



Structural prepayment risk behavior of the underlying mortgages for residential mortgage life insurance in a developing market

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Abstract

Since 1998 all residential mortgages in China have been adjustable rate mortgages (ARMs). However, the borrower's motivation for prepayment is different from that in the US or other developed mortgage markets. In the US, mortgage insurance plays an imperative role in covering some of the risk typically faced by housing finance institutions. However, China's residential mortgage life insurance (RMLI) market is in its infancy. It offers the insured mortgagor a life-insurance death benefit, arising from only illness or accident, settling the insured's outstanding residential mortgage balance. Prepayments of some RMLIs' underlying mortgages are observed, leading to a premature termination of both the residential mortgage and the insurance commitment to settle the outstanding mortgage balance even though the insured has not yet passed away. Because such prepayments significantly influence the pricing of the RMLI, it is imperative to know more about the prepayment rate of occurrence and the prepayment characteristics of the underlying residential mortgages in terms of observable macro economic factors, loan specific factors and borrower specific characteristics. Hence, this study investigates the prepayment risk behavior of the underlying mortgages for RMLIs, utilizing a pilot study of 1000 Shanghai residential mortgagors who took up RMLIs between January 1999 and December 2003. This study uses the Cox proportional hazard model to investigate RMLI-mortgage prepayment risk behavior. The resultant hazard rate is dependent on four primary factors: combined monthly income of the co-borrowers, growth in the gross domestic product, number of co-borrowers and initial loan-to-value ratio.

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1. Introduction

The residential mortgage market has rapidly developed in China since 1998, when the State Council of the People's Republic of China introduced several administrative laws to broaden housing reform and expedite housing construction. Residential mortgage lending has thus accelerated since 1998 in line with reforms aimed at ending the state-controlled welfare-housing system. In 1999 residential mortgages loans to individual households exceeded RMB 126 billion, doubling the previous year's level. By August 2002, the total outstanding balance of residential mortgages reached RMB 763 billion, a 27% increase compared to the balance at the beginning of 2002, and some 34 times that at the end of 1997. More than half of the real estate loans newly issued in 2002 were residential mortgage loans. The residential mortgage market has fuelled China's booming residential housing development market. Traditionally, China's housing finance sector has been confined to the primary residential markets while the secondary residential market has been undeveloped. The residential mortgage market is dominated by China's four state-owned commercial banks. The basic requirements imposed on borrowers are the following: the mortgage loan amount must not exceed 80% of the valuation or purchase price of the house; the payment-to-income ratio must not exceed 70%; the ratio of the total of the other assets associated with the loan amount must be greater than or equal to 25%; the mortgage term shall not exceed 30 years; and the borrower's age plus the mortgage term must not exceed 65 years.

US studies by [Kau et al. \(1994\)](#) deem residential mortgage debt to be providing the borrowers with prepayment (call) and default (put) options. Under prepayment, the borrower repurchases the market value of the mortgage, while under default the borrower sells the house to the mortgagee (lender) at a price equal to the value of the mortgage instead of the market value of the residential asset. Borrowers generally default when they cannot pay their monthly mortgage payments owing to death, disability, sudden illness or unemployment. Default of this type is characterized as involuntary because the borrower suddenly becomes financially constrained. The homeowner tends to avoid exercising the default option if residential prices have risen since the time of purchase. Other US studies by [Green and Shoven \(1986\)](#) and [Quigley \(1987\)](#) support the competing risks theory. They use the competing risks model to analyze mortgage prepayment and default risks. Their empirical studies show that many variables, including the characteristics of mortgage loans, the homeowner and macro economic environment, have significant influence on the prepayment and default of primary residential mortgages. The key variables include the loan-to-value ratio, loan size, loan age and mortgagors' credit history. [Quigley and Deng \(2001\)](#) investigate the apparently irrational behavior of those borrowers who do not terminate their mortgages even when the option is deeply into the money. An option-based empirical model is estimated to investigate the behavior of irrational "wood heads". They analyze the covariates of unobserved heterogeneity within a large sample of mortgage holders, and with the results of [Stinebrickner \(1999\)](#), develop a simulated maximum likelihood estimator (SMLE) of the proportional hazard model in order to estimate the competing risks of mortgage prepayment and default.

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