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## A NOTE ON THE EFFECTS OF PREPAYMENT RISK ON MORTGAGE COMPANIES AND MORTGAGE REITs

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*The purpose of this paper is to determine whether prepayment risk impacts the performance of mortgage companies and/or mortgage REITs. Previous research finds prepayment risk impacts bank returns and also impacts bank loan returns (He, 2007; Fayman & He, 2011). This paper uses regression analysis to measure the prepayment risk premium and then uses those results as a dependent variable in several separate regression models that utilize performance metrics as the independent variable. The results indicate that prepayment risk has a positive impact on sales growth in mortgage companies and also has a negative impact on ROE and a positive impact on ROA in mortgage companies. One possible explanation for this finding is mortgage companies may opt to sell mortgages faster in interest rate environments that have higher levels of prepayment risk. However, prepayment risk appears to have little to no impact on the performance of mortgage REITs.*

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Keywords: Mortgage companies, mortgage REITs, prepayment risk

### INTRODUCTION

Previous research finds that prepayment risk impacts bank returns and various performance metrics of banks respectively (He, 2007; Fayman & He, 2011). However, in spite of the fact that mortgages represent a larger fraction of the portfolios of both mortgage companies and mortgage REITs, no study to date estimates the impact of prepayment risk on these classes of organizations. The purpose of this research is to investigate whether the prepayment risk impact found in the banking industry extends to mortgage companies and mortgage real estate investment trusts.

Prepayment risk is a function of a probability that a mortgage borrower will choose to prepay a mortgage by either refinancing the mortgage or walking away from the property. Prepayment risk impacts firms that hold mortgages in a portfolio due to the fact that the prepaid mortgage must now be replaced (i.e. funds reinvested) and the new securities may very likely be mortgages that generate lower returns given that mortgage refinancing often increases more when market interest rates fall. Therefore we expect organizations that have a larger fraction of their portfolios invested in mortgage-based assets to be impacted by prepayment risk.

A strong relationship between prepayment risk, as measured by the prepayment risk premium, and performance of commercial banks has been shown to exist. Indeed, He (2007) finds that prepayment risk significantly impacts the performance of NASDAQ traded bank stocks. Further, Fayman and He (2011) show specific bank performance metrics, such as return on loans and profit margin, are impacted by prepayment risk. Another study by Fayman and He (2008) finds that prepayment risk impacts bank returns whether interest rates are rising or falling. However, as you would expect the magnitude is much greater in a falling interest rate environment.

Using performance ratios can help isolate areas of underperformance, or conversely, better than expected performance (Bhagat and Jefferies (2002)). Thus, we expect the size of prepayment premium should also be related to the performance of mortgage REITs and mortgage companies. This relationship, perhaps, should be even stronger for these firms than for commercial banks because their sole business focus is on the mortgage markets. In contrast banks also make commercial and consumer loans and offer many services to their customers that drive fee income. These other sources of income are not available to mortgage companies or mortgage REITs. Thus, any variation driven by prepayment risk may be offset by other business functions.

Refinancing has been studied in past literature. Bennett et al (2000) finds that loan-to value is an important factor influencing mortgagors' decision to refinance. While Dunn and McConnell (1981) and Schwartz and Torous (1989) show that mortgagors prepay mortgages even if it is not optimal for them, Stanton (1995) finds that borrowers postpone refinancing by one year after they can refinance profitably.

Prepayment risk, indeed, is very important to banking. Since in the case of default, banks do take possession of the property. However, while default risk is important, Frantantoni and Schuh (2003) argue that prepayment risk is more important to banks. Further, the probability of refinancing is greater than probability of default. It has been shown, and confirmed by He (2007), that after the Financial Institutions Reform, Recovery, and Enforcement Act, there was a structural change in the mortgage market whereby frictions were removed and allowed refinancing at lower costs to borrowers. Given the importance of prepayment risk we postulate that it should impact mortgage company performance and mortgage REIT performance in a similar manner.

This topic is particularly important given the integration of global financial markets and the ubiquitous nature of financial derivatives based on mortgages. Inaccurate pricing of risk in the mortgage market is largely responsible for the financial crisis and ensuing global recession that spanned that emerged in 2007.

## METHODOLOGY

According to He (2007), the annual prepayment risk can be represented by the sum of the constant term and residuals from the following model:

$$Mort_t = \alpha + \beta_R REIT_t + \beta_T Term_t + \beta_D Default_t + \varepsilon_t \quad (1)$$

where  $Mort_t$  represent risk premiums in mortgage rates and are measured by differences between mortgage rates and T-bill rates;  $Reit_t$ , the proxy for real estate market, are reflected in differences between stock returns for equity real estate investment trusts (REITs) and T-bill rates;  $Term_t$  are maturity risk premiums as defined by Fama and French (1993): differences between returns on long-term government bonds and T-bill rates;  $Default_t$  are default risk premiums quantified by differences between returns on long-term corporate bonds and long-term government bonds which are default risk free (Fama and French, 1993).

After obtaining prepayment risk data from Equation (1), a second model is applied to examine the impact of prepayment risk on performance of mortgage companies and mortgage REITs with control for effects of other important variables:

$$Ratio_t = \alpha + \beta_p Prepay_t + \beta_c Cmort_t + \beta_{ppi} PPI_t + \varepsilon_t \quad (2)$$

where  $Ratio_t$  represents different performance ratios for individual mortgage companies and mortgage REITs;  $Prepay_t$  is the sum of the constant terms and residuals from Equation (1);  $Cmort_t$  is percentage changes in mortgage rates; and  $PPI_t$  is the percentage changes in PPI. We find no evidence of any strong linear dependencies among those three variables in a variance decomposition proportions matrix.

Equation (2) is estimated by the pooled cross-section heteroskedasticity and time-wise autoregressive method described in Greene (2000). This method calculates a panel-corrected covariance matrix of the coefficient estimates and uses panel-corrected standard error.

## DATA

The data for this study was obtained from Compustat/Research Insight. The sample firms include mortgage companies that fall into a four-digit SIC codes 6160, 6162 and 6163 for the period 1990-2005 and for REITs that fall into a four-digit SIC code of 6798 for the period of 1990-2005. Ending the period of study two years prior to the mortgage and financial crisis of 2007-2009 should keep the impact of that event from skewing the results. GICS (Global Industry Classification Standard) codes were used to identify mortgage REITs. Table 1 lists the number of mortgage companies analyzed by year and Table 2 lists the

number of mortgage REITs analyzed by year. The data set used in this study includes some macroeconomic variables and financial ratios for mortgage companies and mortgage REITs.

**Table 1. Number of Mortgage Companies Analyzed By Year (1990-2006)**

<b>Year</b>	<b># of Firms</b>
1990	10
1991	14
1992	16
1993	22
1994	14
1995	14
1996	24
1997	29
1998	30
1999	29
2000	28
2001	27
2002	27
2003	25
2004	21
2005	13

**Table 2. Number of Mortgage REITs Analyzed By Year (1990-2006)**

<b>Year</b>	<b># of Firms</b>
1990	8
1991	8
1992	8
1993	7
1994	7
1995	11
1996	11
1997	11
1998	15
1999	20
2000	20
2001	20
2002	21
2003	30
2004	32
2005	37

## EMPIRICAL RESULTS

The results for the mortgage companies sample are presented in Table 3. Four OLS models are presented in Table 3 with sales growth rate, profit margin, ROE and ROA as dependent variables and prepayment risk, changes in mortgage rates, and PPI as independent variables. The results indicate that prepayment risk is significantly related to sales growth rate (0.60, t-statistic=7.76), ROE (-0.18, t-statistic=-6.81) and ROA (1.55, t-statistic=4.01). However, prepayment risk was not significantly related to profit margin (5.92, t-statistic=1.50).

**Table 3. The Effects of Prepayment Risk and Other Macroeconomic Variables on Performance of Mortgage Companies**

Model	Constant	Prepay- ment risk	Changes in mortgage rates	PPI	R <sup>2</sup>
Sales growth rate	-0.36 (-0.21)	0.60 (7.76)***	-4.47 (-2.00)**	3.37 (.55)	15.83
Profit margin	15.49 (0.76)	5.92 (1.50)	51.87 (0.52)	- (-0.82)	0.01
ROE	0.31 (2.44)**	-0.18 (-6.81)***	-0.30 (-0.24)	2.15 (0.55)	7.41
ROA	-0.14 (-0.12)	1.55 (4.01)***	-7.86 (-0.64)	-0.77 (-0.02)	6.00

\*\*\*, \*\*, \* Represent significance at the 1, 5, and 10% level, respectively.

t-statistics are in parenthesis.

Prepayment risk;

PPI-measure of inflation;

Changes in mortgage rates from previous year;

Sales growth rate = one year sales growth;

Profit margin = net income as a percent of total income.

Prepayment risk premiums are charged by mortgage lenders for the risk of early prepayment of the loan. Mortgage companies are in the business of originating mortgages and subsequently selling them in the secondary mortgage markets. However, buyers in the secondary market may demand a premium for prepayment risk that should be considered by mortgage originators. Our results indicate that sales growth and prepayment risk premiums are positively related. As prepayment premiums increase it has a slight impact on sales growth. Part of this may be explained by the fact that mortgage rates were in a secular trend downward over much of the period studied. From January 1990 to December 2005 mortgage interest rates fell from 9.90% to 6.27%. In falling interest rate environments prepayment risk tended to have a greater impact on bank performance metrics in previous work by Fayman and He (2008).

Conversely the ROE of mortgage companies and prepayment risk premiums is negatively related while the ROA is positively related. In both models prepayment risk is significant at the 0.01 level. For these results to hold simultaneously the value of the firm's assets must decrease at the same time equity increases. Therefore, according to the basic accounting equation the prepayment risk premium increases when liabilities fall by a greater magnitude than the increase in equity. Given that a mortgage company's assets are primarily mortgages and the liabilities are funds borrowed to fund mortgages it appears that a higher prepayment risk premium may result in more internally generated financing through retained profits. Another possible explanation is that mortgage companies opt to sell mortgages (assets) faster in environments with higher prepayment risk. Prepayment risk was not a significant predictor of changes in net income. We also find that changes in mortgage rates and PPI are not significantly related to the dependent variables with one exception. In model one sales growth rate is negatively impacted by changes in mortgage rates (Changes in mortgage rates -4.47; t-statistic = -2.00). As expected, when mortgage rates increase, growth in sales falls.

Table 4 provides results from a sample of mortgage REITs. While mortgage REITs are not in the mortgage origination business, they do, however, invest in mortgage-backed securities. From the discussion above, it is expected that prepayment risk would be related to performance metrics of mortgage REITs. However, the results do not support this expectation in three of the four models. Prepayment risk is not related to profit margin (-0.81, t-statistic=-0.190), ROE (-0.25, t-statistic=0.66) and ROA (0.88, t-statistic=-1.66). However, prepayment risk is shown to be marginally related to sales growth rate (-22.10, t-statistic=-1.74). Thus, as prepayment risk increases and interest rates decline, revenue growth declines. This may be driven by the increased prepayment of mortgage-backed securities held on the balance sheet by mortgage REITs. As prepayment risk increases and mortgages are prepaid, the revenues received from mortgage backed securities declines. However, this result was only significant at the 0.10 level.

**Table 4. The Effects of Prepayment Risk and Other Macroeconomic Variables on Performance of Mortgage REITs**

Model	Constant	Prepay- ment risk	Changes in mortgage rates	PPI	R <sup>2</sup>
Sales growth rate	1.46 (1.91)	-22.10 (-1.74)*	-2.00 (-1.65)*	-2.47 (-0.35)	0.66
Profit margin	0.20 (1.75)*	-0.81 (-0.19)	-1.86 (-1.20)	2.41 (1.25)	0.99
ROE	0.03 (0.96)	0.87 (0.66)	-0.25 (-2.46)***	0.15 (0.54)	2.49
ROA	0.00 (-0.01)	0.88 (0.73)	-0.09 (-1.66)*	-0.10 (-0.47)	1.61

\*\*\*, \*\*, \* Represent significance at the 1, 5, and 10% level, respectively.

t-statistics are in parenthesis.

Prepayment risk;

PPI-measure of inflation;

Changes in mortgage rates from previous year;  
 Sales growth rate = one year sales growth;  
 Profit margin = net income as a percent of total income.

Mortgage rate changes are found to be significantly related to sales growth rate (-2.00, t-statistic=-1.65), ROE (-0.25, t-statistic=-2.46) and ROA (-0.09, t-statistic=-1.66). As interest rates decline the value of the assets of mortgage REITS, which are mostly financial instruments, increases as does value of equity. Therefore, income as a percent of total assets and total equity declines. As a result, we are demonstrating a negative relationship between changes in mortgage rates and ROA and ROE of mortgage REITS. PPI is not shown to be significantly related to the mortgage REITS' performance metrics sales growth rate (-2.47, t-statistic=-0.35), profit margin (2.41, t-statistic=1.25), ROE (0.15, t-statistic=0.54) and ROA (-0.10, t-statistic=-0.47).

## CONCLUSIONS

The relationship between ROA, ROE, profit margin, sales growth and prepayment risk is analyzed this study for a sample of mortgage companies and mortgage REITS. Prepayment risk was predicted to be related to performance of mortgage companies and mortgage REITS since these firms' business is related to extending mortgages to home buyers. Prepayment risk variable is a measure of the size of the prepayment risk premium that is charged by financial institutions when making a mortgage. Oddly, mortgage companies appear to have greater performance exposure to changes in prepayment risk premiums in spite of the fact that most mortgages are rapidly resold on the secondary market. Again, it is possible that failure to appropriately price prepayment risk impacts the resale value and/or timing and ultimately impacts profitability of mortgage companies.

Mortgage REITS invest in mortgage backed securities and the prepayment risk premium does not affect their performance. It appears that the prepayment risk premiums are more important at the time the loan is priced and less important when added to a longer term portfolio of mortgage-backed securities. Since mortgage companies and mortgage REITS are in a business related to lending, it is important to measure levels of risks that they are exposed to and to understand how all risks, including prepayment risk, impact their performance.

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