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How important is liquidity risk for sovereign bond risk premia? Evidence from the London stock exchange

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ABSTRACT

Using a unique data set, this paper studies the relationship between market liquidity risk and sovereign bond risk premia. The London Stock Exchange during the late 19th century is an ideal laboratory in which to examine the effect of market liquidity on sovereign bond prices. This period was the last time when the debt of a heterogeneous set of countries was traded in a centralized location and for which sufficiently long time series of observable bond prices are available to conduct asset-pricing tests. Empirical analysis of these data establishes two results. First, illiquid sovereign bonds carry larger factor loadings on market liquidity than liquid bonds. The difference in average excess returns is not only due to the larger transaction costs associated with holding illiquid bonds but also to the greater sensitivity of the returns of illiquid bonds to fluctuations in market liquidity. Second, excess bond returns are linearly related to the returns of a liquidity-mimicking portfolio in the cross-section, indicating that market liquidity is a priced common risk factor. At about 2.8% per year, the price for bearing liquidity risk is economically significant. Overall, this evidence underscores the importance of understanding the effect of market liquidity on bond prices, even in an economic environment that seems remote from today's.

1. Introduction

Recent events suggest that liquidity risk may be an important component of sovereign bond risk premia. In the fall of 1998, the price of US Treasuries increased sharply relative to less liquid financial instruments in response to the Russian default, the failure of Long-Term Capital Management, and pervasive financial turbulence. More recently, the turmoil associated with the subprime mortgage crisis caused a systemic liquidity crisis in international financial markets and induced a shift into liquid US and European government bonds. For example, in early 2008 investors moved into German government bonds at the expense of less liquid debt instruments (Chung, 2008).

To explain these patterns in terms of asset-pricing theory, market liquidity must be a priced common risk factor. That is, there must be a systematic component to variation in liquidity, and, overall, bonds must have low returns when the market becomes illiquid. Some bonds will be more sensitive to fluctuations in market liquidity and carry larger liquidity premia in the cross-section of excess bond returns.

Using a unique data set collected from 19th century financial publications, I show that liquidity risk is important for pricing sovereign bonds. The London Stock Exchange before the First World War is an ideal laboratory for directly confronting the issue of market liquidity risk and sovereign bond risk premia. A centralized market for trading international debt is a relatively recent development and long time series of transaction data suitable for conducting asset-pricing tests are not widely available. In contrast to today, observable bid-ask spreads for a heterogeneous set of sovereign borrowers are available from the early 1870s until 1907. The data from the Exchange offer an excellent opportunity to study the liquidity premium in the international debt market.

The paper reaches two conclusions. First, illiquid sovereign bonds tend to carry larger factor loadings on unexpected changes in market liquidity relative to liquid sovereign bonds, so their returns are more sensitive to these fluctuations. This finding is consistent with the demand for liquidity being sensitive to overall market liquidity; it implies that investors prefer sovereign debt that is easier to trade when market liquidity dries up. Second, market liquidity is a common risk factor important for pricing the cross-section of sovereign bond returns. At about 2.8% per year, the estimated liquidity premium is the largest of all the risk premia. Moreover, this estimate is broadly robust to controlling for the level effect of liquidity on bond prices. Thus, the data validate the predictions of models that postulate market liquidity is a state variable important for pricing international securities and underscore its enduring relevance.

Section 2 discusses the features of the 19th century London Stock Exchange that make it an excellent testing ground for studying liquidity risk and sovereign bond risk premia. Section 3 presents the

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theoretical framework and empirical methods. Section 4 describes the data, as well as the market liquidity index and its time-series features. Section 5 presents the evidence and conducts a series of robustness tests.

2. The London Stock Exchange as a Laboratory

It may seem surprising that sovereign bond price data for the current era are not more readily available, but a transparent sovereign-debt market is a recent development.[1] For example, a study of liquidity risk in the US Treasury market relies on transaction data available since 1992 (Li et al., 2009). Price data for emerging-market debt span shorter periods. Until the debt crisis in the 1980s, the primary form of sovereign lending to emerging markets was bank loans (Folkerts-Landau, 1985). Although the Brady Plan created a market for emerging-market debt in the early 1990s, the secondary market remained thin for some time, and the available pricing data are considered unreliable (Stone, 1991). To the extent that transaction data for those bonds exist, they are not necessarily publicly available (Boehmer and Megginson, 1990; Cumby and Pastine, 2001). Papers that study the pricing of bonds issued by emerging markets are forced to rely on data from the 1990s onward (for example, González-Rozada and Yeyati, 2008). Transaction data are unavailable because the secondary market for sovereign debt is an over-the-counter market. Pricing is decentralized, so that prices are equalized indirectly, and often imperfectly, by arbitrage.[2]

The bond price data available from the London Stock Exchange during the late 19th century do not suffer from these limitations. Sovereign bonds were widely traded on the Exchange, so observable bid and ask prices are available from contemporary financial publications. During that era, the breadth and depth of the London capital market made it the center for countries to raise capital. Indeed, the period encompasses three sovereign lending booms — one in the mid-1870s, one in the mid-1880s, and one in the decade before the First World War (Suter, 1990). By current standards, the amount of credit extended to foreign governments was large because sovereign bond issues represented the principal means by which countries imported capital from the rest of the world (Mauro et al., 2002). In 1883, the market value of foreign government bonds traded on the London Stock Exchange was about 76% of British nominal GDP.[3] Until the 1890s, foreign government bonds were the largest single asset class traded on the Exchange. Including the market value of British government debt, the size of the government bond market as a percentage of total market value was almost 60% in 1873 and 52% in 1883 (Michie, 1999, Table 3.3). From the 1890s onward, equities issued by foreign railroads surpassed sovereign bonds as a share of total market value.[4] Nevertheless, sovereign borrowing remained an important part of the London capital market; its share of London's market value remained above 20% until 1914.

The importance of the London debt market offers a unique opportunity to study liquidity as a common risk factor in sovereign risk premia. The fact that the bonds were traded in a single, centralized market permits the identification of the relationship between market liquidity and sovereign risk premia without conducting the test across markets that may be not be fully integrated (see Bekaert et al., 2007). In addition, the diverse cross-section of issuers ensures dispersion in the liquidity factor loadings, which aids in the identification of the asset-pricing model. Finally, the time series of bond prices are long enough to conduct asset-pricing tests with statistical power. Thus, the London sovereign bond market during the late 19th century is a rich laboratory for studying the link between market liquidity risk and the price of sovereign debt.

3. Theoretical framework and empirical methods

The empirical analysis is guided by asset-pricing models that predict investors demand compensation for bearing the risk associated with fluctuations in market liquidity. Two asset-pricing models that formalize the relationship between expected returns and liquidity risk are Acharya and Pedersen (2005) and Bekaert et al. (2007).[5] Acharya and Pedersen propose a liquidity-adjusted capital asset pricing model in which liquidity varies randomly and exogenously and a security's required rate of return reflects compensation for bearing market risk as well as the risk associated with fluctuations in market liquidity. In a similar vein, Bekaert et al. introduce exogenous fluctuations in market liquidity directly into the stochastic discount factor, so that it affects the required rate of return on risky assets. The empirical implication of both models is that expected excess returns reflect a premium associated with fluctuations in market liquidity. Furthermore, several papers study the empirical importance of liquidity risk in the equity market (Pástor and Stambaugh, 2003; Liu, 2006; Goyenko and Sarkissian, 2008; Korajczyk and Sadka, 2008), while Li et al. (2009) examines the pricing of liquidity risk in the returns of US Treasury securities.

From this perspective, arbitrage-pricing theory is a natural framework for evaluating the effect of liquidity as a pervasive risk factor on sovereign risk premia. It predicts that a security's risk premium is proportional to its sensitivity to unexpected changes in a set of pervasive risks (Ross, 1976; Connor, 1984). Security returns are driven by K common risk factors

$$r_i = E[r_i] + \sum_{K=1}^{K} \beta_{ki} f_k + \varepsilon_i \quad (1)$$

where $E[r_i]$ is the expected return on security $i = 1,\ldots; N$; $f_k = F_k - E[F_k]$ is the unexpected change in the common risk factor F_k that drives security returns; β_{ki} is the sensitivity of security i's returns to unexpected changes in risk factor k; and ε_i is the idiosyncratic component in the returns of security i. The expected risk premium $E[r_i - r_f]$ of a security i can be expressed as a linear function of its K factor betas

$$E\left[r_i - r_f\right] = \sum_{K=1}^{K} \beta_{ki} \lambda_k \quad (2)$$

where r_f is the risk-free rate of interest; $\lambda_k = E[r_k - r_f]$ is the expected risk premium associated with the kth pervasive risk factor; and $E[r_k]$ is the return on the factor-mimicking portfolio p_k that has a unit loading on the kth common risk factor $\beta_{pk} = 1$. The factor-mimicking portfolio captures the marginal returns associated with unit exposure to the common risk factor and provides a way to estimate the risk premium associated with that factor.

[1] Datastream provides sovereign bond price data from the mid-1990s. Bloomberg has price data for some bonds since 1987, but bid and ask prices are available for only a small set of countries and for shorter time periods.

[2] The market's opacity makes it difficult to construct transaction-based indicators of liquidity comparable across countries. For example, a Bank for International Settlements study found it problematic to compare measures of liquidity among the G10 (Bank for International Settlements, 1999, pp. 13). Cross-country differences in how transactions are negotiated made it difficult for the authors to compute comparable bid-ask spreads. In the past 10 years, however, technological developments have improved the transparency of bond markets, including the market for sovereign debt, and facilitated the broader dissemination of transaction data (Economist, 2000; Bessembinder and Maxwell, 2008).

[3] The market value of foreign government traded on the Exchange in 1883 was £975.1 million and the nominal value of Great Britain's GDP in 1883 was £1,285 million. The foreign government debt data are taken from Michie (1999, Table 3.3) and the GDP data are from Lawrence Officer's webpage http://www.measuringworth.org/ukgdp/.

[4] In 1893, foreign railroads comprised about 32% of the Exchange's total market value whereas foreign government bonds made up around 21% (Michie, 1999, Table 3.3).

[5] Developing a structural model in which market liquidity varies endogenously remains a major outstanding research challenge, but some progress has been made in this area. For instance, Eisfeldt (2004) proposes a model in which real-sector liquidity varies over time because of productivity shocks.