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Interest rate risk propagation: Evidence from the credit crunch



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ABSTRACT

During the 2007–2009 financial crisis, US subprime mortgage risk exposures led to severe liquidity problems in several other foreign markets. Such risk contagion was caused by enormous changes in interest rates. Although risk contagion has been investigated by several literatures, the magnitude of propagated interest rate risk around global financial markets remains unexplored. Therefore, this study quantifies the degree to which the increased credit risk within the US financial system propagated to the European markets' liquidity risks. Specifically, using a conditional value-at-risk (CoVaR) model, we quantitatively measure interest rate risk of a European country, by looking at the upside risk in distribution of changes in interest rate. And such propagation risk measure considers additional value-at-risk conditional on the interest rate movements in the US. The results show significantly positive differences between European country's value-at-risk conditional on the US financial markets being in a normal or distressed state. This propagating effect increased from 2007, and was particularly pronounced in the 2008–2009. In addition, the interest rate risk contagion is especially severe for some countries in the Euro regions with greater sovereign debt problems. Hence our result foretells the deterioration of the European sovereign debt crisis which started

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to unfold in 2010. Our work supplements the literature by successfully quantifying the magnitude of additional interest rate risk conditional on risk exposure from external sectors.

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1. Introduction

In this paper, we posit that the interest rate risk contagion is the channel through which the credit risk in the US caused the European country illiquidity problems during the 2007–2009 credit crunch. The more illiquid financial institutions in the banking industry are, the larger the impact will be on risk contagion from an increase in interest rate, and such close linkages caused interest rate risk contagion (e.g., Brunnermeier & Pedersen, 2009). Therefore, banks suffering interbank credit risk threats are exposed to illiquidity, and such a contagion of systemic risk leads to subsequent bankruptcies (see e.g., Billio, Gatemansky, Lo, & Pelizzon, 2010; Diamond & Rajan, 2005; Enenajor, Sebastian, & Witmer, 2012; McAndrews, Sarkar, & Wang, 2009; Pais & Stork, 2011; Sarkar, 2009). Besides the risk contagion among institutions, the increased interest rate can also exacerbate international liquidity shortages, and the vicious circle makes interest rate risk more severe around different countries. Thus, from the risk contagion in country level, we quantify the degree to which the credit risk in one country spread to other countries by an increase in interest rate and result in liquidity problems.

The risk exposures from US credit losses quickly spread and exacerbated to the global financial market during the 2007–2009 credit crunch, and banks' insolvencies also spread rapidly to other countries by way of an increase in interest rates. The domino effect of interest rate risk propagation in the interbank market led to bank insolvency and liquidity risks in many European markets (e.g., Reinhart & Rogoff, 2009; Upper & Worms, 2004) and the 2007–2009 credit crunch (e.g., Melvin & Taylor, 2009; Longstaff, 2010). The facts of interest rate risk contagion are consistent with Diamond and Rajan (2005) that the contagion of interest rate risk problems occurs all the time, even when sectors share no explicit connection.

Although prior literature has investigated risk contagion across stock markets, carry-trade markets, real estate sectors, or foreign exchange markets. Similarly, risk contagion due to counterparty relationships, macroeconomic risk, or financial linkages has been fully investigated (e.g., Changa, McAleerc, & Tansuchat, 2013; Forbes & Rigobon, 2002; Mandilaras & Bird, 2007; Pais & Stork, 2011; Pritsker, 2001). However, less attention has been paid to interest rate risk and bank liquidity, and the magnitude of propagated interest rate risk around global financial markets remains unexplored.

During the 2007–2009 credit crunch, idiosyncratic credit problems originating from the US subprime mortgage market spread rapidly to other countries through the channels of changes in interest rate (e.g., Reinhart & Rogoff, 2009; Tang & Yan, 2010) because liquidity problems correspond to counterparty risk (e.g., Brunnermeier & Pedersen, 2009; Melvin & Taylor, 2009). Interest rate spread—that is, the difference between lending and riskless rates—therefore provides a key transmission channel for interest rate risk propagation, particularly for economic shocks (e.g., Edwards, 1998) and can be taken as a leading indicator of default risk (e.g., Bernanke, 1990; Friedman & Kuttner, 1993; Gertler, Hubbard, & Kashyap, 1991; Tang and Yan, 2010). In this study, we use a modified CoVaR measure to explore the degree to which the increased credit risk within the US financial system during the 2007–2009 credit crunch propagated the European markets' liquidity risks, which were caused by an increase in interest rates. We expect to see that the interest rate risk contagion is particularly severe in several specific illiquid Euro regions and during the financial crisis.

Conventional value-at-risk (VaR) models are incapable of effectively addressing the contagion effect because they do not reveal how the risk faced by one country influences the one faced in other countries. Therefore, we look at the upside risk in distribution of changes in interest rate and convert the unconditional VaR model to a CoVaR model, which allows us to capture the additional contagion interest rate risk by setting reasonable conditional factors (e.g., Adrian & Brunnermeier, 2011; Cakici & Foster, 2003). Specifically, we link the interest rate risk contagion to both the liquidity risk in Europe and the credit risk of the US financial system by modeling the CoVaR.

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