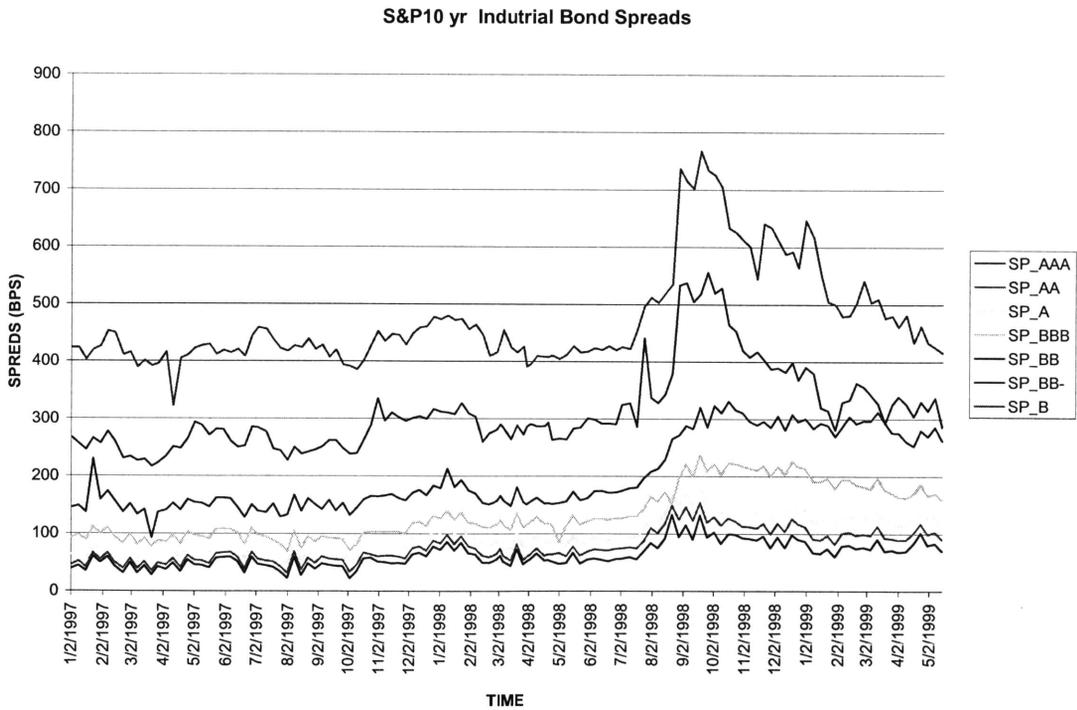


Figure 3: S&P 10 year Industrial Bond Spreads (over 10 year Treasury)

The Asian crisis started in mid-1997 and affected currencies, stock markets, and other asset prices of several East Asian economies. Until 1996, Asia had attracted almost half of total capital inflow to developing countries. However, Thailand, Indonesia and South Korea had large current account deficits and the maintenance of pegged exchange rate encouraged external borrowing and led to excessive exposure to foreign exchange risk in both the financial and corporate sectors. In July 1997, Thai baht was successfully attacked. Within next month, Malaysia, Philippines and Singapore were hit by the crisis and within the next half a year contagion spread out to Indonesia, Hong Kong and Japan. Currency pegging systems in those countries were abandoned and their currencies depreciation followed accompanied by the financial system crash and series of macroeconomic problems.

The Asian crisis to certain extent contributed to the Russian crisis. Russian economy was excessively dependent upon a sound global economy, as its capital flow model was based primarily on the existence of a demand for exports. When the currency crisis plagued Asian countries, though, Russia found that its strategy of using international investment to provide the fuel for internal growth was potentially doomed. The crisis in Asia resulted in plummeting prices for Russia's two most valuable sources of capital flows: energy and metals. Still a fragile economy, the rapid decline in the value of those two capital sources catapulted the entire economy into chaos: GDP tumbled, unemployment soared, and perhaps most painful, investors liquidated their Russian assets. The result was that the government was simply unable to pay back the debts it had issued, and IMF intervention was necessary. On August 17, 1998, Russia announced the float of the Ruble and the

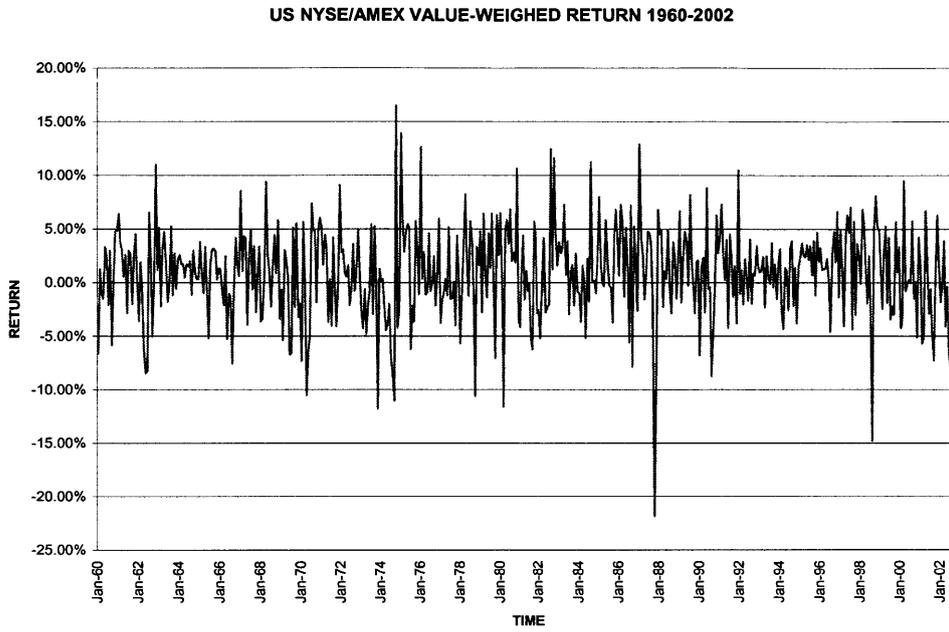
restructuring of its debt maturing before Jan 1, 1999. Later in 1998, Russia restructured more of its debt, defaulted on some part of it and imposed currency controls. Interest rates were over 100% in late 1998, banks were failing and prices were growing uncontrollably.

Eichengreen (1999) summarized five lessons from the crisis that are related to current account deficits, the short-term financing of current account, weak banking regulation, and exchange rate policy. However, the last but the most important lesson might be “ it will not always be possible to prevent or predict financial crisis.” In fact, this is one of the reasons that we feel it necessary to implement this study in the context of financial crisis. We need to be aware of this uncertainty all the time when we are developing the financial product market and designing financing mechanism. The shocks to financial market and their frequency in the past half century are shown in Figure 4 and 5 as follows.

#### **1.4 SUMMARY OF FINDINGS**

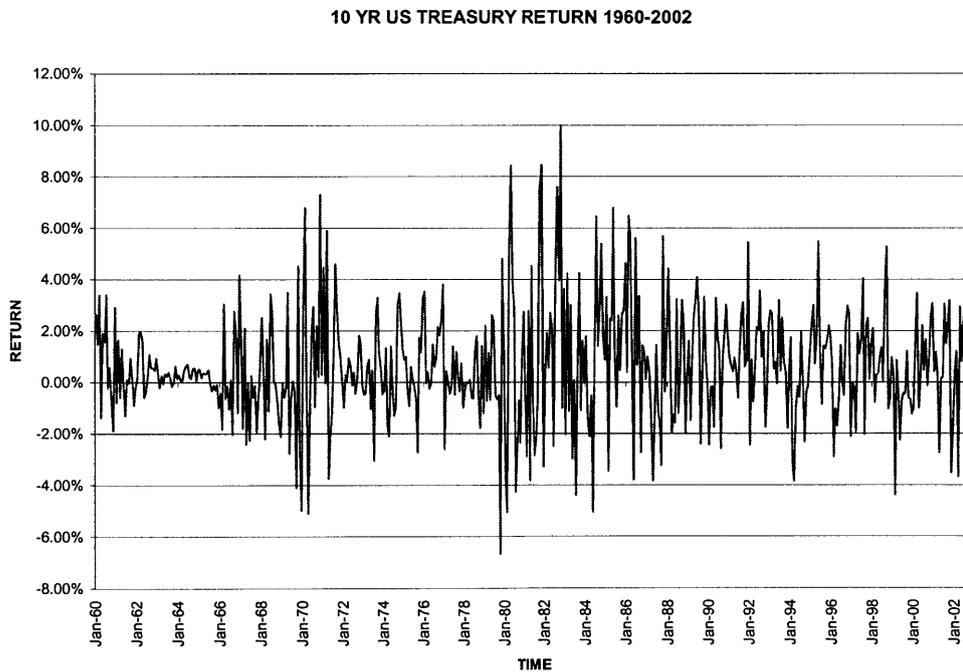
This study examines the low rated CMBS market and its relationship with mortgage REITs in the context of Asian and Russian financial crisis. In this course of analysis, we specifically focus on a single dominant investor on low rated CMBS market known as Crimmi Mae (CMM).

We found that investment grade CMBS market was cointegrated with the bond market throughout the sample period even during the Asian and Russian financial crisis.



Source: CRSP Indices and Deciles.

**Figure 4: US NYSE/AMEX Valued-weighted Return 1960-2002**



Source: CRSP Indices and Deciles.

**Figure 5: US 10 year Treasury Return 1960-2002**

However, the low rated CMBS market diverged from the bond market dramatically since the financial crisis hit. The widened gap between the yield spreads of low rated bond and CMBS, not like that of the investment grade securities, didn't tend to narrow even after the crisis. This implies that the expected long run equilibrium between the low rated CMBS and bond changed due to the negative shock. In other words, low rated CMBS behaved differently from the equally rated and equal-maturity bond. Secondly, the hypothesis that there is significant causality impact from the shock on financial market to the CMBS product market is confirmed by Granger causality test. The significance of the effect was highest during the financial crisis with a lag of one to two weeks. The interpretation is that the illiquid and uncompetitive low rated CMBS market structure together with the inefficient repo debt contract caused the disequilibrium of innovated financial product market. Finally, the benefits and costs of the short-term repo financing mechanism between the investment bank and mortgage REIT are addressed and we propose more resilient financing and market structure so that the conflicting interest problems can be mitigated.

## **2 THE LOW RATED CMBS MARKET**

### **2.1 MARKET BACKGROUND**

The decade of the 1990s was characterized by financial market globalization, integration and innovation. US investment banks facilitated this development by creating a broad array of new securities and marketing these financial products to traditional as well as non-traditional investors. Many of the least standardized, least liquid and riskiest securities were marketed to non-traditional investors such as hedge funds and the like.

Many of these non-traditional investors were less closely monitored and regulated than the larger institutional money sources such as commercial banks, pension funds and mutual funds. During this time of significant innovation and change, global financial markets were buffeted with a series of shocks that are generically known as the Asian and Russian financial crises. A number of the non-traditional investors who helped facilitate financial market innovation and development – most prominently Long-Term Capital Management (LTCM) – were mortally wounded by these financial crises, and the several of the investment banks that marketed these securities were seriously injured as well.

A significant reason why US investment banks were so seriously damaged by these shocks (particularly by the Russian financial crisis) is that they were financing many non-traditional investors as well as selling them financial products, the returns from which were closely correlated with global financial market performance. When these crises hit, financial asset prices declined dramatically to result in a nearly fatal one-two punch to investment banks: i) investment bank customer bases for innovative and highly profitable

financial products dried up and, more seriously, ii) the value of the debt that was collateralized by previously issued securities declined dramatically as asset prices fell in unison.

This started a classic feedback process in which panicked investment banks worsened the situation by calling in their debt, thereby forcing investors to liquidate their positions when current market values were well below fundamental asset values, thereby pushing market prices even lower. If it weren't for centralized intervention by the Federal Reserve (in the case of LTCM) and bankruptcy courts (in the case of certain smaller non-traditional investors), this "rush to the exits" by investment banks may have brought the global financial market to its knees (or even worse).

## **2.2 THE LOW RATED CMBS MARKET AND MORTGAGE REIT CMM**

Although the basic story described above has been told in the popular press, there is a gap in the academic literature in terms of systematically analyzing the rise and fall of 1990s-style financial innovation and product development. A dearth of micro-level analysis is in large part due to a lack of publicly available information. Although most or all of the innovative financial products developed in the 1990s can be identified, they are difficult to catalogue and analyze due to the dispersed nature of their distribution and ownership. Moreover, investment banks are notoriously proprietary when it comes to sharing detailed information with outsiders about their products and customers. In addition, many of the firms who invested in these products were private (e.g., LTCM) and hence under no obligation to publish balance sheet information and other useful data.

In this study we will focus on a representative financial product and market structure for which data are readily available: the commercial mortgage-backed security (CMBS). The dynamics of this product market are similar to those of other developing markets during the 1990s, with the advantage of data availability and relative ease of identification due to a focus on a single market. The CMBS was marketed by investment banks to a number of non-traditional but publicly traded firms known as mortgage REITs. In the course of our analysis we specifically focus on a single dominant investor known as Criimi Mae (CMM).

During the mid-1990s, a number of mortgage REITs were offered to the public by investment banks who also underwrote and issued CMBS. Mortgage REITs are allowed to invest in standard mortgage products and structured securities such as CMBS. Several of the mortgage REITs, including CMM, focused on investing in low rated CMBS. Coincidentally, over the 1996-98 time period, which bracketed the Asian and Russian financial crises, many investment banks who were selling their lower-rated CMBS to mortgage REITs also provided significant amounts of debt financing in form of repurchase (“repo”) debt to buyers of the securities.

As noted earlier, this is the type of debt was often used to finance LTCM and related non-traditional investors. Repo financing is secured debt with a typical maturity of 1-2 years that is marked-to-market frequently (e.g., daily or weekly) based on the value of the underlying collateral. When the value of the collateral declines, the lender can ask the borrower to post additional collateral to maintain a sufficient “margin of safety.” If the

borrower cannot or will not post additional security when the underlying collateral price declines, the lender may require the borrower to liquidate some or all of the collateral to meet the margin call. For mortgage REITs such as CMM, most of its assets are low rated CMBS that are also used as marked-to-market collateral for the short term debt. When investment banks panic and make margin calls due to the negative shocks, mortgage REITs have to sell part of the assets and convert them into safe cash or securities. If the assets have insufficient liquidity and particularly the mortgage REITs are actually the market of those assets, selling the assets would lead to even lower asset price and thus more margin calls. Ultimately, mortgage REITs have to go bankruptcy when the assets value drops below debt value.

In summary, investment banks created non-traditional, “arms-length” investment firms known as mortgage REITs that could be used to park their high-risk, hard-to-sell securities (lower-rated CMBS). Furthermore, they provided low-cost financing to these firms in the form of repo debt so that these firms could finance the purchase of these high-risk CMBS. At the first glance, both parties benefit from this transaction. Investment banks make profits by marketing the highly risky products and providing the lending; while mortgage REITs are able to acquire and service large amounts of low rated CMBS.

However, repo debt is indeed problematic as a mode of finance. First, there is a severe asset-liability duration mismatch, as the repo debt is very short-term due to its mark-to-market features, whereas low rated CMBS typically have expected maturities of 5-20

years. Second, these risky securities are highly illiquid. Indeed, at the time of the Russian financial crisis in 1998, CMM was the largest purchaser of low rated CMBS, and mortgage REITs dominated the market. Hence, requiring firms to sell collateral to meet margin calls when they are the market is a difficult proposition at best. Third, as was the case with LTCM, CMM and other mortgage REITs had several sources of repo debt, typically secured by collateral that was issued by the lender, which created common pool problems when margin calls were made and could not be met. Self interest and difficulties in coordination create incentives for repo lenders to “rush to the exits” through forced asset liquidation in order to sell their collateral faster than the others.

### **2.3 THE IMPACT OF ASIAN AND RUSSIAN FIANCIAL CRISIS ON CMBS MARKET AND CMM**

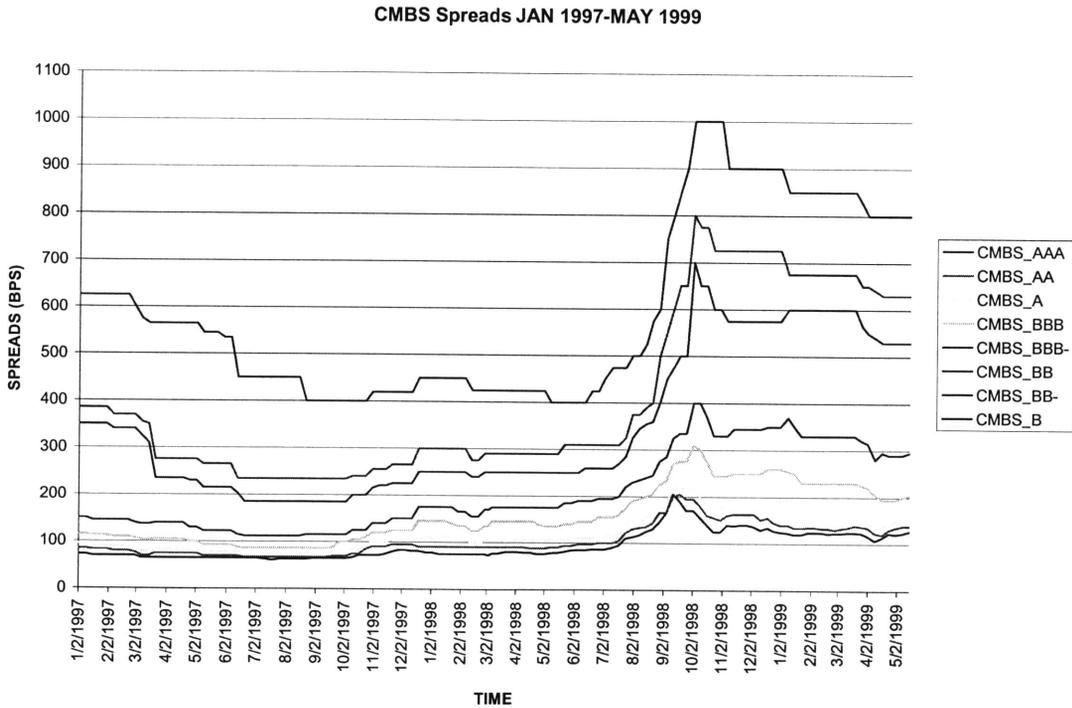
The impact of Asian and Russian financial crisis on the US CMBS market was tremendous as shown in Figure 6. The yield spreads of all CMBS jumped up dramatically after August 1998. The spreads of AAA rated CMBS increased by about 100 basis points within one month and the spreads of B rated CMBS soared from 500 to 1000 basis points.

The cause and effect in the high-risk end of CMBS market as a result of the Russian crisis was as follows. Russia defaulted on its bonds and devalued its currency to cause many investors, including LTCM and a number of commercial and investment banks, to incur significant unexpected losses.<sup>1</sup> A significant fraction of the adversely affected

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<sup>1</sup> Russia had well known problems for many months prior to its default, but the expectation was that Russia would be bailed out by the IMF and possibly the US government as had been case with countries involved

securities were owned or financed by investment banks, causing panic as these firms attempted to unwind their own positions and make margin calls on their repo debt positions. This dynamic contributed to a liquidity crisis in global financial markets, in which *all* risky (i.e., non-Treasury) debt securities incurred significant losses at the same time. Specifically, CMBS prices declined as the market for these securities evaporated, causing investment banks to make margin calls on their repo debt issued to mortgage REITs. This further precipitated declines in the market, since it was anticipated that CMM and others would have to liquidate their positions when there was no market for the securities.



Source: Lehman Brothers.

Figure 6: 10 year CMBS spreads (1997-1999)

in the Asian crisis. When the bailout failed to materialize, Russia defaulted to the surprise of many market participants.

The outcome of this vicious cycle was two-fold. First, CMM declared Chapter 11 bankruptcy in order to fend off repo creditors and prevent a disorderly liquidation of its assets. Thus, in many ways, CMM's fate mirrored LTCM's fate, except that the courts adjudicated the outcome rather than the Federal Reserve. Second, CMM and other mortgage REITs were fatally injured by this crisis, causing a sustained gap in the market for low rated CMBS. This slowed the development of the CMBS market, reduced investment bank profitability in the market, and changed the structure of the market. CMM's failure created a demand-shortage condition that continued to some extent and CMBS spreads had not returned to their pre-crisis level even a couple of years later. Interestingly, however, the crisis did not kill the CMBS market, as it provided a viable product and had matured "enough" prior to the crisis so that it could endure a crisis.

#### **2.4 COINTEGRATION TEST OF CMBS MARKET AND BOND MARKET**

We have been emphasizing the disastrous impacts of the financial crisis on low rated CMBS market. In fact, as we mentioned before, the whole bond market including the sector of investment grade securities in the US was struck by the financial crisis as well. However, we have noticed that although the yield spreads between bond and CMBS widened due to the crisis, the spreads were widened most for the low rated securities and it didn't tend to narrow even after the crisis. For the investment grade bond and CMBS, their yield spreads did rise but they drifted up consistently and drop back to pre-crisis level soon. While on the low rated bond and CMBS market, their yield spreads went up in a disproportional way and the widened gap continued to exist till the mid of 1999. This is illustrated in a series of graphs from Figure 7 to 15.

We are trying to compare the equally rated and equal-maturity S&P industrial bond and CMBS. For the investment grade securities (i.e., from AAA through BBB), the spreads of CMBS are higher than that of bond by 20-40 basis points. The difference reflects higher expected risk premium for the CMBS products than bond in general. The factors contributing to the risk premium include prepayment risk, conflict of interest between senior and junior tranches investors and other information asymmetry. Besides, CMBS market is less volatile than the bond market due to lower trading frequency. Specifically, the yield difference between investment grade CMBS and industrial bond is graphed in Figure 11. We can see that there was a huge jump-up in August and September of 1998 and then it leveled off gradually below 60 basis points.

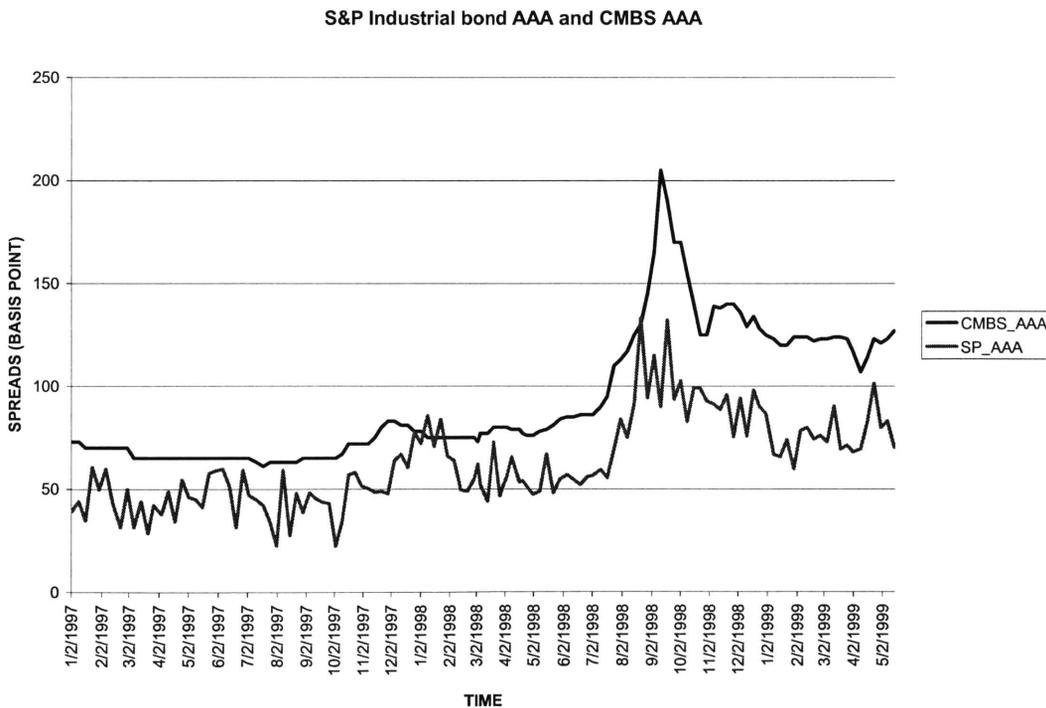


Figure 7: 10 year AAA S&P Industrial bond and CMBS spreads

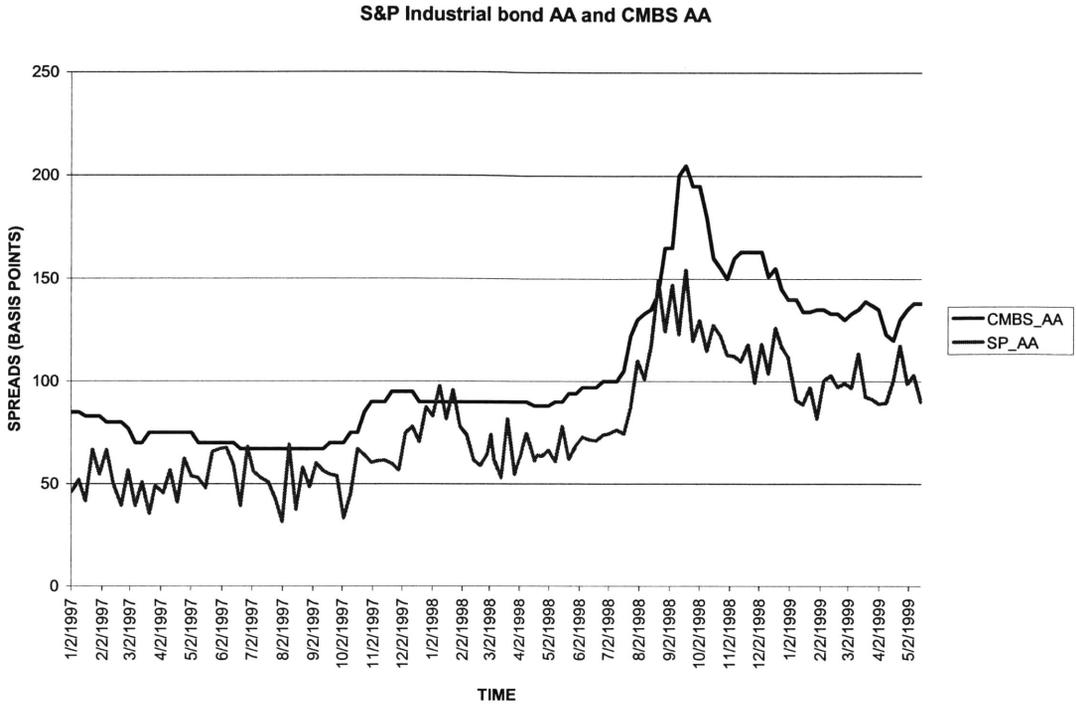


Figure 8: 10 year AA S&P Industrial bond and CMBS spreads

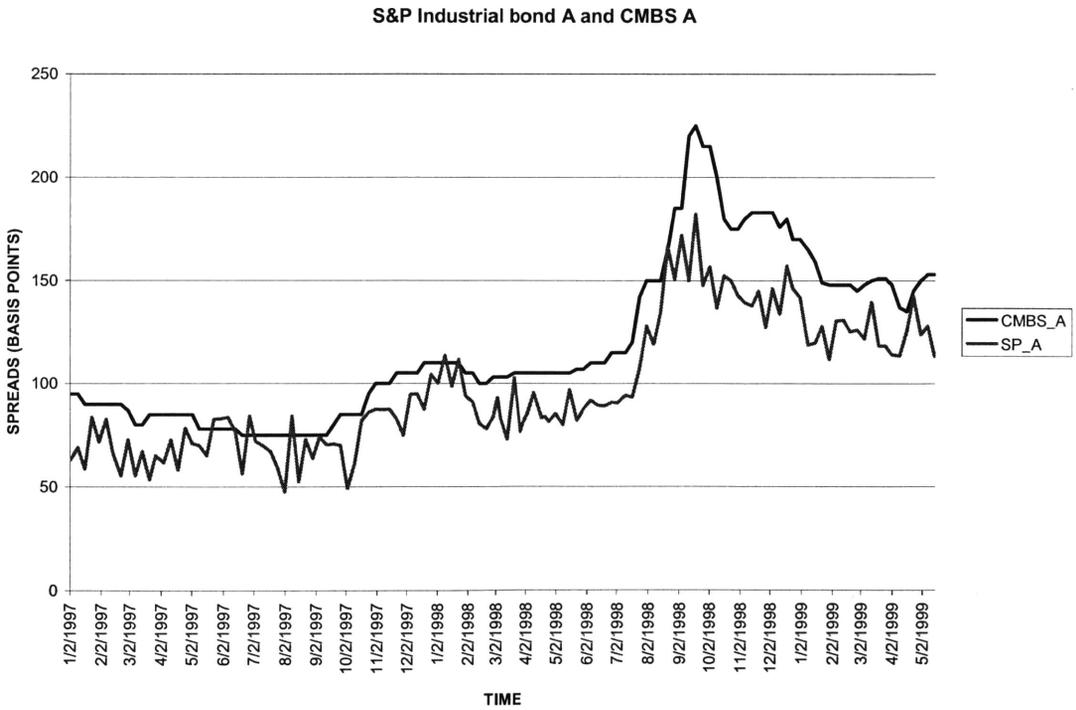


Figure 9: 10 year A S&P Industrial bond and CMBS spreads

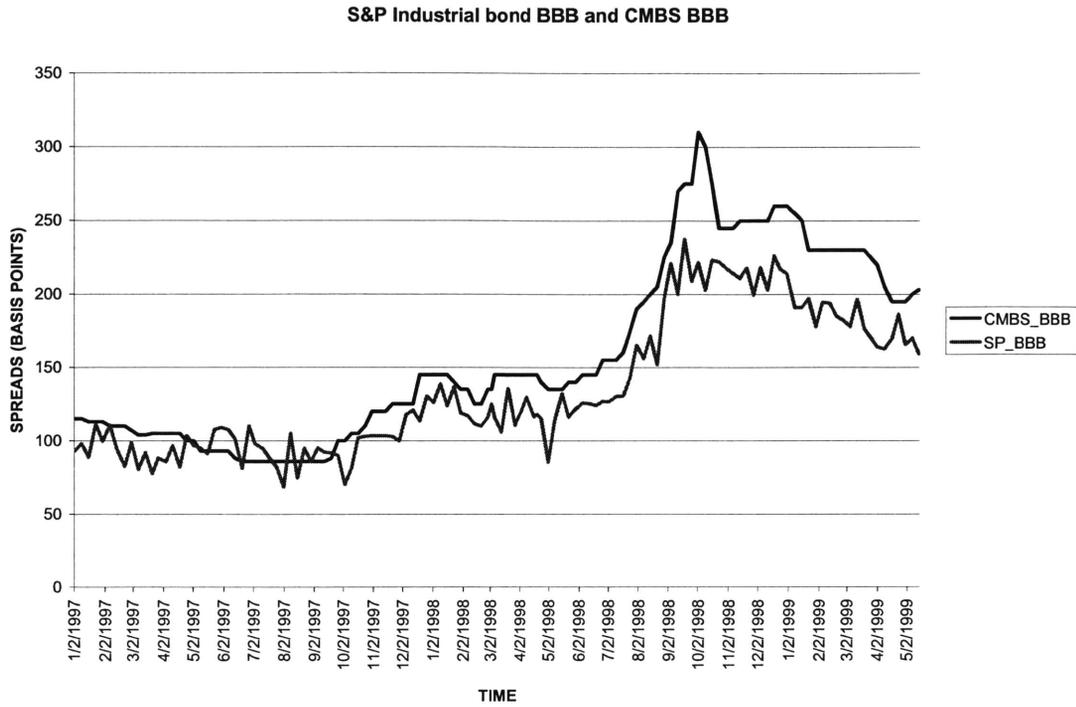


Figure 10: 10 year BBB S&P Industrial bond and CMBS spreads

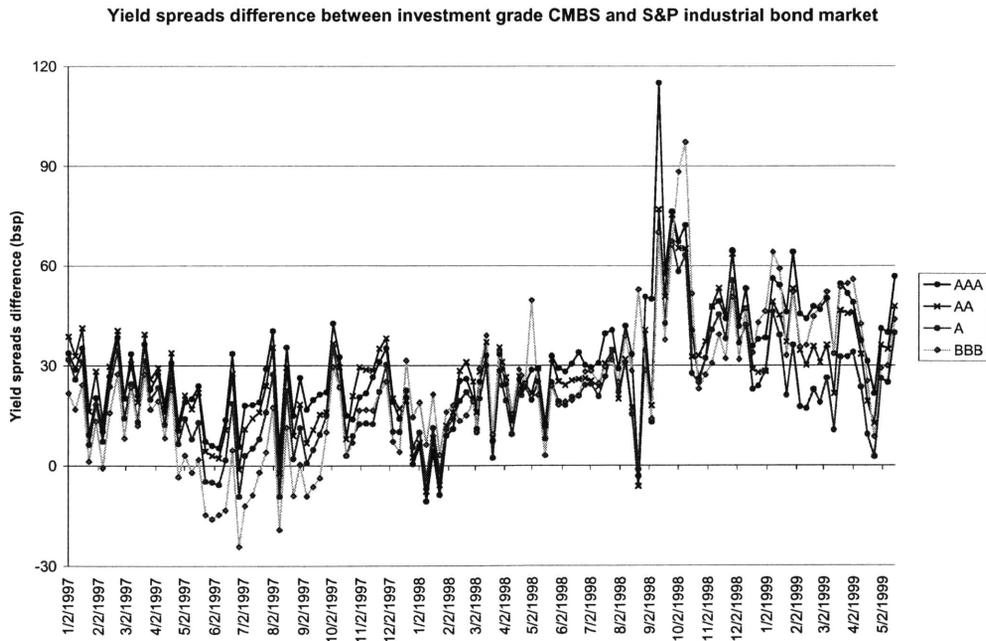


Figure 11: Yield Difference between Investment Grade S&P Industrial Bond and CMBS

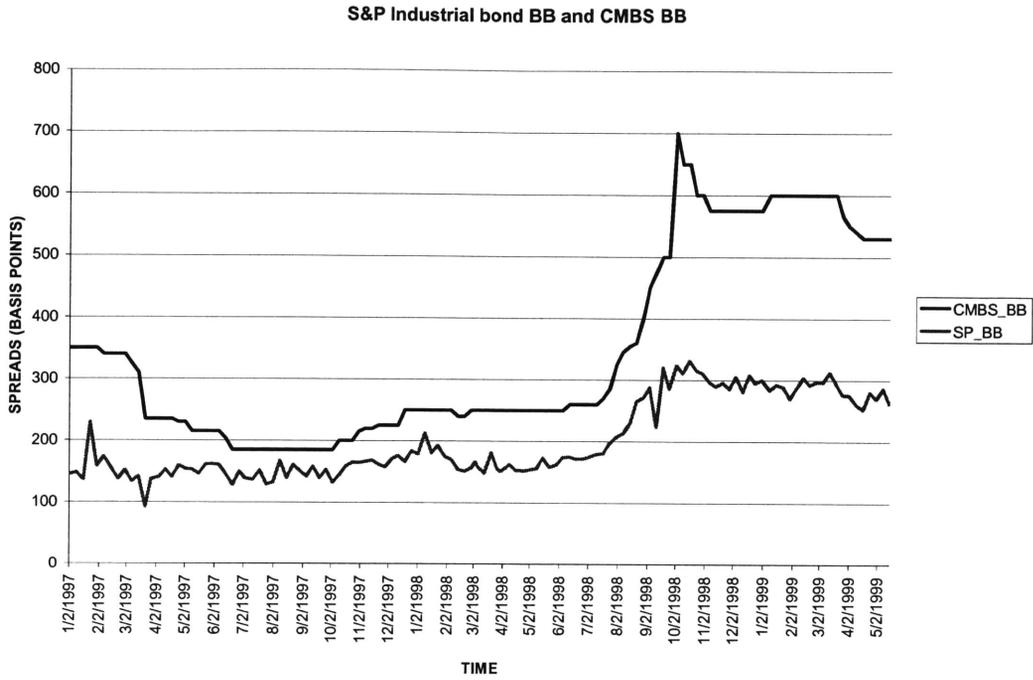


Figure 12: 10 year BB S&P Industrial bond and CMBS spreads

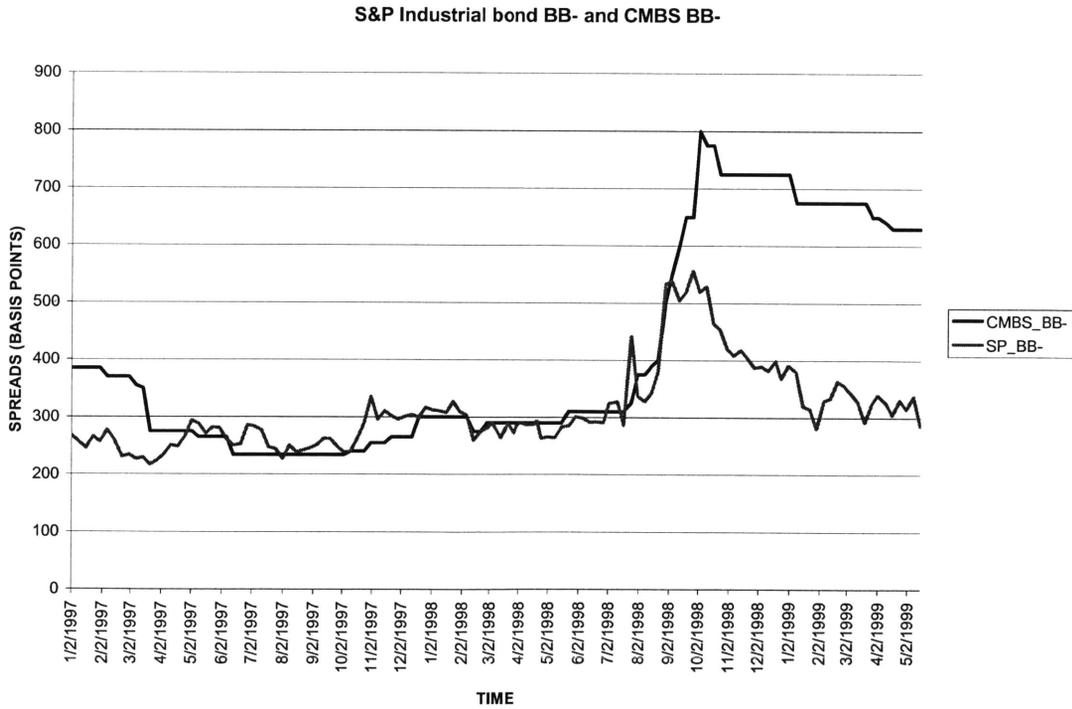


Figure 13: 10 year BB- S&P Industrial bond and CMBS spreads

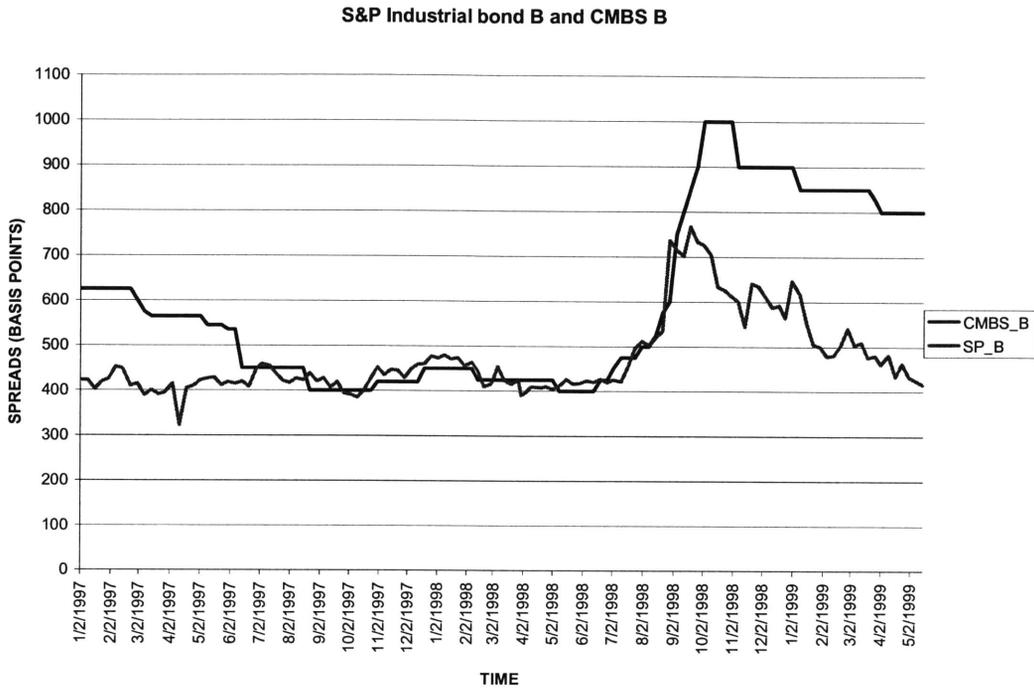


Figure 14: 10 year B S&P Industrial bond and CMBS spreads

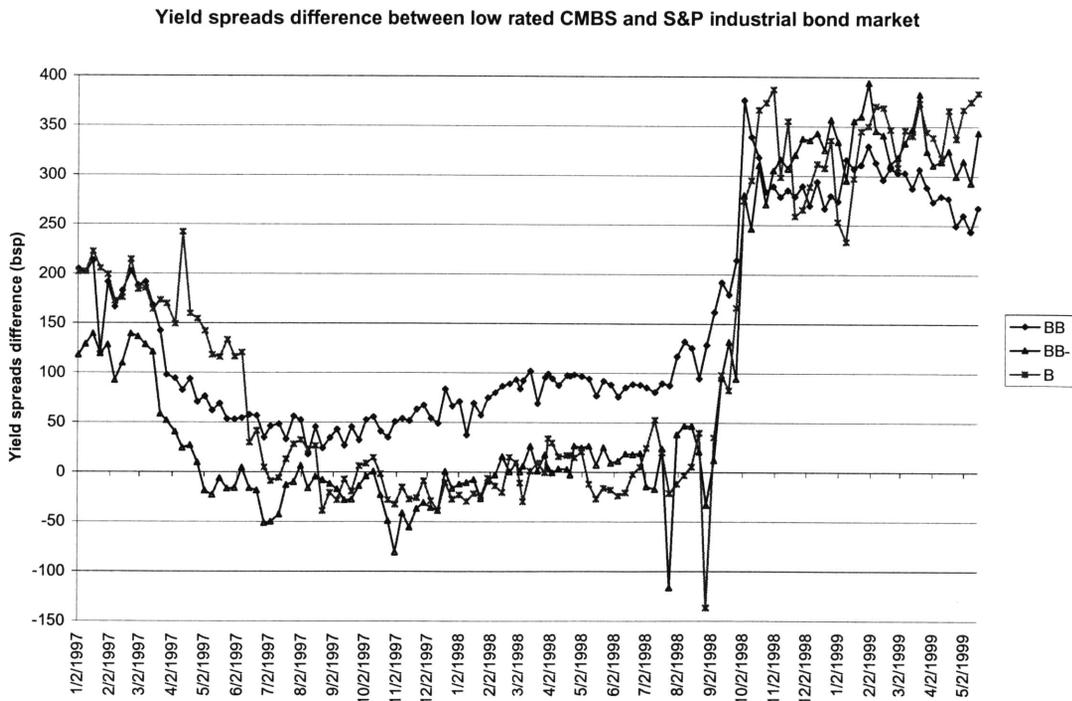


Figure 15: Yield Difference between Low Rated S&P Industrial bond and CMBS spreads

For the low rated CMBS and industrial bond, as indicated by Figure 15, the yield difference used to be about 100-200 basis points but then dropped below 100 basis points until the financial crisis drove it up to 350 basis points in August 1998. Afterwards, however, the yield difference was kept within a band of 250-400 basis points and did not tend to go down even after the crisis.

Given the different pictures for the investment grade and low rated securities, the question is: Is CMBS market cointegrated with the bond market? To what extent did the financial crisis affect or change the cointegration relationship between the two markets? How did the low rated CMBS/bond market respond differently from the investment grade CMBS/bond market to the negative shocks?

In order to empirically test the relationship of CMBS market and the bond market, we adopt cointegration test using the spreads on equally rated, equal-maturity CMBS and S&P industrial bond. In theory, the purpose of the cointegration test is to determine whether a group of non-stationary series/variables are cointegrated or not, or in other words, if there exists a long run equilibrium among the series/variables. Since CMBS are generally regarded as very similar to bond, we would expect that there exists long run equilibrium among the equally rated and equal-maturity securities.

#### **2.4.1 COINTEGRATION TEST THEORY**

There are two broad approaches for testing cointegration: Engler and Granger (1987) method and Johansen (1988) method. Step one of either of the two methods is to establish

that the variables are indeed integrated to the same order. The Dickey-Fuller test is used for this purpose. If the evidence suggests that the series/variables are integrated to different orders or not at all, then the specification of the model should be reconsidered.

The Engler and Granger method is based on assessing whether single-equation estimates of the equilibrium errors appear to be stationary. Let  $y_t$  denote the set of  $M$  variables that are believed to be cointegrated. If the cointegration rank of the system is  $r$ , then there are  $r$  independent vectors  $\gamma_i = [1, -\theta_i]$ , where each vector is distinguished by being normalized on a different variable. If we suppose that there are also a set of  $I(0)$  exogenous variables, including a constant, in the model, then each cointegrating vector produces the equilibrium relationship

$$y_t \gamma_i = x_t \beta + \varepsilon_t$$

which can be rewritten as

$$y_{it} = Y_{it} \theta_i + x_t \beta + \varepsilon_t$$

The consistency of the OLS estimators has been approved by a number of authors including Davidson and MacKinnon (1993). Thus the next step is to apply Dickey-Fuller tests to the residuals. If autocorrelation in the equilibrium errors is suspected, then an augmented Engle and Granger test can be based on the template

$$\Delta e_{it} = \delta e_{i,t-1} + \phi_1 (\Delta e_{i,t-1}) + \dots + u_t$$

If the null hypothesis that  $\delta = 0$  cannot be rejected, then we would conclude that the variables are not cointegrated.

The second approach, due to Johansen (1988) and Stock and Watson (1988), is based on the VAR approach. If a set of series/variables are truly cointegrated, then we should be able to detect the implied restrictions in an otherwise unrestricted VAR. We first formulate the VAR

$$y_t = \Gamma_1 y_{t-1} + \Gamma_2 y_{t-2} + \dots + \Gamma_p y_{t-p} + \varepsilon_{t-p}$$

The order of the model  $p$  has to be determined in advance. Let  $z_t$  denote the vector of  $M(p-1)$  variables,

$$z_t = \Delta y_{t-1}, \Delta y_{t-2}, \Delta y_{t-3}, \dots, \Delta y_{t-p+1}$$

$Z_t$  contains the lags 1 to  $p-1$  of the first differences of all  $M$  variables. With the  $T$  available observations, we have two  $T \times M$  matrices of least squares residuals:  $D$  ( the residuals in the regressions of  $\Delta y_t$  on  $z_t$ ;  $E$  ( the residuals in the regression of  $y_{t-p}$  on  $z_t$ ).

The squared canonical correlations are the ordered characteristic roots of the matrix

$$R^* = R_{DD}^{-1/2} R_{DE} R_{EE}^{-1} R_{ED} R_{DD}^{-1/2}$$

where  $R_{ij}$  is the cross correlation matrix between variables in set  $i$  and set  $j$ , for  $i, j = D, E$

The null hypothesis that there are  $r$  or fewer cointegrating vectors is tested using the trace test statistics. Large values give evidence against the hypothesis of  $r$  or few cointegrating vectors.

#### **2.4.2 COINTEGRATION TEST ON BOND AND CMBS MARKET**

We compared weekly CMBS spreads with equally rated and equal-maturity industrial bond spreads, for example, 10 year AAA-rated CMBS with 10 year AAA-rated S&P

industrial bond. Both Engle and Granger (1987) and Johansen (1988) methods are used and the results are summarized in Table 2.

We first of all did the cointegration test for the period before the Russian financial crisis (i.e., Jan 1997-Aug 1998) and found significant cointegration relationship on both investment grade and low rated CMBS and bond markets. However, when the financial crisis period (i.e., Jan 1997-June 1999) is included, the relationship between the low rated CMBS and bond changed. The percentage in the table denotes the percentage of the critical value at which the null hypothesis is rejected. For example, for AAA rated bond and CMBS, Engler and Granger test shows that the null hypothesis of no cointegration can be rejected at 10% critical value and Johansen test implies that Trace statistics indicates one cointegration equation at 5% critical value. There are some differences in terms of critical value for the two cointegration test methods. However, both tests in general produce the same results.

The implications from the cointegration test results are as follows. CMBS and bond markets are generally cointegrated with each other. The financial crisis did affect both market but did not substantially influence the equilibrium between investment grade bond and CMBS markets. However, the equilibrium between low rated CMBS market and equally rated bond market changed substantially due to the financial crisis. The conventional belief that low rated CMBS would perform very similarly as the other equally rated bond turned out not to be true in the context of financial crisis. This leads to a further question: It is reasonable that the low rated securities are more information-

sensitive than the investment grade securities due to more exposure to risks, but why was the low rated CMBS more vulnerable to the financial crisis than the equally rated bond? What is the driving force behind the change of the long run equilibrium between the low rated CMBS market and bond market?

**TABLE 2: COINTEGRATION TEST SUMMARY**

RATING	ENGLER-GRANGER TEST		JOHANSEN TEST	
	01/97-08/98	01/97-06/99	01/97-08/98	01/97-06/99
<i>AAA</i>	10%*	10%*	5%**	5%**
<i>AA</i>	1%***	1%***	1%***	1%***
<i>A</i>	1%***	1%***	1%***	1%***
<i>BBB</i>	1%***	1%***	1%***	1%***
<i>BB</i>	1%***	No	5%**	No
<i>BB-</i>	1%***	No	5%**	No
<i>B</i>	5%**	No	5%**	No

### **3 GRANGER CAUSILITY TEST BETWEEN LOW RATED CMBS AND MORTGAGE REIT CMM**

As mentioned before, there are some unique features on the low rated CMBS market that might be the reasons leading to the changes of the equilibrium. These features can be analyzed from two perspectives: market structure and product development.

From the perspective of market structure, the low rated CMBS market was an innovated product market with only a few dominant competitors. These products were mostly privately held rather than frequently and publicly traded. For instance, CMM was a dominant investor controlling above one third of the low rated CMBS. This would imply that the liquidity on this market was very limited. From the perspective of product development, the investors of low rated CMBS borrowed marked-to-market short term money from the issuers/underwriters and at the same time used the acquired low rated CMBS as collateral for the debts. Thus the low rated CMBS market might be affected by the financial crisis through the financing linkage.

Now we have a dominant mortgage REIT that controls over one third of privately held and illiquid low rated CMBS product market. On the other hand the mortgage REIT has stocks frequently and publicly traded on stock market. Besides, the linkage between product market and stock market is the fragile and sensitive marked-to-market short term repo debt. As we know, the two-fold impact from the financial crisis was that both mortgage REITs and CMBS products were fatally injured. Hence a question underscoring

the events is: Is there any lead-lag causality relationship between the markets? This is where Granger causality test comes in.

### **3.1 CMM'S DOMINANCE ON THE LOW RATED CMBS MARKET**

Before implementing the Granger causality test, it is helpful to analyze the CMM's situation since it is the specific mortgage REIT that we are focusing in the course of study.

Both CMBS and the re-emergence of REITs are the results of the real estate securitization trend in the 1990s. Mortgage REITs became significant buyers of subordinated CMBS product, which allowed so-called "conduits" (investment banks and commercial banks) to offer better mortgage pricing to borrowers, in competition with traditional portfolio lenders such as insurance companies and pension funds. By providing a market for the low-rated CMBS product, the investment banks could thereby sell virtually the entire CMBS product, including the higher-rated tranches that have an easier and more natural traditional market within the overall bond market. Mortgage REITs such as CMM became a key component that enabled the liquidity and feasibility of the entire CMBS capital supply. CMM had been adopting an aggressive investment strategy that captured around more than one third of the low rated CMBS market. It began purchasing low-rated CMBS in the second half of 1994. Based on the face value of CMBS, the mortgage REIT purchased a modest of 3% of the low-rated CMBS issued that year. In 1995, its purchases of low-rated CMBS increased over five-fold to 27%. From

1996 to 1997, the REIT purchased 24% and 31% of the new issuance value for low-rated CMBS respectively.

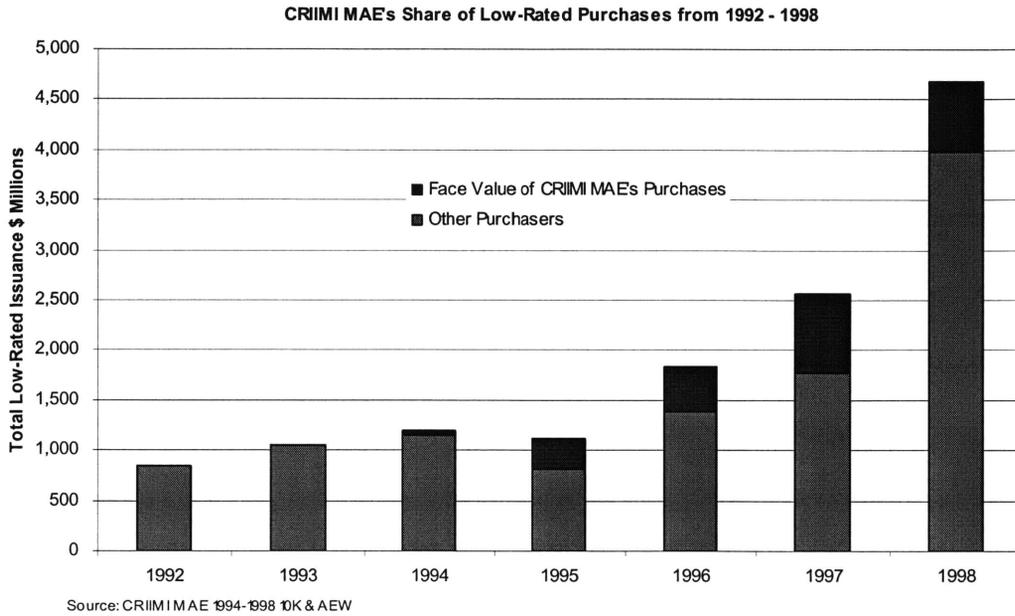


Figure 16: CMM's share of Low Rated CMBS Purchase 1992-1997

### 3.2 CMM'S RELATIONSHIP WITH CMBS ISSUERS/UNDERWRITERS

We pointed out before that CMM became the dominant buyer on the low rated CMBS market with the short-term repo financing provided by the CMBS issuers/underwriters. The players involved in the repo debt relationship can be illustrated by the following diagram (Figure 17). This structure had been working well before the financial crisis.

However, when Russia defaulted on its bonds and devalued its currency in 1998, this caused many investors, including LTCM and a number of commercial and investment banks, to incur significant unexpected losses. A significant fraction of the adversely

affected securities were owned or financed by investment banks, causing panic as these firms attempted to unwind their own positions and make margin calls on their repo debt positions. This dynamic contributed to a liquidity crisis in global financial markets, in which *all* risky (i.e., non-Treasury) debt securities incurred significant losses at the same time. Specifically, CMBS prices declined as the market for these securities evaporated, causing investment banks to make margin calls on their repo debt issued to CMM.

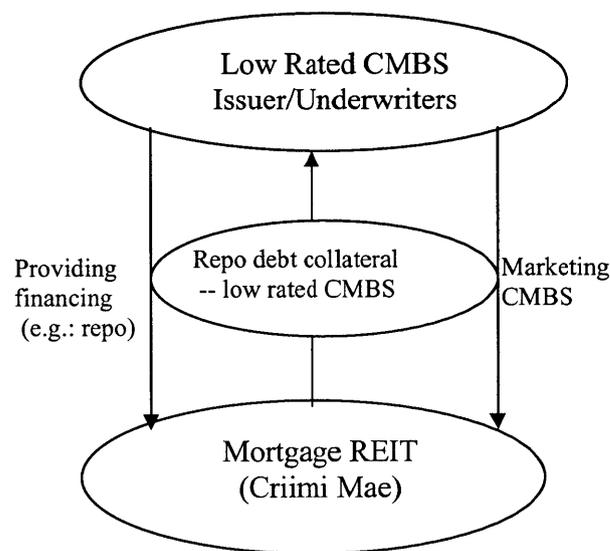


Figure 17: The Players in the Repo Debt Relationship

The calling of debt would not cause a collapse if the product market is mature enough to absorb the impacts from the financing market. However, if the market for certain financial products (such as CMBS) is insufficiently competitive and only has limited participants, financing effects can impact the product market. This dynamic was especially problematic since CMM had significant market share for low-rated CMBS, and this CMBS product market was less competitive, dominated by CMM and only a few

other investors. Calling the debt in this case caused the product market to seize up. As with all “panics”, the result was a vicious cycle. The collapse became a self-fulfilling prophecy, as declines in the product market led to an anticipation that CMM and others would have to liquidate their positions at a time when there was no market for the securities.

In addition, by studying the balance sheet of CMM, it is important to recognize that the global economic problem of the Asian and Russian financial turmoil was reflected in the liability side of mortgage REITs’ balance sheet through share price declines. This has a negative impact on the mortgage REITs’ ability to purchase low-rated CMBS. It then could result in declining CMBS security prices, which would in turn affect the asset side of the balance sheet. In this way, we may have a case in which a decline in asset values does not initially trigger financial distress. Indeed, because the high-risk end of the CMBS market was dominated by mortgage REITs and hedge funds that were relatively optimistic about the values of the assets they specialized in, it may have been the decline in the value of these investment firms’ liabilities that ultimately resulted in the decline in CMBS asset values. Therefore, it is reasonable to question the direction of causality: did the impact go from the CMBS product market to the financing market (or stock market), or did the direction of causality run the other way, from the financing market to the CMBS product market (with its “peculiar” financing mechanism supporting the market for the high-risk component of that market).

Table 3 shows the amount of low rated CMBS acquired by CMM and its repo debt. CMM had large amount of repo debt even before starting to acquire low rated CMBS in 1994. Obviously, the ratio of the short term debt was fairly high.

Table 3: CMM's Low Rated CMBS and Repo Debt

Year	CMBS mount(million) <sup>2</sup>	% of total assets	Repo amount(million)	% of total asset
1993	0	0	331.7	41%
1994	38.9	4%	481.9	50%
1995	278.4	23%	187.9	16%
1996	564.3	41%	241.1	18%
1997	1114.5	59%	585.4	31%
1998	1274.2	52%	932.2	38%

Source: CMM 10K 1993-1998.

In summary, we suspect that the market structure and financing mechanism together resulted in the disequilibrium on the low rated CMBS market. The hypothesis is that the stock price of CMM leads the spreads of low rated CMBS. In order to empirically test this hypothesis, we performed the Granger causality test on CMM's stock prices and the low-rated CMBS spreads. Since CMM focused on BB and B rated CMBS, we used both of them in this study.

If the CMM stock price granger causes CMBS spreads but not the other way around, the effect from the financing market to CMBS product market will be confirmed. This would suggest that with the specific CMBS market structure the debtholders or investment banks did cause the vicious cycle that ultimately hobbled the product market. However, if

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<sup>2</sup> Value at amortized cost.

the results show significant causality in the opposite way or in both directions, the hypothesis won't be confirmed.

### **3.3 GRANGER CAUSALITY TEST**

#### **3.3.1 DATA**

We have weekly spreads of 10-year BB and B rated CMBS and CMM's stock price from Jan 1997 to Jun 1999. The whole sample is divided into three sub-sample periods according to the sequence of the financial crisis. These sub-sample periods are:

- 1) Pre-crisis period: Period between 01/03/97 and 04/30/98. This is the period before the Russian government defaulted on its domestic bonds triggering the global capital flight.
- 2) Crisis peak period: Period between 05/01/98 and 01/01/99. This is the period between the Russian bond default and the bailout of Long-term Capital Management. It marks the peak of the crisis.
- 3) Post-crisis period. Period between 01/02/99 and 05/14/99.

If the causality relationship does exist, we expect to have highest significance during the crisis peak period.

#### **3.3.2 GRANGER CAUSALITY TEST THEORY**

The Granger causality test is to find out whether statistically one can detect the direction of causality (cause and effect relationship) when temporarily there is a lead-lag relationship between two variables. The test assumes that the information relevant to the prediction of the respective variables  $X$  and  $Y$  (e.g., CMBS spreads and mortgage REIT

CMM's stock price) is contained solely in the time series data on these variables. The test involves estimating the following regressions and null hypotheses are that “*X does not Granger cause Y*” and “*Y does not Granger cause X*”.

Unrestricted regressions: 
$$Y_t = \sum_{i=1}^m \alpha_i Y_{t-i} + \sum_{i=1}^m \beta_i X_{t-i} + \varepsilon_i$$

Restricted regressions: 
$$Y_t = \sum_{i=1}^m \alpha_i Y_{t-i} + \varepsilon_i$$

Unrestricted regressions: 
$$X_t = \sum_{i=1}^m \delta_i X_{t-i} + \sum_{i=1}^m \eta_i Y_{t-i} + \varepsilon_i$$

Restricted regressions: 
$$X_t = \sum_{i=1}^m \delta_i X_{t-i} + \varepsilon_i$$

F statistics can be constructed based on the sum of squared residuals from the two pairs of regressions to test whether coefficients  $\beta_i$  and  $\eta_i$  are significantly different from zero.

$$F = \frac{(ESS_R - ESS_{UR})/q}{ESS_{UR}/(N-k)} \sim F(q, N-k)$$

where  $ESS_R$  and  $ESS_{UR}$  are the sum of squared residuals from the restricted and unrestricted regressions respectively.  $q$  is the number of constraints,  $N$  is the number of observations and  $k$  is the number of estimated coefficients in the unrestricted regressions.

The test should normally be applied in both directions to test whether X “causes” Y, and also whether Y “causes” X, with a range of plausible degrees of lag ( $m$ ). An unambiguous Granger Causality finding occurs only for lags in which the  $F$  test is statistically significant for rejecting the null hypothesis in one direction but not statistically significant for rejecting the null hypothesis in the other direction. If there is

lack of statistical significance in either direction, then there is a suggestion of no independent temporal relationship between the two variables. If there is statistical significance in both directions, then there is a suggestion of a feedback relationship between the two variables, suggesting that causality occurs in both directions.

### 3.3.3 GRANGER CAUSALITY TEST BETWEEN BB AND B RATED CMBS AND CMM

To investigate the Granger causality between CMBS and CMM, we have a pair of null hypotheses: 1) the financing market does not Granger causes product market, i.e., CMM's stock price does not Granger cause CMBS spreads.; 2) the product market does not Granger cause the financing market, i.e., CMBS spreads does not Granger cause CMM's stock price. We need to run the two pairs of unrestricted and restricted regressions as follows to test the hypotheses. Here  $\Delta CMBS$  is the weekly change in CMBS spreads and  $\Delta CMM$  is the weekly change in CMM stock price.

$$\text{Unrestricted regression: } \Delta CMBS = \sum_{i=1}^m \alpha_i \Delta CMBS_{t-i} + \sum_{i=1}^m \beta_i \Delta CMM_{t-i} + \varepsilon_i$$

$$\text{Restricted regression: } \Delta CMBS = \sum_{i=1}^m \alpha_i \Delta CMBS_{t-i} + \varepsilon_i$$

$$\text{Unrestricted regression: } \Delta CMM = \sum_{i=1}^m \delta_i \Delta CMM_{t-i} + \sum_{i=1}^m \eta_i \Delta CMBS_{t-i} + \varepsilon_i$$

$$\text{Restricted regression: } \Delta CMM = \sum_{i=1}^m \delta_i \Delta CMM_{t-i} + \varepsilon_i$$

If the F test shows that the coefficients  $\beta_1, \beta_2, \dots, \beta_m$  are significantly different from zero, but  $\eta_1, \eta_2, \dots, \eta_m$  are not significantly different from zero, then we have unambiguous granger test result to conclude that CMM stock price change does Granger cause CMBS spreads change. Both BB and B rated CMBS are used for this study.

The results are summarized in Table 4 and 5 with probability value reported for each test with different number of lags from 1 to 5.  $H_0^1$  is the first null hypothesis that CMM stock price change does not granger cause CMBS spread change;  $H_0^2$  is the second null hypothesis that CMBS spread change does not granger cause CMM stock price change.

Table 4: Granger Causality test results of BB rated CMBS and CMM

		Number of lags				
		1	2	3	4	5
Pre-crisis	Obs.	68	67	66	65	64
	$H_0^1$	.323	.010***	.035**	.005***	.020**
	$H_0^2$	.908	.001***	.004***	.002***	.002***
Crisis peak	Obs.	35	35	35	35	35
	$H_0^1$	.001***	.006***	.005***	.000***	.000***
	$H_0^2$	.992	.335	.672	.212	.057*
Post-crisis	Obs.	23	23	23	23	23
	$H_0^1$	.060*	.030**	.048**	.089*	.17
	$H_0^2$	.862	.934	.811	.431	.409

\*\*\*: significant at 1% critical value; \*\*: significant at 5% critical value; \*: significant at 10% critical value.

Table 4 shows that there is unambiguous causality from CMM to BB rated CMBS during the crisis peak period since all the  $H_0^1$  can be significantly rejected while  $H_0^2$  can not. The probability values are not sensitive to the different number of lags. For the post-crisis period, the results also indicate some causality from CMM to BB rated CMBS although the significance is lower than that of crisis peak period. It makes sense that the effect during both crisis peak and post-crisis period decreases as the number of lags goes up. Among other things, there seems some mutual causality during the pre-crisis period except for the case with one lag. However, the results are sensitive to lags.

Table 5: Granger Causality test results of B rated CMBS and CMM

		Number of lags				
		1	2	3	4	5
Pre-crisis	Obs.	68	67	66	65	64
	$H_0^1$	.107	.310	.105	.089*	.137
	$H_0^2$	.571	.701	.754	.796	.826
Crisis peak	Obs.	35	35	35	35	35
	$H_0^1$	.000***	.003***	.012**	.033**	.035**
	$H_0^2$	.509	.564	.541	.445	.699
Post-crisis	Obs.	23	23	23	23	23
	$H_0^1$	.177	.161	.332	.537	.430
	$H_0^2$	.156	.424	.680	.607	.390

\*\*\*: significant at 1% critical value; \*\*: significant at 5% critical value; \*: significant at 10% critical value.

Table 5 presents results for B rated CMBS and CMM. There is almost no causality relationship between CMM and B rated CMBS during both pre-crisis and post-crisis periods. The significant causality effect exists only during the crisis peak period when  $H_0^1$  is significantly rejected and  $H_0^2$  is not. The results are not sensitive to the number of lags selected. Similarly, the significance drops as time elapses from one week to five weeks.

Both BB and B rated CMBS spread changes turned out to be granger caused by the CMM stock price change during the crisis peak period, which implies that the hypothesis from financing market to CMBS product market can be confirmed by the granger causality test.

#### **3.3.4 ENDOGENOUS BREAK POINT TEST**

In the previous section, the entire sample period is divided into three sub-periods according to the timeline of the financial crisis. In order to see whether the division is in accordance with the endogenous break points of the time series, we adopt recursive residual method to identify the endogenous break points if there is any.

In recursive least squares the equation is estimated repeatedly, using ever larger subsets of the sample data. If there are  $k$  coefficients to be estimated, then the first  $k$  observations are used to form the first estimate of coefficients. The next observation is then added to the data set and  $k + 1$  observations are used to compute the second estimate of coefficients. This process is repeated until all the  $T$  sample points have been used,

yielding  $T + k - 1$  estimates of the coefficient vector. At each step of the last estimate of coefficient can be used to predict the next value of dependent variable. The one-step ahead forecast error resulting from this prediction is defined to be recursive residual.

The plot following the estimation results produces the recursive residuals and standard errors and the sample points whose probability value is at or below 15% percent. It helps spot the periods when the equation is least successful. The upper portion of the plot reports the recursive residuals and standard errors. The lower portion of the plot shows the probability values for those sample points where the hypothesis of parameter constancy would be rejected at the 5, 10, or 15 percent levels. The points with probability values less than .05 correspond to those points where the recursive residuals go outside the two standard error bounds.

Given the fact that there is significant impact from CMM stock price to low rated CMBS market, we run recursive least square of CMBS over CMM and lagged CMBS as what we did for Granger causality test. Since the number of lags in the Granger causality test might be arbitrary, we run the recursive least square with five different lags and their results are presented as five different models from I to V as follows. It shows in Table 6 that the significance of lagged variables dropped after the second period and relatively speaking model II is the most significant one. The recursive residual from model II is plotted in Figure 18. Similarly, the same procedures are applied to B rated CMBS and CMM and the corresponding results are presented in Table 7 and Figure 19.

It is easy to spot that most of the sample points with low probability value are bracketed within the sample of 75 to 105. This is the crisis peak period as we defined before. It indicates that there is structural difference between the periods before and after the peak period. Thus we can conclude that the way the sub-samples are divided is valid and roughly in accordance with the endogenous break points.

### **3.4 SUMMARY OF RESULTS**

The granger causality test shows unambiguous causality from CMM stock price to low rated CMBS product market. The test for sub-sample periods supports the hypothesis consistently without showing sensitivity to different lags. The highest significance of the causality relationship showed during crisis peak period with lags of one to two weeks.

The recursive residual test for structural stability is to testify the endogenous break point of the time series. The results demonstrate that the break points are roughly in accordance with the ones we select to divide into sub-samples. In other words, the way to divide the sample into pre-crisis, crisis and post-crisis periods for Granger test is valid.

Table 6: Recursive Least Square of BB rated CMBS and CMM

	I	II	III	IV	V
BB(-1)	1.0029*** (.0070)	.9406*** (.0904)	.9372*** (0.0902)	.9371*** (0.0933)	.8997*** (.0793)
BB(-2)		-.0613 (.0909)	.2595** (.1228)	0.2439* (.1258)	.1881* (.1082)
BB(-3)			-.1975** (.0899)	-.2388* (.1261)	-.2119* (.1082)
BB(-4)				-.0568* (.0926)	.2353** (.1096)
BB(-5)					-.1174 (.0796)
CMM(-1)	-0.0159 (.2255)	-5.4486** (2.5720)	-4.1793 (2.6666)	-4.6474* (2.7318)	-4.5099*** (2.3473)
CMM(-2)		5.4507** (2.5733)	1.5898 (4.3004)	2.7970 (4.4948)	0.8426 (3.8910)
CMM(-3)			2.6458 (2.7003)	-.7203 (4.4964)	5.8406 (3.9629)
CMM(-4)				2.6275 (2.7515)	-17.3197*** (3.8350)
CMM(-5)					15.3182*** (2.3430)
R square	.9793	.9800	.9811	.9813	.9896

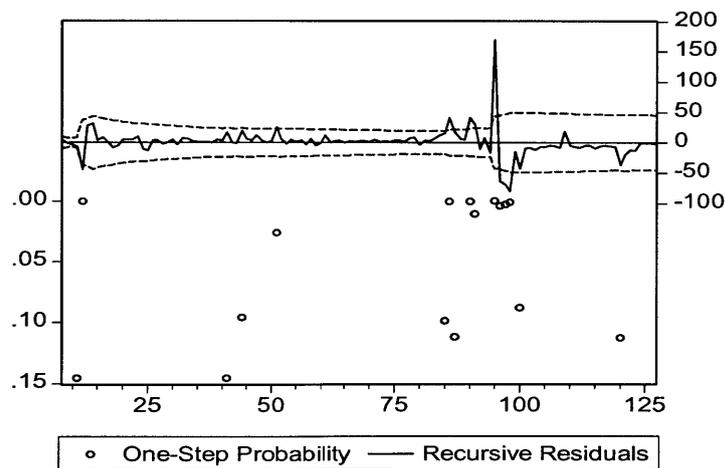


Figure 18: Recursive residual of BB rated CMBS and CMM equation

Table 7: Recursive Least Square of B rated CMBS and CMM

	I	II	III	IV	V
B(-1)	1.0036*** (.0051)	1.2181*** (.0903)	1.1152*** (0.0941)	1.0478*** (0.0976)	.9809*** (.0973)
B(-2)		-.2183** (.0907)	.1565 (.1440)	0.1577 (.1432)	.1490 (.1382)
B(-3)			-.2741*** (.0901)	-.0541 (.1434)	-.0615 (.1389)
B(-4)				-.1556* (.0927)	.0492 (.1395)
B(-5)					-.1243 (.0916)
CMM(-1)	-0.1282 (.2696)	-9.3500*** (2.7596)	-9.3295*** (2.7323)	-10.0898*** (2.7646)	-10.7764*** (2.7024)
CMM(-2)		9.3691*** (2.7528)	8.6820** (4.3082)	9.3638** (4.3924)	8.2885* (4.2888)
CMM(-3)			0.7634 (2.8465)	-1.5939 (4.4582)	.8614 (4.4397)
CMM(-4)				2.4984 (2.8495)	-5.1307 (4.3421)
CMM(-5)					7.0173** (2.7602)
R square	.9845	.9875	.9886	.9890	.9901

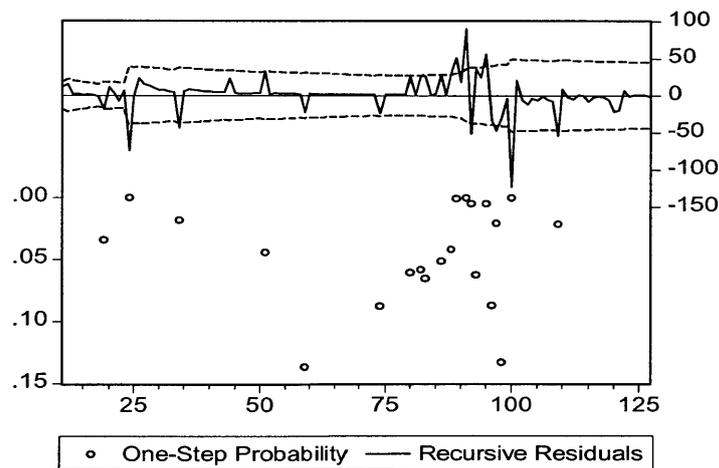


Figure 19: Recursive residual of B rated CMBS and CMM equation

#### 4. CMM' BANKRUPTCY AND EMERGENCE FROM CHAPTER 11



Figure 19: CMM's stock price 1990-2004

CMM was the world's biggest buyer of low rated CMBS. CMM used stockholder funds to buy bonds and also borrowed money from many big players on Wall Street, including Merrill Lynch & Co, Citigroup and Morgan Stanley Inc. etc. Almost anybody in mortgage bonds did business with CMM. To reduce its risk CMM put together the mortgage pools itself and took charge of collecting the mortgage payment. Taking the risk paid handsome rewards. Before it crashed, CMM stock had paid dividends as high as 10% a year. CMM also was correct about the risk of the mortgages themselves—all its loans still were being paid. As the Chairman William Dockser put it: "...the company (CMM) has very significant assets and tremendous earnings, but because of market

fluctuation and instability, we are subject to collateral calls and those collateral calls affect our liquidity.”<sup>3</sup>

According to CMM’s Chapter 11 filing in bankruptcy court in Greenbelt, its assets as of September 22, 1998 were \$2.78 billion and its liabilities were \$2.15 billion. The bankruptcy reorganization case of CMM is a miniature version of the market chaos that might have ensued if Long-Term Capital Management had gone under, shaking the world financial system. CMM’s crash into bankruptcy court has rocked the world wide market for bonds backed by mortgages on commercial buildings, triggering turmoil that affects major players in a business with billions of dollars in annual revenue. Though the business strategies were different, CMM and LTCM were the biggest players in their highly specialized business. The crucial difference between CMM and LTCM is that LTCM was such a big participant in world currency market that Wall Street could not afford to let it fail. CMM, by contrast, fled to bankruptcy court and was pursued by a Wall Street posse.

The conflict of interest between CMM and its creditors didn’t arise until the financial crisis hit in late 1998. CMM sued affiliates of Morgan Stanley, Merrill Lynch and Citigroup for “wrongly seizing millions of dollars of CMM’s cash and securities that had been put up as collateral on loans.” For example, CMM claimed that Merrill Lynch Mortgage Capital Inc. improperly seized more than \$3million in interest payments on \$550 million worth of CMBS it was holding as collateral for a loan to CMM<sup>4</sup>. In

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<sup>3</sup> The Washington Post, Oct 6, 1998.

<sup>4</sup> The Washington Post, Oct 22, 1998.

addition, Merrill Lynch demanded for \$20 million in cash as additional collateral on loans that prompted CMM to seek bankruptcy protection. Afterwards, the U.S bankruptcy court had to issue some restraining order against CMM's creditors to prevent them from seizing CMM's securities that are collateral for its debt.

With the help of the U.S bankruptcy court, CMM reached a series of agreements with its creditors that resolved the disputed issues through various ways such as splitting the cash flows from the low rated CMBS. At the same time, CMM had been seeking additional capital and working with advisors toward an ultimate plan of reorganization. It received several proposals for private equity investments from major financial institutions. Finally, CMM was able to emerge from Chapter 11 protection in April 17, 2001<sup>5</sup>.

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<sup>5</sup> Source: <http://www.criimimaeinc.com/press.asp?year=2001>

## **5. ECONOMIC AND POLICY LESSONS AND CONCLUDING REMARKS**

We attempted to detect if the repo debt financing mechanism between the issuer/underwriters and the mortgage REIT together with the illiquid low rated CMBS market structure indeed caused the low rated CMBS to seize up during the financial crisis. Based on the analysis in the previous sections, we can conclude with a positive answer. However, that's not the end of the story. The economic and policy lessons from this investigation are more related to the behaviors of the players on the market including both issuers/underwriters and mortgage REITs rather than the repo debt itself.

The first question is whether investment banks should be allowed to act as typical debtholders in this context where they are not playing a passive lending role, but instead have an important stake in the low rated CMBS product market and the buyers in that product market, including the borrowers of the banks' repo debt, such as CMM. Real traditional passive debtholders are supposed to have priority over other subordinated debtholders and shareholders. However, whether repo-lending investment banks should be allowed to have this same status is called into question in the present context. There were clearly social costs associated with the described market structure, in which investment banks created firms to park highly profitable but highly risky securities, and then financed these firms with inefficient debt contracts. They behaved in a self-interested but socially wasteful manner when things did not work out as hoped. This market dynamic has implications for bankruptcy policy, where it is a legitimate question as to whether secured repo lenders should have priority over other creditors when their effective role was to create, finance and subsequently hobble a product market. That is,

investment banks were not passive investors whose actions had no bearing whatsoever in the product market, as standard bankruptcy policy presupposes.

There are, however, social benefits that need to be recognized. The creation of viable new securities and markets enhanced product market competition (e.g., there was a new competitive source of debt capital for commercial property owners) as well as allocated risks more efficiently by helping to complete the market. By taking what some might perceive to be shortcuts in order to increase the rate of product market development, investment banks helped assure that the CMBS markets gained a sufficient level of maturity and therefore a toehold prior to the occurrence of any unanticipated negative shocks. This is an important and often overlooked element of 1990s-style financial innovation, as it recognizes that viable new product markets take time to develop and are not automatically sustainable.

Therefore, as what we observed during the financial crisis, the low rated CMBS market was indeed fatally wounded but did not die. While this study demonstrates that the illiquid low rated CMBS market structure with the inefficient debt contract is not sustainable with negative shocks. And the reality is that the negative shocks are not rare events that only happen once or twice every century but instead almost every other years. Thus the only solution is to create more resilient financing instruments and market structure for innovative financial product development.

In this specific case, improvements could be made in the following ways. First, there is duration mismatch between the repo debt and the collaterals for the debt. Using CMBS with maturity of 5-20 years as collateral for the daily or weekly marked-to-market repo debt with maturity of 1-2 year creates severe asset-liability duration mismatch. Once there is any negative shock, the liquidity problem would arise immediately. Thus the lenders should extend the maturity so that the asset-liability mismatch problem could be mitigated. As what was worked out in CMM's reorganization process, lenders might be able to split some cash flows from the collateral with borrowers, which could to certain extent compensate for the debt maturity extension. Obviously, the definition of debtholder needs to be reconsidered since the "lenders" are more like equity investors than traditional debtors. This relates to the issue we raised at the beginning of this section. In short, the relatively long term stability and trust between the borrowers and lenders are critical for the development of innovated financial products.

Secondly, from the product investors' perspective, CMM did make huge profits by acquiring and servicing the low rated CMBS but failed to use hedge tools effectively and keep the short-term leverage under control to deal with financial crisis. Although CMM claimed that the intrinsic value of its collateral was more than the fair value, it turned out that the argument won't work unless it could prove that it really had that much cash or equivalent securities with sufficient liquidity to absorb the shocks. The most important risks that need to be addressed by CMM are default risk, liquidity risk and interest rate risk. Keeping the potential negative shocks in mind and taking preventive measures must

be an indispensable part of financial management for mortgage REITs. In this regard, mortgage REITs must function analogously to other hedge funds.

Last but not least, although not all shocks had some psychological reasons behind, some of them did. The contagion effect of Asian and Russian financial crisis to the could-have-been-sound CMBS market in the US was an example as what we have investigated through this study. However, the fundamental reason behind the panic behaviors is information asymmetry. CMBS issuers/underwriters need more ongoing information about the CMBS product and market so as to be confident enough to provide debt with longer maturity and not to panic easily. If the issuers/underwriters knew that the cash flows underlying the low rated CMBS were still being well paid and the properties underlying the mortgages were operating perfectly as it should be, they would have had no reason to make those margin calls so that the vicious cycles might have been avoided or at least mitigated. The hope is that as the CMBS market gets more matured after it survived the crisis, there would be more competitive players on the market that are more familiar with the product and its essential characteristics so that more information would be available to access and analyze. This would in turn enhance the efficiency of the secondary real estate market. Further research to follow up the low rated CMBS market and its future track would be very valuable.

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