The Quarterly Review of Economics and Finance 52 (2012) 173–182

Contents lists available at SciVerse ScienceDirect

The Quarterly Review of Economics and Finance

journal homepage: www.elsevier.com/locate/qref

Quoted spreads and trade imbalance dynamics in the European Treasury bond market

Guglielmo Maria Caporale[a,*], Alessandro Girardi[b], Paolo Paesani[c]

[a] Centre for Empirical Finance, Brunel University, West London, United Kingdom
[b] ISTAT, Rome, Italy
[c] University "Tor Vergata", Rome, Italy

ARTICLE INFO

Article history:
Received 11 November 2008
Received in revised form 16 March 2012
Accepted 20 March 2012
Available online 7 April 2012

JEL classification:
G1
G15
C32
C33

Keywords:
Liquidity
Trading activity
Treasury bond market
Europe
Commonality

ABSTRACT

Using high-frequency transaction data for the three largest European markets (France, Germany and Italy), this paper documents the existence of an asymmetric relationship between market liquidity and trading imbalances: when quoted spreads rise (fall) and liquidity falls (increases) buy (sell) orders tend to prevail. Risk-averse market-makers, with inventory-depletion risk being their main concern, tend to quote wider (narrower) spreads when they think bond appreciation is more (less) likely to occur. It is also found that the probability of being in a specific regime is related to observable bond market characteristics, stock market volatility, macroeconomic releases and liquidity management operations of the monetary authorities.

1. Introduction

Over the past few years a growing body of research has been devoted to analysing the market for government securities in Europe focusing on the dynamic relationship between trading activity and price movements (Cheung, de Jong, & Rindi, 2005) and between yield dynamics and order flow (Menkveld, Cheung, & de Jong, 2004), on the determination of the benchmark status among securities of similar maturity (Dunne, Moore, & Portes, 2007), on the analysis of yield differentials between sovereign bonds (Beber, Brandt, & Kavajecz, 2009), and on the process of price discovery in cash and future markets (Upper & Werner, 2002) or in multiple cash markets (Caporale & Girardi, 2011a, 2011b).

With the aim of contributing to this literature, the present study focuses on the relationship between quoted spreads and trading imbalances and on its financial and macroeconomic determinants. While these issues have been extensively discussed in the case of the US stock market, no comparable analysis has been conducted to date in the case of European markets for government securities. In particular, our dataset contains high-frequency transaction data for nine benchmark medium-long term Treasury bonds (taken as representative of general market dynamics) over the period July 3 2006 to June 29 2007.

Our analysis is related to the strand of financial literature investigating the interaction between liquidity and trading activity. This interaction affects the process of price discovery (Brandt & Kavajecz, 2004), depends on the degree of financial integration (Hasbrouck & Seppi, 2001; Korajczyk & Sadka, 2008). Furthermore, as liquidity affects the cost and feasibility of dynamic trading strategies (Johnson, 2008), understanding what factors influence quoted spreads and trading imbalances is relevant for trading-strategy formulation purposes.

Our main results can be summarized as follows. First, by estimating bivariate Markov-switching Vector Auto-Regressions (MS-VAR) for each bond in the sample, we document the existence of an asymmetric relationship between quoted spreads and trading imbalances such that when liquidity is high (low) and quoted spreads narrow (wide), sell (buy) orders tend to prevail. For most bonds in the sample, we also find an intermediate state when orders tend to be balanced.

* Corresponding author.
E-mail address: guglielmo-maria.caporale@brunel.ac.uk (G.M. Caporale).

1062-9769/$ – see front matter © 2012 The Board of Trustees of the University of Illinois. Published by Elsevier B.V. All rights reserved.
http://dx.doi.org/10.1016/j.qref.2012.03.001

Table 1
Bond codes.

Market code	Bond code	Issue date	Maturity date	Maturity (years)	Trades on domestic MTS (%)	Trades by market makers (%)
Germany	DE0001141489	3/22/2006	4/8/2011	5.05	84.31	98.04
	DE0001135291	11/23/2005	1/4/2016	10.12	56.31	89.08
	DE0001135275	1/4/2005	1/4/2037	32.02	73.81	97.81
France	FR0108354806	1/19/2006	1/12/2011	4.98	79.49	99.36
	FR0010288357	2/2/2006	4/25/2016	10.23	47.21	98.83
	FR0010070060	4/25/2003	4/25/2035	32.02	81.64	100.00
Italy	IT0004026297	3/13/2006	3/15/2011	5.01	91.59	99.70
	IT0004019581	2/27/2006	8/1/2016	10.43	86.60	97.73
	IT0003934657	8/1/2005	2/1/2037	31.53	90.61	98.06

Note. For each market, the first, the second, and the third code refers to the 5, 10 and 30-year bond, respectively.

Table 2
Summary statistics for liquidity and trading activity measures.

Bond code	Quoted spreads						Trade imbalances					
	x_M	x_{Me}	x_{SD}	ρ_1	ρ_2	ρ_3	x_M	x_{Me}	x_{SD}	ρ_1	ρ_2	ρ_3
DE0001141489	0.025	0.025	0.007	**0.264**	**0.180**	0.136	−5.944	−7.500	21.650	**0.710**	**0.513**	**0.396**
DE0001135291	0.032	0.031	0.011	**0.412**	**0.241**	**0.181**	−4.824	−2.500	25.089	**0.814**	**0.669**	**0.539**
DE0001135275	0.092	0.087	0.033	**0.610**	**0.414**	**0.311**	−0.069	0.000	16.990	**0.850**	**0.713**	**0.590**
FR0108354806	0.027	0.028	0.007	**0.384**	**0.184**	0.054	2.679	−10.000	32.531	**0.890**	**0.786**	**0.694**
FR0010288357	0.035	0.032	0.019	**0.594**	**0.288**	0.038	−11.050	−5.000	39.302	**0.886**	**0.780**	**0.683**
FR0010070060	0.112	0.113	0.032	**0.179**	0.136	0.069	3.551	5.000	12.937	**0.837**	**0.718**	**0.620**
IT0004026297	0.019	0.020	0.006	**0.572**	**0.394**	**0.263**	−13.059	−5.000	63.370	**0.955**	**0.913**	**0.875**
IT0004019581	0.026	0.025	0.008	**0.792**	**0.659**	**0.554**	3.850	5.000	80.238	**0.957**	**0.914**	**0.871**
IT0003934657	0.093	0.093	0.031	**0.664**	**0.517**	**0.426**	4.812	2.500	38.994	**0.958**	**0.915**	**0.873**

Note. For each bond, we report the mean (x_M), the median (x_{Me}) and the standard deviation (x_{SD}) of quoted spreads and order flows along with their serial correlations up to the third lag (ρ_i, $i = 1, 2, 3$). Values in bold indicate statistically significant autocorrelation coefficients at the 5 percent level. Market codes for German, French and Italian bonds are DE. . ., FR. . . and IT. . ., respectively. For each market, the first, the second, and the third code refers to the 5, 10 and 30-year bond, respectively.

Second, after daily averaging intra-day probabilities extracted from the estimated MS-VAR models, we investigate common potential determinants for the switches across states by random effect probit-estimation for longitudinal data. We find that the relationship between liquidity and trading imbalances is affected by financial and macroeconomic factors including: refinancing costs, bond and stock market volatility, changing business and macroeconomic climate and changing monetary policy stance.

The rest of the paper is organised as follows. Section 2 presents the data and some descriptive statistics. In Section 3 we investigate the dynamic interaction between quoted spreads and order flow imbalances at the individual bond level. Section 4 explores the role of common factors in explaining co-movements between these two market characteristics at an aggregate level. Section 5 offers some concluding remarks.

2. Data and measurement

We use transaction-based data for benchmark Treasury bonds with maturities of 5, 10 and 32 years. The data are extracted from the MTS (Mercato Telematico dei Titoli di Stato) database.[1] The MTS system is a quote-driven electronic order book market for government securities. Proposals are firm, immediately executable and aggregated in a limit order book.[2] As in Dunne et al. (2007), we analyse the three largest European markets (Italy, France and Germany), which account for over 70 percent of the European secondary bond market.[3] The dataset consists of tick-by-tick transaction data (prices and traded nominal volumes) matched with the bid-ask spread prevailing at the moment each transaction took place. The sample covers the period from 3 July 2006 to 29 June 2007. In terms of both its cross-sectional dimension and time span it is broadly comparable to that used by Cheung et al. (2005), D'Souza, Lo, and Sapp (2007) and Dunne et al. (2007), among others. Based on data from opening hours of the MTS system (from 8:15 to 17:30 Central European Time, CET), Table 1 provides the list of bond codes along with information on issue dates, maturity dates and summary statistics on trading activity.[4]

Following Goldreich, Hanke, and Nath (2005) and Pasquariello and Vega (2009), our preferred indicator of liquidity is the quoted bid-ask spreads (*qspr*), defined as the difference between the best bid and best ask divided by mid-quote prices (equally weighted) averaged during half-hour time intervals. The trading imbalances indicator (*oflw*) is constructed as the aggregate volume of buyer-minus seller-initiated orders during half-hour intervals.[5] Excess buy-side or sell-side order flows are closely related to trading costs

[1] For a detailed discussion of the MTS system, see Scalia and Vacca (1999) and Cheung et al. (2005), among others.

[2] Using Italian Government bond data, Coluzzi and Ginebri (2008) examine the microstructure determinants of flows of limit and market orders. Recent theoretical contributions on this issue include those by Foucault, Kadan, and Kandel (2005) and Rosu (2009), among others. In this paper, we adopt a complementary approach focusing on commonalities driving the relationship between trading activity and quoted spreads for the European government bond market as a whole.

[3] According to Dunne, Hau, and Moore (2008), with an outstanding aggregate value of around 4396 billion Euros in 2006, the European sovereign bond market is the world's largest market for debt securities and it exceeds the size of the US one by roughly 3 billion euros.

[4] While a government fixed income instrument becomes a benchmark security *de jure* once auctioned in the primary market, it becomes a benchmark bond *de facto* once its trading volume exceeds the one for the old benchmark.

[5] Using data with higher frequency (namely variables recorded at 5-min intervals), the estimates of MS-VAR models failed to converge. This is due to the huge number of observations (up to 25,000 datapoints) when using 5-min intervals.