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Hedging European government bond portfolios during the recent sovereign debt crisis

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ABSTRACT

The sovereign debt crisis challenged investors in European government bonds to deal with volatile interest rate spreads. For managing sovereign risk, "Eurex" introduced futures contracts on Italian government bonds reflecting risks of lower rated countries. We analyze hedging strategies for bond portfolios with futures on German and Italian government bonds before and during the sovereign debt crisis and evaluate their out-of-sample hedging effectiveness. Before the crisis, German futures were efficient instruments for hedging government bond portfolios, but during the crisis, a composite hedge combining German and Italian futures was superior. Allocating bonds to high and low sovereign risk-buckets and hedging these buckets individually further enhanced the hedging efficiency.

1. Introduction

During the recent European sovereign debt crisis, financial markets rigorously reassessed sovereign risk as fears of governments defaulting on their bonds emerged as a real threat. These fears resulting from rising government deficits and increasing debt levels in several European countries had a dramatic impact on government bond yields. Consequently, banks and asset managers holding European government bonds had to develop new strategies to deal with interest rate risk and sovereign risk simultaneously. Fig. 1a presents the yield spreads for several European Monetary Union (EMU) 10-year-government bonds relative to German 10-year-government bonds for the 1995–2011 period. Prior to the introduction of the Euro there were substantial yield differences between EMU countries, reflecting differences in sovereign risk and expected inflation. Subsequent to the introduction of the Euro in 1999 yields of EMU government bonds converged and yield spreads diminished. Thus, market participants acted as if all countries within the EMU had equally low levels of default risk or were convinced that EMU member countries would bail-out each other in case of financial distress.

Because yield spreads between EMU government bonds were only marginal from 1999 until the beginning of the sovereign debt crisis in mid 2008 (Fig. 1a), interest rate risk was the dominant risk factor for European government bond portfolios during this period. Interest rate risk could be hedged efficiently with futures contracts on German government bonds such as the Bund, Bobl, and Schatz futures. In late 2008, however, bond markets severely reassessed sovereign risk, which was associated particularly with Greece, Ireland, Italy, Portugal, and Spain. Arghyrou and Kontonikas (2012) and Oliveira et al. (2012) find a shift in the behavior of market participants from a convergence-trade expectation, based on market related factors to one mainly driven by macroeconomic country-specific variables. Consequently, yield spreads of government bonds of these countries relative to German bond yields widened substantially. Hence, apart from managing

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interest rate risk, managers of European government bond portfolios suddenly had to develop new strategies for dealing with sovereign risk.

Moreover, as illustrated in Fig. 1b, the central bank supplied short-term liquidity from the very beginning of the sovereign debt crisis in mid 2008, resulting in a steepening of the yield curve, and making hedging with a single maturity futures contract an even more challenging task. To address the new market challenges, and to complement the benchmark German government bond futures, 'Eurex' introduced short-, mid-, and long-term Euro BTP futures based on notional debt instruments issued by Italy. Therefore, three maturity buckets along the yield curve were now covered with futures contracts on bonds with lower (Germany) and higher (Italy) sovereign risk. Together, these six instruments should enable bankers, investors, and asset managers to efficiently hedge interest rate risk for different maturities and sovereign risk of higher and lower rated countries such as Italy, Spain, and Portugal and might even contribute to stabilizing bond portfolios that contain Greek bonds. Moreover, employing futures contracts traded on an organized futures exchange such as 'Eurex' minimizes counterparty risk and therefore alleviates the problems inherent in OTC derivatives such as CDS.

The objective of our study is to analyze the efficiency of different future contracts and hedging strategies for European government bond portfolios prior and during the sovereign debt crisis. We proxy European government bond portfolios with an index widely employed as benchmark for EMU fixed income portfolios (iBoxx Liquid Euro Sovereigns Capped 1.5–10.5 years). Our research contributes to the literature in three major aspects. First, while earlier studies analyze hedging strategies for bond portfolios in general, we provide detailed analyses for an extremely risky period, the European sovereign debt crisis. Second, we analyze the risk reduction potential of the newly launched BTP futures contracts for hedging European government bond portfolios. We evaluate the out-of-sample hedging effectiveness of various hedging strategies with one or multiple hedging instruments based on portfolio and duration approaches. Third, we propose hedging strategies in which we first divide the bond portfolio into different sovereign risk buckets and then hedge each bucket individually with the appropriate hedging instrument. We analyze the period from January 2006 to December 2011 and compare the results of the sub-periods prior and during the sovereign debt crisis. Our empirical results provide evidence of a dramatic change in risk factors and risk exposures during the sovereign debt crisis, requiring innovative hedging instruments and strategies.

Our empirical results suggest that a composite hedge employing German government futures and Italian BTP futures consistently improves the hedging effectiveness relative to single futures hedges. While the futures contracts on German government bonds were very efficient hedging instruments during the pre-crisis period, the introduction of the BTP contracts was essential for hedging EMU bond portfolios during the sovereign debt crisis. Finally, we provide evidence that a 'bucket hedging' strategy, in which the bond portfolio is divided into different sovereign risk buckets, which are hedged individually, yields superior hedging results compared to hedging all portfolio risks simultaneously.

The remainder of the paper is organized as follows. In Section 2, we review the literature on hedging strategies and describe the methodology used in our analyses. Section 3 provides the data and some descriptive statistics. In Section 4, we present and discuss our empirical results. Section 5 concludes.

2. Literature review and methodology

In this Section, we present the related literature and the methodology employed in this study. We begin with discussing some general thoughts on hedging EMU bond portfolios in Section 2.1. Section 2.2 explains duration and factor approaches for hedging, whereas Section 2.3 discusses portfolio and regression based hedging approaches. In Section 2.4 we discuss composite hedges that employ more than one futures contract. Sections 2.5 and 2.6 illustrate measures to evaluate hedging strategies based on their ability to reduce risk and the associated futures turnover and transaction costs. Most importantly, Section 2.7 presents the variance decomposition technique that we use to analyze the potential of different futures contracts to hedge EMU government bond portfolios. Finally, in Section 2.8 we discuss several approaches to identify sovereign risk for choosing appropriate hedging instruments on an ex ante basis.

2.1. Hedging EMU bond portfolios

When devising a hedging strategy for EMU bond portfolios, the investor first has to select the appropriate hedging instruments such as futures contracts. In a simple perfect hedge, the futures contract exactly matches the spot position. However, EMU government bond portfolios that we analyze in this study usually contain a large number of different EMU government bonds with different coupons and maturities as well as different sovereign risk exposures. Because there are currently no futures contracts on EMU bond portfolios traded, future contracts, which are highly correlated with the bond portfolio returns need to be determined (Ederington, 1979). Chen and Sutcliffe (2012) provide evidence that for cross hedges, in which the spot and futures position differ with respect to the maturity and underlying instrument, a composite hedge consisting of two futures contracts is superior relative to hedging with a single futures contract. Therefore, employing two or more different hedging instruments is probably superior for efficiently hedging EMU bond portfolios. Having selected adequate future contracts, appropriate methods for computing optimal hedge ratios need to be determined.

Although various approaches for computing optimal hedge ratios exist in the literature, most studies focus on hedging commodities or equity portfolios, while hedging bond portfolios attracted only minor attention. Because our analysis focuses on hedging European bond portfolios during the sovereign debt crisis, rather than on analyzing the theoretical features of different hedging approaches, we concentrate on the typical hedging strategies widely discussed in academia and