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# A tale of two risks in the EMU sovereign debt markets

Erdinc Akyildirim [a], Duc Khuong Nguyen [b], Ahmet Sensoy [c,*,1]

[a] University of Zurich, Department of Banking and Finance, Zurich, Switzerland
[b] IPAG Lab, IPAG Business School, Paris, France
[c] Bilkent University, Faculty of Business Administration, Ankara 06800, Turkey

## HIGHLIGHTS

- Introduce dynamic systematic yield risk (SYR) and liquidity risk (SLR) measures for EMU sovereign bond markets.
- Trend components of SYR and SLR are strongly positively correlated.
- Shocks to the SLR has significant impact on SYR lasting up to 5 days.
- Shocks to the SYR has no significant impact on SLR.
- As of 2018, both SYR and SLR are at their highest levels.

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## ABSTRACT

We introduce time-varying systematic yield risk (SYR) and systematic liquidity risk (SLR) measures for sovereign bond markets of the major European Monetary Union (EMU) country members. Using daily sovereign bond data, our analysis shows that trend components of both types of risk are strongly positively correlated. Vector auto-regression and generalized impulse response analysis reveal that shocks to the SLR has significant impact on SYR lasting up to 5 days, whereas shocks to the SYR has no significant impact on SLR. Since mid-2015, both risks are gradually increasing and as of 2018, they are at their highest levels over the last five years.



## 1. Introduction

Market liquidity, defined as the ability to trade large quantities of assets quickly at a low cost, is a crucial element for the proper functioning of financial markets and of great interest to market participants and policymakers. We have seen, over the last two decades, an extensive body of research that examines the co-movement between individual asset liquidity and market-wide liquidity. Following the works of Chordia et al. (2000), Huberman and Halka (2001) and Hasbrouck and Seppi (2001), empirical studies have shown that liquidity is subject to a spillover effect influencing other assets traded in the same market. In this scheme of things, liquidity is not just the trading cost of an individual asset but also a potential systematic risk factor due to commonality (Pastor and Stambaugh, 2003; Acharya and Pedersen, 2005; Sadka, 2006; Korajczyk and Sadka, 2008). Therefore, analyzing the systematic liquidity risk factor is important as it might offer a clue to solving the puzzles of market dry-ups and crashes, provide more accurate signal for portfolio selections, improve market designs, and further contribute to financial stabilization policies (Sensoy, 2017).

The related literature on this subject has covered many asset classes such as equities (see above), foreign exchanges (Mancini et al., 2013; Karnaukh et al., 2015), US treasuries (Fleming, 2003; Chordia et al., 2005), US corporate bonds (Lin et al., 2011; Bao et al., 2011), and even the CDS markets (Coro et al., 2013; Mayordomo et al., 2014). However, sovereign bond markets, and particularly the European Monetary Union (EMU) sovereign bonds, have not received much attention. This is indeed surprising given the fact that the recent global financial crisis of 2007–2008 and the Eurozone debt crisis in 2012 caused deep recession, unemployment, macro-economic imbalances, and banking sector problems in the region. More importantly, these crises have revealed that

* Corresponding author.
*E-mail address:* ahmet.sensoy@bilkent.edu.tr (A. Sensoy).

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the EMU sovereign bond markets are not immune to liquidity shortage.

Regarding the EMU sovereign bond markets, studies mostly focus on the determinants of liquidity differences across bonds, or how individual liquidity effects the corresponding bond's main characteristics. For example, Petrella and Resti (2013) show that both market factors (such as the quality difference between low and high rated bonds) and bond specific factors (duration, size) have an impact on the cross-sectional liquidity differences (see also Manganalli and Wolswijk (2009)). In a recent study, Boermans et al. (2016) find that liquidity is a significant driver of bond price volatility during the 2013 Taper Tantrum and 2015 Bund Tantrum period.

In this study, we rather focus on the systematic liquidity component of the EMU sovereign bond markets as well as its relationship with the systematic yield risk. For this purpose, we first introduce a systematic liquidity risk (SLR) index using daily bond spreads and dynamic conditional beta methodology (Bali et al., 2017) to observe its time variation. Next, we introduce a similar index (systematic yield risk, SYR) to detect the collective variation in yields of these sovereign bonds.

Earlier studies suggest that the systematic liquidity is an important determinant of an asset's expected return (Pastor and Stambaugh, 2003; Acharya and Pedersen, 2005; Korajczyk and Sadka, 2008; Brunnermeier and Pedersen, 2009) and this was also tested empirically on EMU sovereign bond prices by Jankowitsch et al. (2006) and Favero et al. (2010).[2] Differently, this paper is not just interested in a bond's expected yield but focuses on the systematic yield variation across all bonds. Our proposed approach will, therefore, bring a fresh look to the subject, and have important policy implications for these markets.

Our findings show that both types of risk are strongly positively correlated, which typically supports the theoretical approach on an asset's liquidity–return spiral by Brunnermeier and Pedersen (2009) at the aggregate market level. Vector auto-regression and generalized impulse response analysis reveal that shocks to the SLR has significant impact on SYR lasting up to 5 days, whereas shocks to the SYR has no significant impact on SLR, emphasizing the increased importance of proper liquidity management in the EMU sovereign bond markets in the last decade. Finally, since mid-2015, both risks are gradually increasing and as of 2018, they are at their highest levels of the last five years, suggesting that policymakers, public debt managers, and market participants should be alerted and on guard for the potential upcoming consequences in these markets.

The rest of our paper is structured as follows. Section 2 presents the data and reports the empirical results. Section 3 provides some concluding remarks.

## 2. Data and results

We consider daily 10-year benchmark government bond's ask and bid yields for a sample of eleven countries to carry out our empirical analysis. These countries include Austria, Belgium, Finland, France, Germany, Greece, Italy, Ireland, Netherlands, Portugal, and Spain. The data are obtained from Bloomberg. The sample spans a time period from May 1, 2013 until Feb 6, 2018. The sample start date was chosen to get bid and ask yield data for all countries in our study. It is worth noting that before this date, there are many missing observations for some of the sample countries.

### 2.1. The model and the results

Inspired by the work of Chordia et al. (2000), we start with the following market models to examine the systematic yield and liquidity risks in EMU:

$$DY_{i,t} = \alpha_i + \beta_i DY_{M,t} + \varepsilon_{i,t} \quad (1)$$

$$DL_{i,t} = \tilde{\alpha}_i + \tilde{\beta}_i DL_{M,t} + \tilde{\varepsilon}_{i,t} \quad (2)$$

where $L_{i,t}$ is a general notation to denote the measure of an individual liquidity (bid–ask spread) for bond $i$ on day $t$; $L_{M,t}$ is equally-weighted cross-sectional average of the liquidity variable for all bonds on day $t$ excluding bond $i$. $Y_{M,t}$ is equally-weighted cross-sectional average of individual yields for all bonds on day $t$ excluding bond $i$. The operator $D$ stands for the daily first difference wherever it is used. Exclusion of the individual bond variables in constructing the aggregate variables is to remove the effect of bond $i$'s own variation on the market average and remove the constraint that the cross-sectional average of the betas has to be unity. Finally, $DY_{i,t}$ and $DL_{i,t}$ are winsorized at 2.5% levels on both sides for each $i$ to remove the outlier effect in our analysis.

Unlike the classical approaches, the estimations above are performed by the state of the art methodology of Dynamic Conditional Beta (DCB) proposed by Bali et al. (2017), which allows us to estimate a time-varying yield and liquidity beta for each bond $i$ without consuming any initial data unlike in the case of rolling window beta estimations.[3] With these estimations, we end up with a liquidity beta ($\tilde{\beta}_{i,t}$) and yield beta ($\beta_{i,t}$) value for each day $t$ and for each bond $i$.

After estimating the time-varying yield and liquidity betas in Eqs. (1) and (2), we calculate the median of betas for yield and liquidity on each day for the whole sample countries. While the former is a proxy for systematic yield risk (SYR), the latter is an indicator of systematic liquidity risk (SLR).[4,5]

Fig. 1 displays the time-varying SYR and SLR measures. The sub-figure on the upper-left corner shows the actual dynamic median beta values for yield and liquidity. To make them easily comparable, we add the normalized version of these risk measures that have zero means and unit variances, which are displayed on the upper-right corner of Fig. 1. Finally, we apply Hodrick and Prescott (1997) filter to our normalized risk measures to eliminate noise and extract the trends in both types of risks in order to focus on the big picture.[6]

At the first sight, we notice that there is the strong similarity in the long term trends of the SYR and SLR. The correlation level among the first differences of these risk trends is 0.50 and statistically significant. The two risks increased significantly between May 2013 to June 2014, and then felt down to the lowest level in the third and fourth quarters of 2015. They then rose sharply to reach extremely high level in October 2017.

Specifically, a deeper investigation of the smoothed risk trends shows that the SYR and SLR indices increase for the EMU bond

2 However, these studies find conflicting results. The former study finds very limited liquidity effect on bond prices and suggests that other effects, such as credit risk, are important driving factors of bond price differences in the cross-section. On the other hand, the latter study states that bond price differentials increase with liquidity risk.

3 It also saves us from picking window length which is usually subject to criticism in empirical studies. See Appendix for the DCB methodology.

4 This approach was previously used by Sensoy (2016) on equity markets to measure systematic return risk.

5 Taking the mean of betas produces similar results.

6 This filtering uses ideas related to the decomposition of time series: Let $y_t$ for $t = 1, 2, \ldots, T$ denote the logarithms of a time series variable. The series $y_t$ is made up of a trend component, denoted by $\tau$ and noise $c$ such that $y_t = \tau_t + c_t$. Given an adequately chosen positive $\lambda$, there is a trend component that solves $\min_\tau(\sum_{t=1}^{T}(y_t - \tau_t)^2 + \lambda \sum_{t=2}^{T-1}[(\tau_{t+1} - \tau_t) - (\tau_t - \tau_{t-1})]^2)$. The first term of the equation is the sum of the squared deviations $d_t = y_t - \tau_t$ which penalizes the noise. The second term is a multiple $\lambda$ of the sum of the squares of the trend component's second differences. This second term penalizes variations in the growth rate of the trend component.