Specialists' Incentives on Government Bond Markets

Luciano Greco* Filippo Mormando†

May 2018
Preliminary and Incomplete Version

Abstract

MTS Italy is the Italian government bonds wholesale secondary market that operates under the *specialist system*. In order to push specialists to provide a high level of liquidity, the Italian Treasury monitors and publicly ranks their performance. This paper investigates whether the ranking system, through its explicit and implicit incentives, effectively affects market makers in their quoting decisions and, consequently, the liquidity conditions of order books. The empirical analysis, based on diff-in-diff models, definitely identifies these effects on specialists' quoting behavior. The results are reconciled with traditional microstructure models taking into account the positive effects of a public ranking system. Furthermore, the paper definitely highlights a heterogeneous impact among market makers, suggesting these operators are differently exposed to the potential benefits of a ranking system. These results provide important implications for policy makers in the design of financial markets and suggest that traditional microstructure models and empirical studies can be enhanced by taking into account incentives provided by the ranking regime when it exists.

Keywords: Government Bonds; Market microstructure; MTS; Market makers; Monitoring rules.

JEL Classification Numbers: D47, G12, G14, G18, H63.

*dSEA – University of Padova & CRIEP
†dSEA – University of Padova & CRIEP

1 Introduction

In recent years, the debate about the restructuring of the regulatory framework of financial markets has increased significantly. In Europe, the structure and the design of Government bond markets are one of the main concerns of regulators and policy makers. Studies, linked to the European sovereign debt crisis, have clearly highlighted that market microstructure and liquidity risk are crucial components that affect sovereign borrowing cost, especially during periods of distress and turbulence (D'Agostino and Ehrmann (2014)).

For sovereign issuers, a good functioning of the secondary market provides an essential supportive environment for the primary market, by which the sovereign entities issue their bonds among investors. A good design of secondary market implies a reduction of liquidity risk and the correspondent premium demanded by investors, leading to lower bond yield and sovereign debt cost.

In the European case, the government bonds secondary markets operate under the *market making system*. Market participants are divided into two groups: market makers and market takers. Market makers face quoting obligations: they quote continuously the bid price (on which market takers can sell the bond) and the ask price (on which market takers can buy the bond). Thus market makers offer market liquidity and they are subject to several regulations on pre and post-transparency, on capital and organizational requirements.

Looking at the Italian case, MTS Italy is the secondary wholesale market of the Italian government bonds[1]. It is defined as a *wholesale* secondary market, implying only banks and institutional intermediaries may be admitted as dealers. Among market makers on MTS Italy, a group of selected dealers act as *specialists* of Italian public debt, facing, other than quoting obligations on MTS, other duties in terms of activity in the primary and in the repo markets. These operators benefit from some privileges, explicitly defined by the Specialists' Decree of Italian Ministry of Economy and Finance (henceforth MEF or Italian Treasury). In order to verify the compliance on

[1]MTS Italy is the most important electronic market for Italian government bonds since it has the highest market share in terms of trading activity among electronic platforms (Consob - biannual bulletin June 2017).

their duties and obligations, the Italian Treasury monitors continuously their activity on primary and secondary markets. At the end of each year, based on the overall evaluation, MEF calculates the final ranking and publishes the first five specialists. Monitoring rules and the public ranking regime are employed by the Italian Treasury in order to push specialists to compete in the liquidity provision. These operators are so subject to both market makers' obligations and specialists' duties defined by MEF.

The contribution of the present study is threefold. First, it highlights that liquidity conditions are affected by monitoring rules, not only due to their compulsory nature, but also through the incentives linked to the correspondent ranking system. For instance, these incentives could be related to higher reputation among financial investors. The analysis employs the changes in monitoring criteria occurred between 2015 and 2016 on BTPs with residual maturity longer than 10 years. These changes are suitable for this analysis since these affect only a restricted number of BTPs, determining both temporal and units discontinuities that are opportunely employed in the econometric analysis. The results suggest that empirical research on MTS Italy[2] should take into consideration whether changing in the ranking system occurred during the period considered.

Second, this study suggests how traditional market microstructure models could handle this new source of market externality. The basic idea is that specialists are exposed heterogeneously to the benefits of being in the top positions of the final ranking. Direct and explicit benefits derived from higher probability to be selected by the Italian Treasury as lead managers of syndicated issuances or as dealers in bilateral operations. Other implicit benefits may be essentially related to the higher reputation among investors and these benefits vary among specialists. The ranking signals the quality of execution services of these investment banks: reaching the top positions, specialists signal their compliance in offering a good liquidity service in government bonds, an asset class characterized by high competition and low profitability, in order to increase fidelity of their clients for execution in other asset classes. However, this heterogeneity could be related to

[2] A large number of studies on the liquidity conditions on MTS domestic platforms are conducted recently (Girardi and Impenna (2013), Pelizzon et al. (2014), Cafiso (2015), Pelizzon et al. (2016), Scheneider et al. (2016), Corradin and Maddaloni (2017)).

several other reasons. Further research could investigate why some banks are more exposed than others to potential benefits of ranking regime.

Third, these results contributes significantly on the debate about the restructuring of markets design, highlighting that monitoring and ranking regimes may increase market competition, globally leading to better market quality.

The paper is organized as follows. The next section presents the literature related to market microstructure models, regulatory changes, the correspondent impact on market makers' behavior and a review of studies on liquidity conditions in MTS markets. Then, Section 3 presents MTS Italy platform, the specialists' evaluation criteria, the ranking system set by the Italian Treasury and it formalizes the testable predictions. Sections 4, 5, 6, 7 and 8 discuss methodologies, data and the main results of the econometric analyses. Concluding remarks are offered in Section 9.

2 Related literature

Market microstructure models examine the process by which institutional market rules, investors demands and traders' heterogeneity interact and are translated into transactions and price variations. Market makers play a crucial role in this process: they stand ready to buy and sell a particular amount of an asset on a continuous basis at a publicly quoted price. If v_t is the public fair value of a risky asset at a some point in the time t, market makers set the bid price b_{vt} ($< v_t$), on which investors are able to sell the asset, and the ask price a_{vt} ($> v_t$), on which investors can buy the asset. The bid-ask spread should compensate market makers for their immediacy of transaction and for other costs that they implicitly and explicitly face: operation costs, participation costs, transaction costs, asymmetric information, imperfect competition, inventory control costs, funding constraints and search. Vayanos and Wang (2012) provide an exhaustive survey on theoretical work and empirical literature on these imperfections. Among implicit costs, the existing literature extensively studies asymmetric information costs and inventory control costs. Asymmetric information costs arise when some investors are better informed about the true value of the asset. If

market makers are not able to distinguish these investors, they set bid and ask prices taking into account the risk of dealing with a better informed investor.

Several studies have focused on those costs and proposed different models (information-based models) that try to explain how asymmetric information on the real value of the asset affects the bid-ask spread. Among these models, two different classes can be distinguished: strategic models and sequential trading models. The common idea is that a trade reveals something about the agent's private information. Kyle (1985) proposed the first strategic model. The basic idea of this model is that the better informed trader trades strategically maximizing its trading profits before the information becomes common knowledge. This model considers the existence of a single informed trader. Holden and Subrahamanyam (1992) propose a similar multi-period auction model but characterized by multiple noncompetitive agents. In contrast with Kyle results, they find that even just two informed traders cause an immediacy in private information incorporation in asset price. Some other basic assumptions of the original Kyle's framework have been relaxed in other papers: Admati and Pflederer (1988) introduce endogenous patterns in buy and sell volumes that induce buyers and sellers to trade in different periods mitigating the adverse selection problem, Foster and Viswanathan (1990) argue that, since prices are an important source of information both for informed and uninformed traders, also uninformed traders could act strategically in the market.

The sequential trade models focus on the basic idea that, in a quote driven market with heterogeneously informed traders, the bid-ask spread is linked to the probability structure of the market participants. Among these model, Copeland and Galai (1983) and Glosten and Milgrom (1985) propose the first models in this direction. Looking at the basic assumptions, the market maker is risk neutral and sets quotes in a competitive way (zero profit condition is respected). Since the market maker losses on dealing with informed traders, she quotes higher bid-ask spread. The adverse selection problem implies that there is an increasing and positive effect of the fraction of informed traders on the bid-ask spreads. Easley and O'Hara (1987) incorporate in the model also the trade size and the different effect of a small or large trade in signaling the quality of information. Better

informed trader faces a trade-off. In order to maximize their profits, they could trade a large size but in this way they send a higher quality signal on the information. Based on these models, several studies discuss when crashes in financial markets arise with the inability of the market maker in playing its crucial role in stabilizing the market. Romer (1993) argues that crashes may arise when traders are uncertain about the precision of information of other traders.

The second implicit cost that a market maker faces is the inventory-control cost. This cost arises when imbalances of buying and selling flows increase. Market maker, setting their bid-ask spread, should consider the risk in holding inventory that may deviate from their desired position and causing losses if prices move against. If they already own a significant long (or short) position, they set the bid and ask prices in order to facilitate the turnover of the position. Garman (1976) proposes a model in which he assumes that the market maker has to face the Gambler's Ruin problem since dealer capital is finite and the probability that inventories become greater than the capital is equal 1 for some finite time T. As Madhavan (2000) explains, this simple model well highlights the relation between market making activity, inventories and dealer capital structure. Inadequate capitalization could cause an increase in price volatility due to inventories control: if market maker already owns a relevant position (suppose long), after an heavy selling flow, she could be reluctant in increasing her long position, leading to a deterioration in the bid side of the market, a compression in the ask side and an increase in market volatility. Stoll (1978), Amihud and Mendelson (1980), Ho and Stoll (1981) propose a model of a monopolistic specialist that sets the markup on the fair price of the asset depending on monopoly power, volatility and inventory control costs. Ho and Stoll (1983) relax the assumption of monopolistic market maker and analyze the equilibrium condition under multiple specialists in a competitive framework. In their paper, authors conclude that market volatility is affected not only by uncertainty about the returns on their inventories, but also by uncertainty about the arrival of transactions.

Differently from previous literature that limits the specialist' choice to the bid and ask prices in order to compensate several implicit and explicit costs, Kavajecz (1998) proposes the first model in which a specialist chooses prices and depths jointly in order to maximize her profits. He found

that prices and depths are used as substitutes: a narrow bid-ask spread induces small depth quotes whereas large depth quotes induce a wide bid-ask spread. These depths quotes are not, however, the familiar depth parameter discussed in the Kyle (1985) paper, rather they are quantities that specialists post in real time that announce the number of shares available at the posted price (Kavajecz, 1998). Kavajecz (1999) and Caglio and Kavajecz (2006) link the specialist's choice of quoted depth and tightness of her bid-ask spread in order to face the adverse selection risk. Specifically, they found that specialists decide to reduce their exposure risk, reducing their quoted size, when they face an increase in the amount of adverse selection or in price uncertainty. These works are the main references for our study since it focuses on the opportunity for specialists, provided by the new monitoring rules, to manage both prices and quantities in their quoting proposals.

The second strands of literature refers to the empirical analyses on the impact of changes in quoting obligations on market makers' behavior. Only few of these changes affect directly the obligation on the minimum quantity set by market makers. McInish, Van Ness and Van Ness (1998) have examined how the change in the Actual Size Rule (ASR) affected Nasdaq market quality. They find a negative impact on the quoted depth and a positive effect on the number of small quotes in the 10 days after the implementation of the new rule. Porter et al. (2006) investigate the link between the ASR change and periods of market stress. They find that ASR may significantly reduce market quality under times of financial distress. Chung and Zhao (2006), employing both cross sectional and intertemporal analyses on Nasdaq stocks, find that dealers post large depths when their quotes are at the inside[3] and frequently quote the minimum required depth when they are not at the inside, leading to a negative intertemporal correlation between dealer spread and depth.

Other previous studies of the spread-depth interaction focus on specialist quotes on the NYSE. However, our paper differs from these studies since the MTS setup is substantial different from equity markets. The main difference in the market structure is that in MTS, only the group of market makers quotes simultaneously the whole group of Italian government bonds, while in NYSE

[3]Inside quote represents the best bid or ask prices of the quoting book. The inside quote is the prices at which market order will be executed.

each stock has just one specialist that faces the quoting obligation and acts competitively with limit orders of other investors. Gozluklu et al. (2015), employing a dataset on Borsa Italiana, investigate how market quality has been affected by the reduction of the minimum trade unit (MTU). They find a substantial improvement of liquidity driven by the reduction in adverse selection and by the increase in retail trading. However, Gozluklu setup and other previous studies on the reduction of MTU (e.g. Amihud et al. (1999)) differ from this paper since our focus is on quoting obligation and not on the opportunity to increase liquidity with low entry barriers in stocks trading.

In addition, a wide literature exists on the effect of other regulatory changes in financial markets. For instance, the effects of changing the minimum tick size draws considerable attention. The tick size is the minimum price movement of a trading instrument. Harris (1994) hypothesizes that a smaller tick size is likely to cause a reduction in the bid-ask spread since to the removal of the artificial ceiling allows investors to place limit orders at prices which were previously unavailable. Empirical studies, applied in different markets, confirm these hypotheses (Goldstein and Kavajecz (2000), Chung and Chuwonganant (2004), Ahn and al. (2007), Buti et al. (2013), Lepone and Wong (2017)). Other studies assess the impact of ban on stub quoting that should narrow volume weighted bid-ask spread and reduce the price impact leading to better liquidity conditions. Findings of Egginton and al. (2016) are consistent with these hypotheses. These studies differ from our paper since the rule changes concern different characteristics of the market design and because, as mentioned above, other important structural differences exist between MTS and equity markets.

Finally, this paper is related to the literature on MTS market, one of the most important electronic trading platforms of European government bonds with a peculiar organizational setup. As discussed above, this market differs substantially from equity markets. Cheung at al. (2005) provide a first extensive description of the European bond market and investigate some aspects of the microstructure of MTS markets, as the link between Euro MTS and domestic platforms. Coluzzi et al. (2008) analyze the microstructure liquidity evolution on MTS Italy employing a wide set of different liquidity measures. Later, Darbha and Dufour (2013b) review the microstructure of Euro area government bond market, including the high number of studies linked to the European

sovereign bond crisis. Pelizzon et al. (2016) study the evolution of liquidity measures during the Euro-zone crisis in the MTS Italy, highlighting the links with sovereign risk and ECBs intervention through LTRO and OMT programs. Pelizzon et al. (2014) investigate the links between the cash (MTS) market and the correspondent futures market (Eurex) in price discovery and in liquidity discovery processes. Paiardini (2015) studies how economic news are incorporated in MTS markets. Cafiso (2015) investigates the connections between primary and secondary markets, employing data on the Italian case. Scheneider et al. (2016), employing a dataset that runs from 2011 to 2015, study the spillover effects of shocks in liquidity conditions among different segments of BTPs.

MTS provides also a platform to execute repos on government bonds[4]. Since market makers face order imbalances and manage scarcity risk, a good functioning of repo market is crucial in order to guarantee high level of liquidity in the cash market. Corradin and Maddaloni (2017) study how supply and demand shocks (e.g. ECB's intervention) affect the specialness of Italian government bonds.

3 Institutional details

3.1 MTS Italy market structure

MTS was introduced in 1988 by the Italian Treasury and it was the first electronic market for government bonds in Europe. In 1997 it was privatized and it began expansion across other public debt issuers. The main reason for the launch of MTS was to create a supportive environment for the big changes that were ongoing in the primary market, namely the evolution in the placement technique of government bond from a system of firm sale to a predetermined group of banks to an auction based system, where all market players can participate and bid competitively for the amount of bonds announced by the issuer. In 1998 MTS has become a *Regulated market* owned by the private sector. However, according to several second tier regulations (e.g. Ministry decrees), the set of rules according to which the market for wholesale trading in government bonds works is

[4]Miglietta et al. (2015) documents that the market share of MTS repo platform is close to 90% .

laid down by the Italian Treasury, while the supervision is under the control of Bank of Italy and Consob.

The Italian Treasury issued two main regulations in 1999 and 2009 that reaffirmed MTS as a pure interdealer platform with market making obligations, high levels of transparency both pre trade and post trade, even before MIFID 2 requirements. These decrees also set down the rules for specialists. These measures, to create an efficient secondary market, were adopted within the general framework of public debt management policy, aimed at achieving a structural minimization of funding cost, increasing liquidity for government bonds through an electronic system which makes transactions very easy to be executed, providing a clear picture of market conditions for the market participants by means of a continuous "on screen" availability of bid-ask prices, helping the issuer in the placement of specific bonds offered at auctions (Iacovoni (2017)).

Currently MTS Italy is the domestic trading platform of Italian government bonds of MTS markets. It is defined as a wholesale secondary market, implying that only banks and institutional intermediaries are admitted as dealers and participate on their own account (or on behalf of institutional investors but as a direct counterpart).

As the other MTS markets, the Italian platform is a quote-driven electronic order book market. Participants are divided into two groups: market makers and market takers. As discussed above, the role of market makers is to provide liquidity continuously, quoting two proposals (bid and ask prices) that are aggregated in the order book for each bond. Other participants, acting as price taker, can buy and sell a certain amount of a bond, hitting the proposals with a market order. Other important features of MTS markets are that the proposals are anonymous (the counterpart is revealed only if at least one of the two dealers settles bilaterally) and market makers are not forced to show the maximum quantity they are willing to trade. Market maker could show only a partial amount of its proposal, maintaining the priority for the entire size of the proposals (disclosed/undisclosed quantities). However the undisclosed size has to be at least equal to the minimum lot size (2mm), defined by MTS market rules.

3.2 Evaluation criteria of Specialists in Italian Government bonds

In 1994, the Italian Treasury introduced a new category of operators: specialists. Originally, this group was composed by selected primary dealers operating in MTS Italy. The aim was to enhancing the demand at auctions, the liquidity conditions in the secondary markets and assisting Treasury with advice on debt management policy issue (IMF Guidelines for Public Debt Management, 2001). From 1994, the list of specialists has been modified several times: when a new specialist arrives or an old one decides to limit her participation in government bonds activity. Note that specialists are necessarily market makers in MTS Italy, the contrary is not always true. However, as the next sections will show, the market share as fillers[5] in MTS Italy of the whole group of specialists is very high, more than 90%, indicating that the liquidity provided by market makers, that are not specialists, is negligible.

The Italian Treasury clearly explains in its decrees (e.g. *Selection and evaluation of Specialists in Government Bonds Decree*) which privileges are provided for banks that act as specialist in its government bond market. The Ministry guarantees to the whole group of specialists exclusive access to reserved reopenings of government bond auctions[6], to the selection of lead managers of syndicated issuances, of dealers for bilateral buyback operations and for derivative transactions. In order to verify the compliance of specialists on their duties, the Italian Treasury monitors continuously their activities on primary and secondary markets. At the end of each year, based on the overall evaluation, the Italian Treasury calculates the final ranking and publishes the first five specialists on the Italian Public Debt website.

In its evaluation criteria, the Italian Treasury defines general principles and lists the specific criteria for monitoring specialists' activities, with formulas and practical informations. The Ministry monitors that specialists efficiently and continuously participate in the placement auctions, in the

[5]As mentioned above, market makers set their quotes defining prices and quantities that they are willing to trade. When a price taker (the *aggressor*) decides to hit the proposals in the quoting book, the counterparts of the deals are market makers that act as *fillers*.

[6]Reserved reopenings give to the Specialists the right to buy predetermined additional quantities of the issued bond at the price settled at the auction. The application deadline is fixed at 3.30 p.m. of the business day following the auction. Thus it represents a free call option on the issued bond. We refer to Coluzzi C. (2011) for an extensive discussion on the value of this option for specialists.

secondary markets, in the repo market and contribute to the management of public debt through advisory and research activity. The maximum total score a specialist can reach is 100 points.

3.2.1 Specialists evaluation criteria - year 2015

Looking at the 2015 criteria, the most important criteria on the primary market activity, in terms of contribution for the ranking (33 points), is the Primary Quantitative Indicator. Each specialist is assigned a score in proportion to the share in the primary market allocation. The score begins to be assigned with the allocation of a share of at least 3% up to a maximum level of 6%. The score assigned to each specialist is given by: *(Q_s-3%)*33/(6% - 3%)*, where Q_s is the specialist's share in the primary market.

Looking at the criteria on the secondary market, Treasury defines four indicators: the quotation quality index (QQI), the traded volumes (TV), the number of bonds traded as filler (NBTF) and the large in size contract (LSC).

The QQI is an indicator based on high frequency snapshots, made on each market day, on the order book of each bond for each specialist. For each snapshot, the ranking of the specialist in the order book of the bond with respect the best ranked specialist (both for the bid and ask sides) is recorded. To calculate this indicator only proposals associated with visible quantities equal to 5mm are considered. For each bond, the average ranking of the specialist is calculated relative to the market day. To calculate the average ranking, each position in the order book is weighted with increasing coefficients that are in proportion to the position in the order book with respect to the best price, in order to reward more those dealers that continuously show the best prices both for the bid and the ask sides. Thus QQI measures the contribution of each specialist in narrowing the best bid-ask spread. The higher is the contribution, the lower is QQI. At the end of the year, the specialist with the lowest QQI is assigned 8 points. The other specialists are rescaled with respect to the best one.

The TV index measures the market share of trading activity of each specialist in MTS Italy. The parameter is calculated with two subsequent weightings, the first takes into account the type of

bond traded (BOT, CTZ, BTP, CCT), the second discriminates the volumes traded as filler (weight equal to 1) or volume traded as aggressor (weight equal to 0.50). The best specialist is assigned a score of 8 points.

NBTF measures the ability of each specialist to trade, as filler, the highest possible number of bonds on MTS. To the best Specialist are assigned 4 points and a score between 0 and 4 is proportionally assigned to the other specialists.

Lastly, LSC measures the contribution of each specialist to provide size to contracts traded as filler. All contracts larger than or equal to a threshold size are selected. The threshold size, for each class of BTPs, is defined by averaging the size of contracts traded during the observation period within that class. Then Treasury calculates the share of each Specialist as filler. The specialist with the highest indicator is given a score of 2 points.

Other indicators refer to the activity in the repo market, in the buyback or exchanges transactions and in evaluating the organizational structure. The full list of criteria, coefficients of QQI and weights of TV are presented in Appendix 10.1. As said before, the total maximum score is 100 points and specialists compete for the first five positions, in order to be published in the final ranking[7]

3.2.2 Changes in evaluation criteria - year 2016

Every year, the Italian Treasury may modify monitoring and ranking criteria. As explained in the introduction, this paper employs the changes between 2015 and 2016 on criteria of the secondary market in order to verify whether and how market liquidity is affected by the ranking rules. As a matter of fact, the changes in the criteria for 2016 ranking modified some important features only in the segment of BTPs with residual maturity longer than 10 years, providing a quasi natural experiment to be employed for statistical purpose.

[7]Note that, although the rules about mandatory exclusion from the list of specialists are clearly listed in the MEF's decrees, in the last decade no case of exclusion has occurred. Conversely, cases of banks that voluntarily decide to suspend their activity as specialist occurred several times. In this sense, there is not a competition to comply the minimum compulsory conditions set by the Italian Treasury, actually if banks compete for the ranking, they do that to be published in the five top positions.

Treasury has changed several times monitoring rules, but these changes are different from those occurred in the past: in most of the cases, rules were modified homogeneously among bond segments (i.e. introducing new criteria applied to the whole group of bonds); actually the changes of 2016 determined both temporal and units discontinuities. For this reason, the variation between 2015 and 2016 is suitable to detect the causal effect of monitoring rules on liquidity conditions.

Before explaining in details the new rules, the timeline of the events is presented. On November 20th, 2015, the Italian Treasury invited specialists to communicate their proposals for potential changes to be introduced in the 2016 by November, 30th. On December 9th, Treasury, collected specialists' comments, discussed with them its definitive proposal on how to modify the monitoring rules for 2016. On December 15th, Treasury formally confirmed the set of changes for the new year. On January 4 (the first trading day of the year), the new regulation has entered into force.

The changes with respect to 2015 were mainly designed to push market makers to provide higher liquidity in the group of BTPs with residual maturity longer than 10 years. With respect the quoting and trading activities on MTS, the Italian Treasury modified in two ways the calculation of the four indicators of secondary market. Firstly, the minimum size required for the evaluation of QQI on nominal BTP with maturity longer than 10 years was removed and became 2mm, the minimum quoted size defined by MTS rules. Secondly, in order to offset the potential negative impact of this change on the depth of the quoting book, Treasury doubled the weight for this group of BTPs in calculating QQI, NBTF and LSC indicators and increased the weights of these BTPs in calculating the total share in the secondary markets (TV index) of each specialist (new weights are shown in Appendix 10.2). In this way, specialists face a trade-off in choosing their quoted depth: if they reduce to 2mm their proposals, then they benefit from lower quoting risks but they also reduce their expected scores in the final ranking.

With the new monitoring rules (the list of other changes is provided in the Appendix 10.2.), Ministry desired to incentivize market makers to narrow their bid-ask spread in the longer maturity BTPs group allowing them to reduce their quoted quantities. However, modifying also the weights on TV, NBTF and LSC indices, each specialist should set her quoted prices and depths in order to

maximize her expected returns from market making activity and her expected score for the final ranking.

3.3 The role of rankings in the microstructure models

Market microstructure models ignore some important implicit and explicit benefits that a market maker could face in providing liquidity on a specific asset under a ranking regime. More generally, microstructure models[8] assume that, in a competitive framework, the individual market maker sets its quotes in order to get at least an expected zero profit level. In these models benefits are linked to the markup of the bid and ask prices on the asset's fair price and the costs are mainly related to fixed components, order processing costs, inventories control costs and asymmetric information costs. However in the real world, market making activities are carried out by desks of global investment banks or financial intermediaries. These operators, in order to decide whether to provide liquidity on a specific asset, take into consideration not only the expected direct costs and benefits, but also implicit and indirect ones.

Market making in the Italian government bond market provides a suitable example of these potential benefits. Firstly, specialists could benefit quite homogeneously from their privileges explicitly cited by MEF in its Specialist Decree: exclusive access to reserved reopenings and to the selection of lead managers of syndicated issuances or in any other extraordinary transactions. Secondly, this activity could be used for marketing purposes with respect clients and Debt Management Offices of other sovereign issuers, in order to increase their reputation. Being in the top positions of the ranking provides a costly signal for specialist' skills and compliance in offering good execution for buy-side or sell-side clients. Thus they can use this segment, characterized by high competition and low profitability, to increase fidelity of their customers in execution services in asset classes with low competition and high margins. Lastly, since Ministry plays also a role as national regulator, some banks could consider positively the opportunity to strengthen this relationship.

[8] We refer to De Jong and Rindi (2009) for an exhaustive literature review.

The contribution of this paper is to highlight the ranking system's impact on liquidity conditions of quoting books through its explicit and implicit benefits on specialists. Since the dataset does not provide information at the individual market maker level, the focus is on the structure of the quoting books. However, the book is just the aggregation of the proposals provided by market makers; employing suitable liquidity measures, one may infer on the aggregated market makers' quoting decisions. The idea is that these operators, characterized by rational behavior, quote strategically in order to consider the positive component (direct privileges and higher reputation) of reaching high positions in this ranking. In microstructure models, these components have not been yet formalized.

Using Kavejecz (1998) notation, specialist's optimization problem is to set her proposal schedule on the bond i in order to maximize profits: the specialist j posts bid and ask prices b_{ij}, a_{ij} and the quoted bid and ask quantities β_{ij}, α_{ij}. Her expected return will be $E_{ij}[\pi(b_{ij},\beta_{ij},a_{ij},\alpha_{ij})]$, facing direct and indirect costs as asymmetric information, fixed trading costs, inventory risk. In previous literature, no role for incentives deriving from the ranking system exists. The simplest way to consider this potential benefit is to add a positive economic component in the profit maximization problem. Suppose $h_{ij}(\gamma_j,b_{ij},\beta_{ij},a_{ij},\alpha_{ij})$ is the function that describes the expected return to offer liquidity on a specific asset reaching a top position in the final ranking. $b_{ij},\beta_{ij},a_{ij},\alpha_{ij}$ directly affect the individual ranking score: choosing narrow bid-ask spread and high quoted depth returns, *ceteris paribus*, higher final score in the ranking. The γ_j parameter represents the individual ability to transform the position in the final ranking in economic revenues, that are related to higher reputation in financial markets, marketing, direct explicit privileges or cross-subsidies deriving from the execution services provided to her customers in other asset classes. This parameter varies across market makers since the portfolio of clients, the propensity to conduct aggressively marketing activities and the interest in final ranking position could be different. The final expected return becomes $E_{ij}[\pi_{ij}()+h_{ij}()]$.

Assuming the perspective of a generic specialist, Table 1 presents the expected impact on the scores of the criteria of secondary market of a narrow bid-ask spread and lower quoted quantities.

Higher the scores, higher position in the final ranking is expected by the specialists.

Variable	Variation	QQI	TV	NBTF	LSC
Q_b or Q_b	$\downarrow$	=	$-$	=	$-$
Bid-Ask Spread	$\downarrow$	+	+	+	+
Total		+	+/$-$	+	+/$-$

Table 1: **Relation between quoting variables and scores of evaluating criteria**. Assuming the perspective of an individual market maker, the table shows how a reduction of quoted depth or a tighter bid-ask spread, *ceteris paribus*, affect the expected scores got from the four evaluation criteria on the secondary market.

When a market maker reduces her quoted depth, *ceteris paribus*, she reduces the expected market share in the secondary market (TV) and the contribution in increasing the traded contracts size (LSC). At the same time, the quoted quantities do not affect QQI and NBTF indicators. Conversely, narrowing the bid-ask spread, market maker increases scores in all indexes: quoting more aggressively leads market maker to lower her QQI (but higher score for the ranking) and to increase volumes traded as filler, leading to higher scores in TV, NBTF, LSC indicators.

Assuming the perspective of traditional models, only the removal of minimum quantity of 5mm in the segment of BTPs with residual maturity longer than 10 years could affect specialists' behavior. Let's recall that in these models there is no role for ranking regime: competition among specialists should have already led to a market equilibrium characterized by a zero expected profit for them. Relaxing the rule of the minimum quantity, market makers should set a lower quantity (2mm, the new minimum size) and should maintain unchanged the competition in narrowing the best bid-ask spread.

First, looking at quoted depth, as highlighted in Buti and Rindi (2013), operators have a strong incentive to choose a quantity very closed to the minimum size since they face exposure costs that arise when agents submitting large orders run the risk of being undercut by aggressive traders. This is particularly true in MTS setup: order priority is guaranteed on the entire quantity of the quote, both disclosed and undisclosed parts. Even if a specialist desires to be filled for an higher quantity, the optimal choice, in line with Buti and Rindi (2013), may be to quote undisclosed size of 2mm

and to hide the remaining quantity.

Second, looking at the indirect impact on the bid-ask spread, no effect on the tightness of bid-ask spread should be found. Due to the specific features of MTS setup, that is a market under specialists regime without any competition from limit orders of other market participants, there are no reasons to expect a narrow best bid-ask spread if the ranking's incentives are not considered by operators. The reduction in the minimum quoted size does not imply any new entry of specialist or dealers' limit orders, differently from the setup in Rindi (2015). Thus market makers, following predictions of traditional models, should set lower quantities and maintain unchanged their bid and ask prices.

Introducing potential benefits from the ranking system, the effects of the changes in monitoring rules on quoted bid-ask spread and depths could be different. Assuming the perspective of a single market maker, she sets prices and quantities taking into account also the effects on the final score in the ranking. One strategy could be to reduce proposals' size in order to compete in tightening the bid-ask spread and get an higher score in QQI and NBTF indicators. More precisely, looking at the Table 1, decreasing depths and tightening spread in response to the new rules, the total effect on QQI and NBTF criteria is strictly positive, while the effect on TV and LSC indices is uncertain. Thus market makers, in order to limit the negative impact of their quoting choices on TV and LSC indexes, are incentivized to reduce less their quantities with respect the case without monitoring and ranking.

In line with Kavajecz (1998) predictions, higher the propensity of a specialist to compete in narrowing the bid-ask spread, lower the quoted sizes will be. A market maker that does not compete in tightening the market, and consequently reduces her expected scores in QQI and NBTF indexes, should reduce her quantities less than a more competitive market maker (in terms of bid-ask spread) in order to limit the negative impact on TV and LSC indicators. Note that it is not of interest to formally determine the optimal strategy of each market maker in setting her quotes and quantities; the purpose of the paper is just to argue the importance of taking into account the role of the ranking regime in evaluating market microstructure when monitoring and ranking systems exist.

Variable	Traditional models	Ranking model
Total quoted depth	$\downarrow$ (5mm $-$ 2mm)x Num Specialists	= / $\downarrow$
Best Bid-Ask Spread	=	$\downarrow$

Table 2: **Changes in ranking system and microstructure models**. Assuming the quoting book perspective, the table shows the effect of the variations of monitoring rules over two liquidity measures (total quoted depth and best bid-ask spread) whether ranking system is assumed to be considered or not by specialists in their quoting choices.

This section has provided a description of ranking's incentives that affect market makers' choices. Assuming the aggregated perspective of the quoting book, the effect on liquidity measures (e.g. total depth and best bid-ask spread) of the new rules under ranking and no-ranking models are summarized in Table 2. If ranking plays no role in market makers' choices, no effect on best bid-ask spread and a reduction of quoted depth, equal to difference between the two minimum quantities (3mm) multiplied by the number of specialists, will be found. If the positive incentives of ranking system are considered, a combination of high level of tightness and a smaller reduction of quoted depth should be found. This paper hypothesizes that ranking system, through its implicit incentives, links compulsory monitoring rules with specialists' quoting behavior, incentivizing them to set quotes' schedule taking into consideration the returns from being in the top positions of the final ranking.

In the light of the previous discussion, I can summarize the following testable empirical predictions.

Prediction 1: Ranking system affects positively market liquidity conditions.

Monitoring rules and public ranking system may affect quoting preferences of market makers. In a *pure specialists* market, the quoting book aggregates only specialists' proposals. Since ranking system increases competition among specialists, the final effect is a positive impact on aggregated liquidity conditions.

Prediction 2: Ranking system affects heterogeneously specialists.

The return from high ranking position is uncertainty and heterogeneous since each operator

is differently exposed to the potential benefits of the ranking regime (e.g. higher reputation in financial markets and with other sovereign DMOs, direct explicit privileges or cross-subsidies deriving from the execution services provided to customers in other asset classes).

In the following sections, the empirical application tests these predictions.

3.4 Appraisal of the activity of Primary Dealers in the Eurozone countries

Lastly, this section provides a brief discussion about evaluation criteria of Primary Dealers (henceforth PD) employed by the Debt Management Offices (henceforth DMO) of the main other Eurozone countries[9]. In particular, in this section, the differences with the Italian case are highlighted. Let's recall that MTS Italy is the only eligible trading platform and PDs are publicly ranked at the end of each year. The combination of these two characteristics makes MTS Italy the most suitable case to study the impact of ranking regime in the market makers' quoting choices.

Austria uses a broad range of criteria to measure PDs' performance on primary and secondary markets, turnover statistics with real money investors and other qualitative factors. Looking at the secondary market activity, Austria does not prescribe specific platform eligibility criteria and does not have a firm quoting obligation. Austria leaves the selection of a platform to its PDs, that have to submit daily data on their quoting and trading activities that are matched with data provided on voluntary basis by all major platforms. The final ranking's top ten dealers are made public in the DMO's website in December.

Belgium appraises the activity of the PDs in the primary and secondary markets according to various quantitative and qualitative. Since April 2014, Belgium have selected three trading platforms (MTS Belgium, Eurex, Icap BrokerTec) on which PDs can comply with their quoting obligation. The system guarantees an high level of flexibility: each PD can select daily at its discretion the platform on which it complies with its quoting obligation; moreover, the selected platform may be different for different securities. The appraisal is communicated to each Primary

[9]For an extensive discussion on all European national public debt frameworks, I refer to the *European Primary Dealers Handbook*, publicly available on AFME website.

Dealer individually.

Finland's evaluation system is based on an internal scorecard model that takes into account various areas of services. Looking at the market making obligations, the Finnish Treasury selects four eligible platforms (BGC, Eurex, MTS, BrokerTec) on which PDs are forced to provide two-way proposals for all securities with minimum quantity and maximum spread obligations. The scorecard rankings are not public.

France measures the PDs' performance through an overall assessment on primary, secondary, repo and strips markets. The selected trading platforms on which PDs are evaluated are MTS France and ICAP/Brokertec. The main criteria on the evaluation of the secondary market activity is the market share wighted for different segments (maturity and the nature of security). Quarterly, the *Agence France Tresor* informs each PD of its position on the primary and secondary markets.

Germany does not have any PD system and corresponding ranking regime. However, there are still rules that apply to the *Bund Issues Auction Group*, a group of investment banks to whom the direct participation in the auctions is guaranteed. Starting from 2015, the members of the *Bund Issues Auction Group* provide to the Finance Agency on a voluntary basis the trading activity in the secondary market.

In the Irish case, Primary Dealers are required to quote two-side proposals for benchmark bonds on any recognized electronic platform such as MTS, BGC Partners and BrokerTec. Monthly, each PD declares on which platform it decides to quote in line with its obligations and then the National Treasury Management Agency monitors its activity in the selected venue. The ranking of PDs, based on an all-encompassing basis, is not made public.

The Dutch State Treasury Agency (DSTA) has selected four platforms (ICAP, MTS, Eurex Bonds, BGC Brokers) in order to outline a multi-platform environment on which each PD may select a single venue to fulfill its quotation obligations. The assessment criteria for appraising the PD activity are based on the market share in the primary and secondary selected markets, the fulfillment of their quotation obligations and the support in the promotion and development of products related to dutch public securities. Three times a year, the DSTA publishes the top five

positions of PDs ranking.

Also in the Portuguese case, a multi-platform environment has been established. Portugal has set a compliance ratio of at least 80% for PDs' quoting obligation on MTS for each entire calendar month and other quoting obligations weighted by daily volatility in designated platforms (BGC eSpeed, MTS, BrokerTec). No information about public ranking are found.

Lastly, Spain identifies SENAF (that does not impose any quoting obligations) and MTS Spain (that imposes obligations to market makers not registered as PDs) as two authorized electronic trading platforms. Spanish Government requires PDs to quote in one platform at least 5 hours the benchmark bonds and a strip basket. Each PD can quote part of the securities on one platform and part on the other. Annually, Spanish Treasury publicly ranks the five most active primary dealers.

In the light of this discussion, one can conclude the Italian case is the most suitable framework to analyze how these ranking systems can affect market makers' choices: quoting obligations are applied to a single eligible trading platform (MTS Italy) and annually the first five positions of the ranking are published. The former characteristic helps the analysis limiting confounding effects and any potential endogeneity problems, since each market makers could have unobservable preferences about the trading venue[10] on which comply its quoting obligations. On the other side, the Italian ranking regime, characterized by a clear assessment, may boost competition among specialists and it provides high implicit benefits (e.g. reputation) due to its public nature.

4 The causal effect of changes in monitoring rules on market liquidity

This section discusses econometric strategies to estimate the effect of monitoring rules and ranking systems on liquidity conditions of the quoting book (*Prediction 1*). The analysis employs the changes in evaluation criteria between 2015 and 2016. In practice, an analysis on individual level cannot be performed but, since the order book is the direct aggregation of the proposals

[10]Regulated markets and multilateral trading systems.

of specialists, the paper estimates the causal effect of the modified regime on a set of liquidity measures of the quoting book. The changes in specialists' evaluating criteria entered into force from 4th January 2016 and affected some market making features and obligations in the segments of BTPs with residual maturity longer than 10 years. The impact of the regulatory switch on liquidity measures is investigated using a standard panel regression model with individual and time fixed effects.

4.1 Data and methodology

The paper considers the period that runs from 1st September 2015 to 29th April 2016 and selects bonds that, in line with the regulatory variation, were closed to the threshold of 10 years as residual maturity. These bonds are those included in two classes of BTPs defined by Treasury for TV index around the 10-year maturity: seven bonds with residual maturity between seven to ten years (the control group that has not been affected by rules' change)[11] and eight bonds with residual maturity between ten to fifteen years (the treatment group)[12]. This specific classification is defined by the Italian Treasury to evaluate the specialist's activity in the primary and the secondary markets, with the aim to aggregate different bonds in more homogeneous classes (see Table 14 in Appendix 10.1). Boehmer et al. (2015) suggest that, analyzing regulatory experiments, the fundamental assumption that the control group is unaffected may not hold in financial markets, due to potential existence of spillover effects. However, in this framework no indirect and spillover effects should exist, since minimum obligations in the control group are unchanged and no rational behavior could explain different quoting preferences in these bonds.

The period that has been considered is suitable for the analysis for several reasons. First, as explained in section 3.2.2, the changes in monitoring rules between 2015 - 2016, affecting a

[11] In more details, the control group is composed of bonds with residual maturity at 4th January 2016 lower but close to 10 years. Isin codes: IT000366655, IT0004953417, IT0005001547, IT0005045270, IT0004513641, IT0005090318, IT0005127086.

[12] The treatment group is composed of bonds with the residual maturity greater but close to 10 years. Isin codes: IT0004644735, IT0001086567, IT0001174611, IT0004889033, IT0001278511, IT0005024234, IT000144378, IT0005094088.

restricted number of bonds, are appropriate to highlight the role of ranking system in influencing market makers' behaviors. During this period, the other relevant regulatory features remained unchanged. Note that, even if other regulatory changes or structural variations occurred in that period, these should impact differently the two segments of BTPs since the empirical analysis is conducted to find any significant difference between these two groups.

Second, since BTPs with maturity longer than 7 years and smaller than 15 years are selected, the paper discusses and controls whether any market factors could lead to divergence between these two groups. Looking at the spread between the yield of the BTP 10 years benchmark versus the yield of the BTP 15 years benchmark, it could help to understand how operators managed these two segments. The average spread of this period is 43.840 bps, the maximum value is 53.753 bps and the minimum value is 37.141 bps. If one looks to the annualized volatility (a financial indicator of risk and uncertainty) of this spread, computed on rolling window of 160 days (8 months), its centered value in Sep 15 - Apr 16 period is 52.823%, the maximum is 71.734% and the minimum is 51.614%. Comparing with those values computed on 2010-2017 period (respectively equal to 41.235 bps, 79.443 bps, -8.762 bps, 204.511%, 692.77%, 48.086%) confirms that the period employed in the analysis is characterized by low level of instability and uncertainty.

Moreover, since market makers intermediate the allocation of the Italian bonds among investors, some facts about the demand and supply should be previously discussed, in order to analyze whether structural variation in inventories' control cost occurred. First, the Italian Treasury follows a fully transparent calendar about auctions. Quarterly, MEF publishes its *Quarterly Issuance Program* which announces new securities and reopenings of outstanding bonds that will be issued in the subsequent quarter. About longer BTPs, monthly the Italian Treasury supplies BTPs with 15y, 20y or 30y maturities at mid-month auction and 10y BTPs at the end of the month. In September 2015 - April 2016 period, 8 auctions both on 10y BTPs and on longer BTPs were conducted. Comparing the issued amounts through regular auctions during September 2015 - April 2016 and the average amounts of the same period during last five years (2013 - 2017), no substantial difference in the supply side can be identified. In the period 2015-2016, the issued amounts on

10y BTPs was 21.750 millions (mm) and on 15y BTPs was 5.956mm. In the same periods over the last five years, the average issued amounts on 10y BTPs has been 21.825mm and on 15y BTPs was 6.114mm[13].

Lastly, from the demand side, this period benefits from the homogeneous buying activity of ECB through its PSP program: the QE on sovereign bonds has started in March 2015 and it has been modified only at the end of the period (on March 10th, 2016, the Governing Council of ECB took the decision to reduce its reference interest rates and to increase its monthly purchases of European sovereign bonds and other corporate bonds from 60€billions to 80€billions starting from April 2016).

From a market perspective, it seems to be a good period to be analyzed with limited risks that contingent or long-run factors caused divergence in the inventories of market makers of 10 years BTPs versus 15 years BTPs. However, next paragraphs explain in more details how the analysis controls in the empirical setting for auctions and global trading activity of investors.

The following model is estimated:

$$Y_{it} = \alpha_0 + \beta change_{it} + d_t + a_i + \varepsilon_{it}, \tag{1}$$

where $change_{it}$ is a dummy variable that assumes value one when observation is about a bond i that has maturity longer than 10 years in the 2016 year (treatment period), d_t represents time fixed effects and a_i is bond fixed effects. The coefficient β represents the effect of the regulatory switch on the outcome variable. The model is estimated on four different outcome variables in order to verify different dimensions in the quoting response of market makers. In particular, the analysis estimates the effect on:

1. Bid-Ask Spread in percentage on the mid quote (BA_{it}): normalizing the absolute bid-ask spread with respect mid price allows to compare bid-ask spreads of different BTPs.

2. Total quoted quantity (Q_{it}): the average between the total depth quoted on the ask and on the

[13]Table 17 in Appendix 10.3 presents the details of the Italian Treasury's issuance activity.

buy sides.

3. Volume-weighted bid-ask spread in percentage on the mid quote ($VWBA_{it}$): to get a measure that combines the tightness and depth of the order book.

4. Price impact of 20mm (PI_{it}): the difference between the mid price and the realizable execution price of a deal of 20mm (both on the bid and ask sides).

These outcome variables are selected among the most informative liquidity measures about the quoting activity of market makers on MTS Italy (Coluzzi et al., 2008). By employing these four measures, one can jointly infer about the choices of specialists about the level of tightness and the quoted size. In Appendix 10.4 descriptive statistics of each outcome variable for each bond are presented.

In order to conduct the analysis, monthly averages are employed[14]. The dataset is originally composed by the snapshots of the quoting book of each bond with a frequency of 5 minutes from 9.00 am to 5.00 pm. For each snapshot, liquidity measures are computed and then are averaged in order to get monthly observations.

As a first robustness check, covariates are added to the model: idiosyncratic volatility, computed as the monthly average of daily min-max quoting prices range; trading activity, computed as the monthly volumes traded on MTS platform; specialness, computed as the monthly average of daily differences between the realized repo yield and general collateral repo yields on the TomNext segment; auction, a dummy variable that assumes value one if an auction of the bond occurs in that month. As previously discussed in the section of the literature review, these controls are selected in order to check for different factors that *a priori* could affect the liquidity conditions of bonds. Volatility and trading activity are the key drivers that proxy the main risk in providing immediacy in execution service. Specialness replicates the inventory (opportunity) cost to hold negative (positive) net position. Auction variable refers to the supply activity of the Italian Treasury.

The second estimated model with the vector X of covariates becomes:

[14] I have also employed weekly observations. The results confirm those with monthly data.

$$Y_{it} = \alpha_0 + \beta change_{it} + \gamma X'_{it} + d_t + a_i + \varepsilon_{it}, \tag{2}$$

4.2 Results

The estimates of the causal effect of the regulatory change on the four liquidity measures are presented in Table 3.

	(1)				*(2)*			
	BA	*Q*	*VWBA*	*PI*	*BA*	*Q*	*VWBA*	*PI*
β	-0.017	-0.060	-0.013	-3.976	-0.015	0.785	-0.012	-3.982
Robust SE	0.003	2.433	0.003	0.584	0.003	1.715	0.003	0.694
p-value	0.001	0.980	0.001	0.001	0.001	0.654	0.002	0.001
Covariates	no	no	no	no	yes	yes	yes	yes
Obs	120	120	120	120	120	120	120	120
R^2	0.652	0.832	0.622	0.663	0.697	0.841	0.675	0.692

Table 3: **Panel estimates**. The table shows the estimates of β coefficient of OLS panel regressions defined in models 1 and n. 2 in the section 4.1 with bond and time fixed effects with each observation defining a bond-month. The causal effect of the change in monitoring rules between 2015 and 2016 is estimated on four different liquidity measures of the quoting book: best bid-ask spread (BA), average bid and ask depths (Q), volume weighted bid-ask spread (WVBA) and price impact of a deal of 20mm (PI). Under each coefficient, robust standard errors (clustering at the level of individual bonds) and p-value are presented.

The estimates confirm my first predictions about the effect of the changes in monitoring rules on liquidity measures. I find a significant and negative impact on the bid-ask spread and no significant effect on the whole quoted quantities. The effect on the global bid-ask spread (VWBA) is significant but lower than the best bid-ask spread measure: the change causes a tightening on the best spread of 0.17% (17 price ticks on a bond with actual value of 100€) whereas the tightening on the volume weighted global spread is found to be around 0.13%. Price impact is affected significantly and negatively from rules' change: new rules reduces the cost of execution of a 20mm deal of 3.98 price ticks. These results provide a first hint that the regulatory switch has affected heterogeneously market makers' behaviors: only few specialists contribute to tight the order book

reducing their quoted bid-ask spread. Even if the behavior of these few market makers is consistent with Kavajecz (1998) predictions (prices and depths are used as substitutes), traditional models are unable to predict the heterogeneous impact across specialists and to interpret the causal effect between changes in monitoring rules and higher quoting competition. The missing link is the central role of incentives provided by ranking that heterogeneously affects specialists (e.g. higher reputation in financial markets). The estimates with covariates confirm these results (Table 3, equation 2). Next session stresses some preliminary assumptions of the basic model and provides stronger evidences about the heterogeneity impact across specialists.

5 Robustness checks

In this section, robustness checks are provided in order to test the hypothesis of selection bias time invariant before the treatment, to exclude a delayed effect of the new rules, potential seasonal effects and to assess the role of market makers that are not specialists.

5.1 Selection bias time invariant in the pre-treatment period

As a first robustness check, the hypothesis that the selection bias is constant over time in the pre-treatment period has been tested. Three diff-in-diff models are estimated considering the three couples of months in the pre-treatment period (September 2015 October 2015, October 2015 - November 2015, November 2015 - December 2015). Estimating the following model:

$$Y_{it} = \alpha_0 + \alpha_1 D_i + \alpha_2 T_t + \beta D_i T_t + \varepsilon_{it}, \tag{3}$$

where D_i assumes value one if the bond i has residual maturity greater than 10 years and T_t is a time dummy variable, one should expect not to find any statistical significance of β coefficient, if the selection bias is constant in pre-treatment period.

Table 4 shows the estimation results. As expected, the selection bias problem seems not to

	Sep 15 - Oct 15				*Oct 15 - Nov 15*				*Nov15 - Dic 15*			
	BA	*Q*	*VWBA*	*PI*	*BA*	*Q*	*VWBA*	*PI*	*BA*	*Q*	*VWBA*	*PI*
β	-0.007	0.590	-0.009	-1.899	0.007	2.426	0.003	1.724	0.014	1.460	0.018	4.202
SE	0.010	5.085	0.019	2.129	0.009	3.708	0.017	2.063	0.013	3.353	0.022	3.040
p-value	0.481	0.908	0.644	0.381	0.458	0.518	0.847	0.411	0.297	0.667	0.418	0.178
Obs	30	30	30	30	30	30	30	30	30	30	30	30
R^2	0.573	0.706	0.515	0.381	0.604	0.809	0.847	0.411	0.605	0.839	0.534	0.707

Table 4: **Selection bias time invariant in pre-treatment period**. The table shows the estimates of β coefficient of OLS panel regressions defined in model n. 3 in the section 5.1. The selection bias is estimated on four different liquidity measures of the quoting book: best bid-ask spread (BA), average bid and ask depths (Q), volume weighted bid-ask spread (WVBA) and price impact of a deal of 20mm (PI). Under each coefficient, standard errors (without any adjustments, in order to get less conservative estimates of potential risk of selection bias time variant) and p-value are presented.

affect the estimated basic models, since β estimates are not significant in any couple of months in the pre-treatment period. This result confirms the goodness of the design of the basic empirical setup, since in the pre-treatment period no significant difference between the two groups of BTPs is found.

5.2 Slow-acting effect

Secondly, the hypothesis that the regulatory change affects immediately market makers quoting choices without any slow-acting effect has been tested. Also in this case, three diff-in-diff models, considering the three couples of months in the post-treatment period (January 2016 February 2016, February 2016 - March 2016, March 2016 - April 2016), are estimated. The models are the same of the previous robustness check and also in this case one should expect not to find any statistical significance of β coefficient.

Table 5 shows the estimation results. The absence of significant coefficients across the three estimated models suggests specialists immediately react to the entry into force of new rules in January and no slow-acting effect is revealed.

	Jan 16 - Feb 16				*Feb 16 - Mar 16*				*Mar 16 - Apr 16*			
	BA	*Q*	*VWBA*	*PI*	*BA*	*Q*	*VWBA*	*PI*	*BA*	*Q*	*VWBA*	*PI*
β	-0.003	-1.402	-0.010	-0.869	-0.003	0.749	-0.005	-0.549	-0.002	0.369	-0.006	-0.699
SE	0.008	4.299	0.018	1.864	0.007	5.076	0.015	1.510	0.006	5.585	0.015	1.419
p-value	0.697	0.747	0.577	0.645	0.664	0.884	0.733	0.719	0.696	0.948	0.676	0.626
Obs	30	30	30	30	30	30	30	30	30	30	30	30
R^2	0.498	0.762	0.511	0.659	0.465	0.676	0.481	0.698	0.444	0.617	0.445	0.677

Table 5: **Slow acting effect**. The table shows the estimates of β coefficient of OLS panel regressions defined in model n. 3 in the section 5.2. The slow acting effect is estimated on four different liquidity measures of the quoting book: best bid-ask spread (BA), average bid and ask depths (Q), volume weighted bid-ask spread (WVBA) and price impact of a deal of 20mm (PI). Under each coefficient, standard errors (without any adjustments, in order to get less conservative estimates of slow acting effect) and p-value are presented.

5.3 The role of market makers non specialists

On MTS Italy, investors are divided into two groups: market makers and market takers. As mentioned above, among market makers a group of selected dealers act as *specialists*, facing quoting obligations that are set by the Italian Treasury. An issue that has to be discussed is the role of market makers that are not specialists. As a matter of fact, an assumption of the basic model is that this group of operators, not affected by any rules' change, maintains unchanged its quoting behavior across the two groups of BTPs. The dataset does not allow to directly identify proposals of market makers and specialists.

Firstly, some descriptive statistics on quoting books and trading activity could help to identify the dimension of this potential disturbance. Looking at the trading side, the market share of volumes traded as fillers[15] of these operators is 7,23% on the whole segments of Italian government bonds (BOT, CTZ, CCT, BPT) and 8,44% if the sample of the fifteen bonds is considered[16]. Looking at the quoting activity, Table 6 presents descriptive statistics on the number of proposals in the book. The average and the median values in each of the fifteen quoting books along the whole period are very close to twenty, the number of specialists. The distribution is asymmetric and lep-

[15]Market maker quotes her proposals (prices and quantities) that can be filled by investors. If investors are looking to sell (buy) a security, market makers purchase (sell) that security. In this sense, market maker is the *filler* and the investor is the *aggressor*.

[16]Information provided directly to the author by MTS.

tokurtic: negative skewness and positive kurtosis are found in all bonds. While minimum values are zero (that is a snapshot with an empty quoting book), maximum number of proposals are higher than the number of specialists of only few units. However, when there is a number of proposals in the quoting book larger than number of specialists, it could be related to two distinct reasons: the proposals of market makers that are not specialists or double proposals of specialists (Mormando, 2017). This discussion just helps to identify the dimension of the potential disturbance but, since it does not uniquely identify the number of proposals of market makers non-specialists, other identification strategy should be taken into account.

ISIN	Obs.	Mean	Median	Max	Var	Skew	Kurtosis
IT0005127086	16296	21.02	21.50	27.50	8.815	-1.986	10.791
IT0005090318	16296	19.57	20.00	25.50	7.306	-1.802	10.322
IT0004513641	16296	20.22	20.50	28.00	9.835	-1.451	8.561
IT0005045270	16296	20.48	21.00	26.50	7.945	-2.018	11.755
IT0005001547	16296	21.06	21.00	29.50	11.466	-1.065	7.201
IT0004953417	16296	19.87	20.00	27.00	9.502	-1.206	7.914
IT0000366655	16296	19.61	20.00	25.00	7.620	-2.056	11.404
IT0004644735	16296	20.29	20.50	27.00	9.166	-1.593	9.380
IT0001086567	16296	20.31	21.00	26.00	7.432	-2.548	14.069
IT0001174611	16296	19.93	20.00	26.00	8.032	-2.282	13.023
IT0004889033	16296	20.51	21.00	25.50	8.351	-2.523	13.527
IT0001278511	16296	20.27	20.50	26.00	10.807	-1.605	8.654
IT0005024234	16296	20.94	21.50	27.00	9.080	-2.461	13.119
IT0001444378	16296	19.55	20.00	26.00	9.484	-1.759	9.905
IT0005094088	16296	18.88	18.50	29.50	12.635	-0.783	5.546

Table 6: **Descriptive statistics of the number of proposals for the fifteen bonds of the sample**. For each bond in the sample, the table presents descriptive statistics of the number of proposals in the quoting book. The dataset is composed by the snapshots of the quoting book of each bond with a frequency of 5 minutes from 9.00 am to 5.00 pm, in the period that runs from September 1, 2015 to April 28, 2016.

The paper exploits other two liquidity measures in order to test whether market makers (non-specialists) modify their contribution in the quoting book, affecting our estimates of the causal

effect. These measures are related to the trading activity. In more details, the *volumes traded as fillers* of the whole group of market makers non-specialists and the correspondent *proportion over the total activity* are employed. Even if these are trading measures, they are strictly related to the quoting activity, the focus of the paper. As a matter of fact, the trading activity as filler (not as aggressor) is directly linked to quoting behavior. The probability that a proposal of a market maker will be hit by the orders flows is function of the position of this proposal in the quoting book. Narrower the bid-ask spread, higher the probability to deal as filler. To assess the role of this group of operators, the previous model 2 is estimated, employing the *volumes traded as filler* and the correspondent *proportion on the whole trading activity* as outcome variables. From these regressions, one should expect not to find any statistical significance of β coefficient, since this group of market makers are not affected by any regulatory switch.

	(2)	
	Vol MM	*Perc MM*
β	-12.128	-0.026
SE	8.639	0.018
p-value	0.182	0.175
Covariates	yes	yes
Obs	120	120
R^2	0.415	0.308

Table 7: **Panel estimates on outcome variables: VolMM and PercMM**. The table shows the estimates of β coefficient of OLS panel regressions defined in model n. 2 in the section 5.1. The causal effect of regulatory changes is estimated on two different liquidity measures of the trading activity of market makers that are not in the group of specialists: volumes traded as filler (Vol MM) and the fraction of these volumes on the total trading volumes (Perc MM). Under each coefficient, robust standard errors (clustering at the level of individual bonds) and p-value are presented.

As expected, β coefficient is not found significant in both specifications. It means that market makers do not change their quoting behavior on BTPs with different maturities along the period considered. The result strengthens the conclusion that the causal effect estimated in section 4.2 is related to quoting behavior of specialists, that are affected by new monitoring and ranking rules.

5.4 Is there any seasonal effect?

In previous sections, a crucial underlying assumption is that no relevant seasonal effect exists between the two groups of BTPs during the pre-treatment period (September-December) and the post-treatment period (January-April). In order to test whether this effect may invalidate the estimated causal effects of previous sections, the same analysis is conducted on the period that runs from September 2016 to April 2017. Between these two years, MEF did not modify in any relevant way the criteria on quoting and trading activity of specialists on MTS. The more significant change is the reduction of the maximum score assigned to the best specialist in the QQ Index, from 9 to 8 points. However this change, differently from the case of 2015-2016 period, has affected the whole group of BTPs. A second relevant change is linked to the decision of creating new benchmarks for the 20 years and 50 years segments during 2016. MEF issued for the first time on April the new 20 years BTP benchmark and on October the new *matusalem* 50 years BTP. In 2017 criteria, MEF has integrated the weights for the primary and secondary markets' criteria in order to take into consideration the contribution of these two new segments. However, the previous analysis is not affected by the potential disturbance of these segments since the selected group of BTPs under treatment is composed by bonds with residual maturity lower than 15 years, bonds sufficiently far from 20 years of maturity.

2016-2017 period is suitable for the purpose to test whether any relevant seasonal effect exists also because the structure of the Italian Treasury supply and market demand seems to be unaffected by relevant shocks in the difference between the two segments. As shown in Table 17 in the Appendix 10.3, the issued amounts of 10y and 15y BTPs is close to the average of the last 5 years and to the amounts of the same period of 2015-2016. From the demand side, on 8 December 2016 Governing Council of the ECB decided that from April 2017, the net asset purchases were intended to continue at a reduced monthly pace of €60 billion until the end of December 2017. This change, that covers only marginally the period analyzed, did not provide any relevant information about differences on net purchase activity between the two groups of BTPs. However, as in the previous sections, the trading activity on the secondary market is considered in the estimated models in

order to control for market trading activity.

Looking at the data, this section presents the estimations of regression models 1 and 2. considering the 1st September 2016 - 28th April 2017 period and selecting bonds that during these 8 months were included in the two classes of BTPs around the 10y maturities: eights bonds with residual maturity between seven to ten years[17] and seven bonds with residual maturity between ten to fifteen years[18]. In these two models, the treatment dummy coincides with a dummy that is equal 1 for observations of 2017 period for bonds with residual maturity longer than 10 years. The models are estimated on the four basic outcome variables. The expectations are to find no relevant causal effect of the dummy, since no relevant change in monitoring criteria occurred.

	(1)				*(2)*			
	BA	*Q*	*VWBA*	*PI*	*BA*	*Q*	*VWBA*	*PI*
β	0.001	2.449	0.003	0.009	0.002	2.381	0.003	0.255
Robust SE	0.002	3.144	0.002	0.426	0.002	3.230	0.002	0.505
p-value	0.781	0.449	0.126	0.983	0.474	0.473	0.304	0.622
Covariates	no	no	no	no	yes	yes	yes	yes
Obs	120	120	120	120	120	120	120	120
R^2	0.798	0.587	0.793	0.781	0.855	0.599	0.829	0.826

Table 8: **Panel estimates on September 2016 - April 2017 period**. The table shows the estimates of β coefficient of OLS panel regressions defined in models n. 1 and n. 2 in the section 4.1 with bond and time fixed effects with each observation defining a bond-month. The hypothetical seasonal effect between September-December 2016 period and January-April 2017 period is estimated on four different liquidity measures of the quoting book: best bid-ask spread (BA), average bid and ask depths (Q), volume weighted bid-ask spread (WVBA) and price impact of a deal of 20mm (PI). Under each coefficient, robust standard errors (clustering at the level of individual bonds) and p-value are presented.

The Table 8 shows the results of the estimated models. In the eights specifications, the null hypotheses of irrelevance of the dummy have not been rejected. These results corroborate the estimated causal effects of monitoring rules' changes in previous models are not distorted by any

[17]Isin codes: IT0005001547, IT0005045270, IT0004513641, IT0005090318, IT0005127086, IT0004644735, IT0005170839, IT0001086567, IT0005210650.

[18]Isin codes: IT0001174611, IT0004889033, IT0001278511, IT0005024234, IT000144378, IT0005094088, IT0003256820.

seasonal disturbance.

6 Heterogeneous impact among specialists

In this section, I test the second prediction and I investigate whether specialists react differently to changes in ranking regime. The results from the starting model suggest that few market makers decreased their bid-ask spread, and probably reduced also their proposals' size, in order to compete for market orders flows and for getting higher scores for the quoting indexes. I argue that probably only few market makers acted in this way since the volume weighted bid-ask spread decreased less than the best spread and the total depth remained stable. In order to address this question, three more liquidity measures are employed:

1. Variance of quoted prices weighting for correspondent depths in the book (VAR_{it}), in order to verify whether a greater prices' dispersion occurred.

2. Total quoted quantity on the two top positions of the order book ($V2B_{it}$), in order to verify the effect on the positions with the more competitive players.

3. Average quoted quantity per proposal on the two top positions of the order book ($A2B_{it}$), in order to measure the average depth defined by the more competitive specialists.

The previous models 1 and 2 are estimated, employing these measures as outcome variables. Expectations are that a greater variability in the prices occurred, led by an higher competition of few specialists, that reduce their depths and tight their spreads, in the top levels of book. The result on the quoting book is that depth at the top apparently rarefies, actually it is new quoted volumes in higher competitive prices that were unable to be quoted with old rules.

Table 9 shows the results of the estimated regressions. As expected, a significant and positive impact is found between the regulatory changes and the variance of prices in the order book. Conversely, a negative and significant causal effects are found between new rules and the quoted depth in the top positions. This reduction is due to the choice of the most competitive traders to quote

	(1)			(2)		
	VAR	*V2B*	*A2B*	*VAR*	*V2B*	*A2B*
β	0.006	-10.904	-0.889	0.006	-7.954	-0.830
Robust se	0.003	1.664	0.149	0.003	1.521	0.151
p-value	0.100	0.001	0.001	0.057	0.001	0.001
Covariates	no	no	no	yes	yes	yes
Obs	120	120	120	120	120	120
R^2	0.256	0.610	0.707	0.324	0.674	0.739

Table 9: **Panel estimates on outcome variables: VAR, V2B, A2B**. The table shows the estimates of β coefficient of OLS panel regressions defined in models n. 1 and n. 2 in the section 4.1 with bond and time fixed effects with each observation defining a bond-month. The causal effect of the change in monitoring rules between 2015 and 2016 is estimated on three different liquidity measures of the quoting book: variance of prices (VAR), depth of two best prices (V2B), average size of proposals in the best two prices (A2B). Under each coefficient, robust standard errors (clustering at the level of individual bonds) and p-value are presented.

proposals with lower depth. Combining these results with those found in the basic model, one can conclude that new monitoring rules have allowed to increase the competition among specialists in tightening the quoting book, signaling their compliance in the liquidity provision. At the same time, no negative sign of depth depletion in the global liquidity measures is found.

The conclusion on the heterogeneity of the impact across specialists could be enhanced by other evidences and comments got from our dataset and public rankings published in the Public Debt website. As a matter of fact, one possible alternative explanation for the results got from this section is that market makers homogeneously alternate, during a trading day, more and less aggressive quoting strategies in order to compete for trading flows and ranking.

But instead we argue that the effect of new rules impacts heterogeneously different market makers for the following reasons. Firstly, the rankings, published in the Public Debt website, show a strong persistence of few specialists in the top positions. In 2015 and 2016 rankings, the first four specialists are the same, also with the same rank (in Appendix 10.5 we show the rankings over the last decade): MPS Capital Services, JP Morgan, Banca Imi and Unicredit. So, there has not been a

real turnover among specialists on the top positions in 2015-2016 period and the heterogeneity in the quoting preferences is a natural and inherent characteristic among operators.

Secondly, to provide a quantitative demonstration of our argument, we employ the two time series of the QQI index of the best and the median specialists in the two segment of BTPs considered in the analysis. QQI measures the contribution of each specialist in narrowing the market bid-ask spread and it is the exact representation, on a continuous basis, of its quoting strategy. To calculate the QQI of a generic specialist on a single bond, each position in the order book is weighted with decreasing coefficients that are in proportion to the position in the order book with respect to the best price, in order to reward more those dealers that continuously show the best prices both for the bid and the ask sides[19]. The higher is the contribution in tightening the bid-ask spread, the lower is the QQI index. If a specialist quotes in the best positions both bid and ask prices, its QQI assumes value zero. If he quotes in the second positions both bid and ask proposals, its QQI assumes value 10 (5+5), according to values shown in Table 13 in Appendix 10.1.

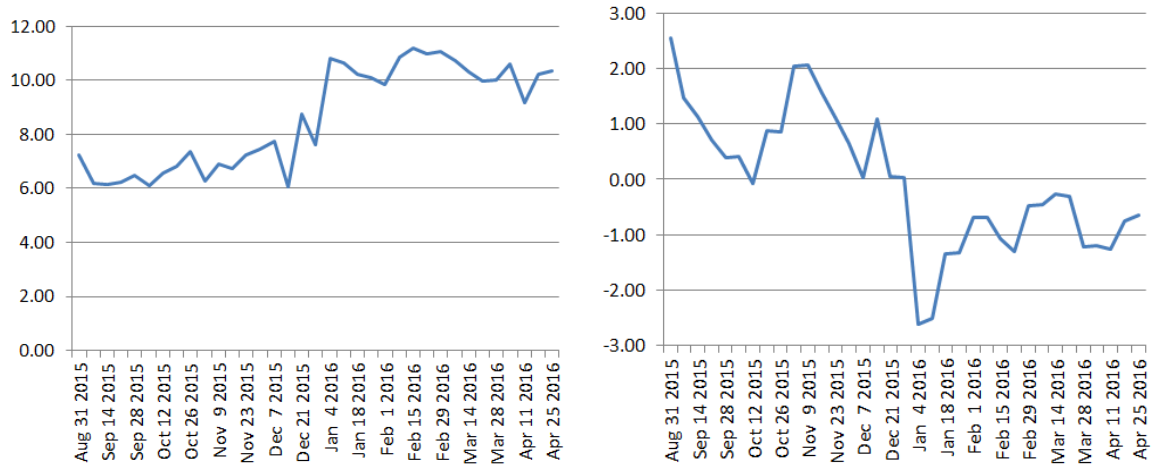

Figure 1: **QQI evolution**. In the left chart, selecting the group of BTP with maturity longer than 10 year, the evolution of the difference of QQI of the best and the median specialist is shown. Formally $QQI_{Median,BTP>10y} - QQI_{Best,BTP>10y}$. In the right chart, the evolution of the difference of QQI of the best and the median specialist on treated BTP and on control BTP is shown. Formally $(QQI_{Median,BTP<10y} - QQI_{Best,BTP<10y}) - (QQI_{Median,BTP>10y} - QQI_{Best,BTP>10y})$.

Selecting BTPs with maturities longer than 10 years, the chart on the left of Figure 1 shows the difference between QQI of the median specialist in the ranking and the QQI of the best specialist

[19]Weights are shown in Table 13, Appendix 10.1

during the September 2015 - April 2016 period[20]. As mentioned above, the best specialist has a lower QQI with respect the other participants. So, this difference is positive. The figure shows a jump in correspondence of the new year. If we assume that the quoting behavior of the median specialist (that could represent the generic representative specialist) remains unchanged, this jump highlights that the new monitoring rules have differently impacted the behavior of the best and the median specialist.

The chart on the right of Figure 1 shows the diff-in-diff impact, considering as control variable the difference between the best and the median specialist on the segment of BTPs with maturity lower than 10 years[21]. From this figure, one can conclude that, from 2016, this difference has become negative. It means that, after the entry into force of the new monitoring rules, the behavior of the best specialist in the $BTP > 10y$ has strongly changed with respect the median operator, decreasing more than other specialists its QQI. The new rules have allowed the best specialist to strongly differentiate its quoting behavior from the quoting preference of the median specialist.

These quantitative and qualitative argumentations lead to consider more probable an heterogeneous impact of the new rules on the whole group of specialist. However, further research, with a different dataset on individual quotes, could specifically address this research question.

7 Symmetry between bid and ask sides

This section investigates the possibility to find different causal effects whether bid or ask sides are considered separately. The previous liquidity measures on quoted volumes, on price impact and on variability of prices are computed as averages of the measures of bid and ask sides. In this section, regression results from models of equation 2, employing as outcome variables liquidity measures separately for the two sides, are shown. The different causal effects of new market rules on *VAR*, *Q*, *PI* and *A2B* liquidity measures, computed for bid and ask sides, are estimated. Several hypotheses could lead to different behavior of market makers on the bid and ask sides. Literature

[20] Formally, $QQI_{Median,BTP>10y} - QQI_{Best,BTP>10y}$.

[21] Formally, $(QQI_{Median,BTP<10y} - QQI_{Best,BTP<10y}) - (QQI_{Median,BTP>10y} - QQI_{Best,BTP>10y})$.

highlights that one of the main reason could be high inventories control costs (Ho and Stoll (1983)) that could affect, in the intraday activity, the quoting preferences of market makers. In previous estimated models, the *Specialness* variable, that measures the (opportunity) cost to own a negative (positive) net position on a given BTPs, should control for this crucial source of direct cost for specialists (Corradin and Maddaloni (2017)).

	(2)							
	VAR Bid	VAR Ask	Q Bid	Q Ask	A2B Bid	A2B Ask	PI Bid	PI Ask
β	0.006	0.006	0.623	0.947	-0.812	-0.848	-3.973	-3.990
Robust SE	0.003	0.003	1.762	1.737	0.146	0.169	0.678	0.713
p-value	0.060	0.063	0.728	0.594	0.000	0.000	0.001	0.001
Specialness	0.012	0.017	3.756	2.934	0.264	-1.204	7.431	8.707
Robust SE	0.055	0.052	16.408	14.030	0.752	1.356	5.753	6.151
p-value	0.837	0.741	0.822	0.837	0.730	0.389	0.217	0.178
Covariates	yes	yes	yes	yes	yes	yes	yes	yes
Obs	120	120	120	120	120	120	120	120
R^2	0.463	0.484	0.835	0.839	0.730	0.682	0.700	0.681

Table 10: **Panel estimates on bid and ask outcome variables: VAR, Q, A2B, PI**. The table shows the estimates of β coefficient of OLS panel regressions defined in model n. 2 in the section 4.1 with bond and time fixed effects with each observation defining a bond-month. The causal effect of the change in monitoring rules between 2015 and 2016 is estimated on four different liquidity measures, separately for bid and ask sides: variance of bid and ask prices (VAR), average bid and ask depths (Q), average size of proposals in the best two prices (A2B) and price impact of a deal of 20mm (PI). The impact on these outcome variables of *specialness*, defined in section n. 4.1, is also shown. Under each coefficient, robust standard errors (clustering at the level of individual bonds) and p-value are presented.

Table 10 shows the results of the estimated models on the causal effect of new market rules and the effect of the *specialness* variable on liquidity measures. First, these results are consistent with the general results got from the aggregated liquidity measures. Variances both for bid and ask sides are significantly and positively related to the new rules' set. A relevant and negative effect is found on A2B in both market sides, with a little stronger effect on the ask side, and on price impact measures. Lastly, no effect is detected on the total quoted quantities, consistent with the

basic models. The specialness is not found to be a significant variable in these eights specifications. Note that the absence of any relation on the total quantity is consistent with previous literature (Buti and Rindi, 2012): even in the case market makers own a large imbalance on a bond's inventory, they have the incentive to quote proposals with undisclosed size near to the minimum level, limiting the difference between depths on the two sides of the market and minimizing their exposure costs.

8 Threshold date analysis

Lastly, an analysis with higher frequency data is conducted in order to verify whether specialists adapt their quoting behavior aligned to the first trading day of the new year. This check verifies the speed of reaction of operators to the new obligations and, if a positive output is found, this evidence could reinforce the argument that the effects on the liquidity conditions in the BTPs with longer maturity are strongly related to the monitoring rules change, since it was the only relevant event that occurred between the two years.

Formally, the daily averages of the liquidity measures for the whole control and treatment groups are computed separately. Then, the Bai and Perron test (Bai and Perron 1998, 2003) is employed in order to verify whether and when a structural change occurred on the differentiated series between measures of the two groups. The underlying assumption of this test is that the level of liquidity fluctuates around a stable mean in absence of structural changes, hypothesis coherent with the results of the previous robustness check. If new market making rules shift the long-run mean towards a different level, this test detects the dates when the changes occur.

In this robustness check, only measures that has been significantly affected by monitoring rules' change are selected: BA, VWBA, PI, VAR, V2B, A2B. In the following figures the results of the test applied to the six liquidity measures are shown. Each graph shows the time series of the aggregate liquidity measure for the treatment group (black line), control group (green line) and the correspondent differentiated serie (blu line in the second box). The red line in the second box represents the output of Bai and Perron test. The horizontal segment is the estimated mean

for each sub-period. The break dates, binding for a maximum one breakpoint, are estimated by the Bai and Perron approach with 5 percent significance level and are shown in Table 11 with the correspondent WD-max statistics of the test.

Liquidity	WD-max		Critical values		
Measure	statistic	Date	10%	5%	1%
BA	19.4813	04 January 2016	8.02	9.63	13.58
VWBA	15.1614	26 January 2016	8.02	9.63	13.58
PI	19.8343	04 January 2016	8.02	9.63	13.58
VAR	18.2913	14 December 2015	8.02	9.63	13.58
V2B	17.8014	04 January 2016	8.02	9.63	13.58
A2B	252.8207	04 January 2016	8.02	9.63	13.58

Table 11: **Bai and Perron test**. The table shows the outcome of Bai and Perron (1998) test applied to daily averages of six different liquidity measures. The null hypothesis is no structural break exists, the alternative is bound to one structural break. The WDmax statistics and the correspondent structural date are shown.

This robustness check confirms the main results of the previous analyses. Bai and Perron test detects a perfect alignment between the structural breaks in market making activity and the new monitoring rules for the level of tightness of the market (BA measure), the price impact measure, the depth and the average proposals' size in top positions of the book. The signs and values of the variations are coherent with the results of the previous sections. With respect the VWBA measure, the test detects a negative effect 16 trading days later the introduction of the new regulation. Since this liquidity measure aggregate the behavior of the whole group of specialists, this result reinforces the idea that the responsiveness of market makers to monitoring rules' change could be heterogeneous among operators in terms of intensity and speed of reaction.

9 Concluding remarks

This paper has investigated the role of monitoring rules and specialists ranking system on liquidity conditions of Italian government bonds. To the best of our knowledge, this is one of the very

first studies to statistically assess the impact of this regime on specialists' quoting preferences. The changes in monitoring rules, occurred between 2015 to 2016, has been employed as an instrument to detect the role of ranking system as a positive externality that boosts competition among specialists.

First, I explain in details the characteristics of MTS Italy and the expected positive effects of the specialists' ranking regime, set by the Italian Treasury, in order to improve liquidity in its wholesale market.

Second, I employ the changes in monitoring rules in order to quantify the global effect of ranking system on the quoting activity and the related liquidity measures. These changes entered into force on January 4th 2016 and affected only the segment of BTPs with residual maturity longer than 10 years, determining both temporal and individual discontinuities.

Lastly, I strengthen the analysis stressing some assumptions of the basic models and highlighting the heterogeneous effect across operators and investigating the speed of responsiveness to new rules. More precisely, I investigate whether the variation in the quoting choices is aligned with the entry into force of new ranking regime.

First, the main contribution, compared to the related literature, is to clearly identify the relevant role of public ranking system of specialists in MTS Italy market: its explicit and implicit incentives (e.g. higher reputation) link the variation in the compulsory obligations, set by the Italian Treasury, with specialists' quoting preferences.

I find that changes in the monitoring criteria have a significant impact on the best bid-ask spread, that decreased in response to new market rules, improving the tightness of the quoting book. At the same time, the volume weighted bid-ask spread decreased but the impact was smaller than in the case of best bid-ask spread.

Lastly, no significant effect on the total quoted depth in the book is found. Looking at the variance of prices, new rules affected proposals distribution in the top levels of the book. More precisely, the variance of prices significantly increased, whereas price impact, total quoted size and average quoted size in top positions decreased in response to new rules. These evidences suggest

that the new market rules heterogeneously affect the decisions of market makers: few specialists reduced their quoted sizes in order to compete in narrowing the best bid-ask spread, the others do not modified their quoting behavior. The total impact on the quoting book is an higher level of tightness and no relevant variation on the level of the global depth. New monitoring rules have globally improved liquidity conditions in treated BTPs.

These results have some important implications for several policy debates. First, I highlight that ranking regime affects specialists behavior. This result implies that, in a pure specialists market, public ranking system may boost competitiveness among market makers in offering high level of liquidity. A strong heterogeneity exists on the structure and rules of government bonds' markets of other European countries. However, the Italian case is the most suitable framework to analyze how these ranking systems can affect market makers' choices since its quoting obligations are applied to a single eligible trading platform (MTS Italy) and annually the first five positions of the ranking are published. The results of this analysis can be generalized to other markets and to other sovereign issuers. Second, since an heterogeneous impact among different players is found, a decrease in uncertainty about potential privileges and benefits could help the principal (in this case, the Italian Treasury) to obtain a more homogeneous response among market participants. Further research could formally assess the specialists optimization problem and could identify the determinants of market makers quoting choices taking into account the impact of ranking system, disentangling the impact of explicit and implicit incentives.

Figure 2: **Bai and Perron test results**. For each liquidity measure, the test with 5 percent significance level is applied to daily series computed as the difference between the average liquidity measure of bonds of control group and the average liquidity measure of bonds of treatment group. Test allows for heterogeneity and autocorrelation in the residuals and different moment matrices of the regressors across segments.

References

ADMATI, A. R., PLEIDERER, P., 1988. *A theory of intraday patterns: volume and price variability.*. The Review of Financial Studies, vol. 1 (1) , pp. 3-40.

AFME, 2016. *European Primary Dealers Handbook. Q4 2015.*

AHN, H., CAI, J., CHAN, K., HAMAO, Y., 2007. *Tick size change and liquidity provision on the Tokyo Stock Exchange*. Journal of the Japanese and International Economies, vol. 21 (2) , pp. 173-194.

AMIHUD, Y., MENDELSON, H., 1980. *Dealership market: market-making with inventory.*. The Journal of Financial Economics, vol. 8 (1), pp. 31-53.

AMIHUD, Y., MENDELSON, H., UNO, J., 1990. *Number of shareholders and stock prices: evidence from Japan*. The Journal of Finance, vol. 54 (3), pp. 1169-1184.

BAI, J., PERRON, P., 1998. *Estimating and testing linear models with multiple strucutural changes*. Econometrica, vol. 66 (1), pp. 47-78.

BAI, J., PERRON, P., 2003. *Computation and analysis of multiple structural change models*. Journal of applied econometrics, vol. 18, pp. 1-22.

BOEHMER, E., JONES, C. M., ZHANG, X., 2015. *Potential pilot problems: treatment spillovers in financial regulatory experiments*. Columbia Business School Research, Working Paper, no. 15-67.

BUTI, S., RINDI, B., WEN, Y., WERNER, I., 2013. *Tick size regulation and sub-penny trading*. Working paper, available at SSRN 2324862.

BUTI, S., RINDI, B., 2013. *Undisclosed orders and optimal submission strategies in a limit order market*. Journal of Financial Economics, vol. 109 (3), pp. 797-812.

CAFISO, G., 2015. *Treasury Auctions and Secondary Market Dynamics. An Analysis Based on the MTS Market for Italy.*. CESifo, Working Paper, no. 5357.

CAGLIO, C., KAVAJECZ, K. A., 2006. *A specialist's quoted depth as a strategic choice variable: an application to spread decomposition models*. The Journal of Financial Research, vol. 29 (3), pp. 367-382.

CHUNG, K. H., CHUWONGANANT, C., 2004. *Tick size, order handling rules and trading costs*. Financial Management, vol. 33 (1), Spring 2004.

CHUNG, K. H., ZHAO, X., 2006. *Decimal pricing and information-based trading: tick size and informational efficiency of asset price*. The Journal of Business Finance and Accounting, vol. 33 (5-6), pp. 753-766.

COLUZZI, C., 2011. *The pricing of the option implicitly granted by the Italian Treasury to the Specialists in the reserved auction reopening*. Rivista di Politica Economica, I-III 2010-2011.

COLUZZI, C., GINEBRI, S., TURCO, M., 2008. *Measuring and analyzing the liquidity of the Italian Treasury Security Wholesale Secondary Market*. UNIMO, Working Paper, no. 48/08.

COPELAND, T. E., GALAI, D., 1983. *Information effects on the bid-ask spread*. The Journal of Finance, vol. 38 (5), pp. 1457-1469.

CORRADIN, S., MADDALONI, A., 2017. *The importance of beign special: repo markets during the crisis.*. ECB, Working Paper, no. 2065.

D'AGOSTINO, A., EHRMANN, M., 2014. *The pricing of G7 sovereign bond spreads: the times, they are a-changin*. Journal of Banking and Finance, vol. 47, pp. 155-176.

DE JONG, F., RINDI, B., 2009. *The microstructure of financial markets*. Cambridge University Press, ed. 1.

EASLEY, D., O'HARA, M., 1987. *Price, trade size and information in securities markets*. The Journal of Financial Economics, vol. 19, pp. 69-90.

EGGINTON, J. F., VAN NESS, B. F., VAN NESS, R. A., 2016. *Dealers and changing obligations: the case of stub quoting*. Financial Management, vol. 45 (3), pp. 583-608.

FOSTER, F. D., WISWANATHAN, S., 1993. *Variations in trading volume, return volatility and trading costs: evidence on recent price formation models.*. The Journal of Finance, vol. 48 (1) , pp. 187-211.

GARMAN, M. B., 1976. *Market microstructure*. Journal of Financial Economics, vol. 3 (3), pp. 257-275.

GIRARDI, A., IMPENNA, C., 2013. *Price discovery in the Italian sovereign bonds market: the role of order flow.*. Bank of Italy, Economic working papers, no. 906.

GLOSTEN, L. R., MILGROM, P. R., 1985. *Bid, ask and transaction prices in a specialist market with heterogeneously informed traders.*. The Journal of Financial Economics, vol. 14 (1), pp. 71-100.

GOLDSTEIN, M., KAVAJECZ, K. A., 2000. *Eighths, sixteenths and market depth: changes in tick size and liquidity provision on the NYSE*. Journal of Financial Economics, vol. 56 (1), pp. 125-149.

GOZLUKLU, A. E., PEROTTI, P., RINDI, B., FREDELLA, R., 2015. *Lot size constraints and market quality: evidence from the Borsa Italiana*. Financial Management, vol. 44 (4), pp. 905-945.

HO, T., STOLL, H., 1981. *Optimal dealer pricing under transactions and return uncertainty*. The Journal of Financial Economics, vol. 9 (1), pp. 47-73.

HO, T., STOLL, H., 1983. *The dynamics of dealer markets under competition.*. The Journal of Finance, vol. 38 (4), pp. 1053-1074.

HARRIS, L., 1994. *Minimum price variation, discrete bid-ask spreads and quotation sizes*. Review of Financial Studies, vol. 7, pp. 149-178.

HOLDEN, C., W., SUBRAHMANYAM, A., 1992. *Long-lived private information and imperfect competition*. The Journal of Finance, vol. 47 (1), pp. 247-270.

IACOVONI, D., 2017. *The secondary market for Italian government securities*. World Bank Group Government Bond Market Conference. April 26-27, 2017. Washington, DC, United States.

IMF, 2001. *Guidelines for Public Debt Management*.

KAVAJECZ, K. A., 1998. *The specialist's qupted depth as a strategic choice variable*. Wharton School, University of Pennsylvania, Working paper, 1998.

KAVAJECZ, K. A., 1999. *A specialist's quoted depth and the limit order book*. The Journal of Finance, vol. 54 (2), pp. 747-771.

KYLE, A. S., 1985. *Continuous Auctions and Insider Trading*. Econometrica, vol. 53 (6), pp. 1315-1335.

LEPONE, A., WONG, J.B., 2017. *Pseudo market-makers, market quality and the minimum tick size*. International Review of Economics and Finance, vol. 47 (C), pp. 88-100.

MADHAVAN, A., 2000. *Market microstructure: a survey*. Journal of Financial Markets, vol. 3 (2000), pp. 205-258.

MCINISH, T. H., VAN NESS, B. F., VAN NESS, R. A., 1998. *The effect of the SEC's order-handling rules on NASDAQ*. The Journal of Financial Research, vol. 21 (3), pp. 247-254.

MIGLIETTA, A., PICILLO, C., PIETRUNTI, M., 2015. *The impact of CCPs margin policies on repo markets*. Technical Report, Bank for International Settlements.

MORMANDO, F., 2017. *An analysis of long term evolution of the Italian Government bonds wholesale secondary market liquidity*. Fixed Income Market Colloquium. July 04-05, 2017. Rome, Italy.

PAIARDINI, P., 2015. *Informed trading in parallel bond markets*. Journal of Financial Markets, vol. 26 (C), pp. 103-121.

PELIZZON, L., SUBRAHMANYAM, M. G., TOMIO, D., UNO, J., 2014. *Limits to arbitrage in sovereign bonds: Price and liquidity discovery in high-frequency quote driven markets.*. The 41th European Finance Association Annual Meeting (EFA 2014).

PELIZZON, L., SUBRAHMANYAM, M. G., TOMIO, D., UNO, J., 2016. *Sovereign credit risk, liquidity, and European Central Bank intervention: Deus ex machina?*. Journal of Financial Economics, vol. 122, pp. 86-115.

PORTER, D.C., SIMAAN, Y., WEAVER, G., 2006. *Effect of the Actual Size Rule under market stress*. Review of Quantitative Finance and Accounting, vol. 26 (2), pp. 87-103.

ROMER, C. D., 1990. *The Great Crash and the onset of the Great Depression*. The Quarterly Journal of Economics, vol. 105 (3), pp. 597-624.

SCHNEIDER, M., LILLO, F., PELIZZON, L., 2016. *How has sovereign bond market liquidity changed? An illiquidity spillover analysis.*. SAFE, Working Paper, no. 151.

STOLL, H. R., 1978. *The supply of dealer services in securities markets*. The Journal of Finance, vol. 33 (4), pp. 1133-1151.

VAYANOS, D., WANG, J., 2012. *Market liquidity Theory and empirical evidence*. National Bureau of Economic Research, Working paper, no. 18251.

10 Appendix

10.1 Specialists' evaluation criteria. Year 2015

Table 12: Evaluation Criteria of Specialists in Government bonds. Year 2015

Parameter		Description	Max score
Primary Market	Primary Market Quota	Each Specialist is assigned a score, between 0 and 33, in proportion to the share allocated obtained in the reference period. The score begins to be assigned with the allocation of a share above the minimum required to maintain the Specialist qualification (3%) up to a maximum level of 6%. The score for the primary quantitative parameter is assigned according to the following formula: (Specialists market share 3%)/(6% - 3%)*33. The specialists market share in the reference period is calculated weighting the allocated amounts of each type of bond with weights that take into account the financial characteristics of the same bonds as well as the status of the bonds placed on auction (bonds currently being issued on-the-run or no longer being issued off-the-run) according to the table 14	33.00

Table 12: Evaluation Criteria of Specialists in Government bonds. Year 2015

Parameter		Description	Max score
Primary Market	Qualitative evaluation AAI	AAI measures the contribution of each Specialists auction strategy in determining the difference between the bond auction price and the prices reported on the secondary market. AAI measures the degree of aggresivity of the auction participation strategy of each Specialist, in other words, the combined effect of the difference between bid prices and market prices (overbidding) associated with bid quantities that ration the amount available to the remaining participants (overdemanding). The score is attributed according to the average value of the AAI, calculated on each auction of on-the-run BTPs, BTPI, CCT, CTZ, obtained by each Specialist and is assigned according to the following scheme: a) if $0 < \text{AAI} < 0.2$, 12 points; b) $0.2 < \text{AAI} < 1.2$, 0-12 points in proportion to the AAI value; c) $\text{AAI} > 1.2$, 0 points. For each auction the value of the AAI may be adjusted by the Treasury in order to take into consideration the specific contribution of the Specialists to the auction result, the requests of the bond at auction by final investors and, more generally, the overall outcome of the auction with respect to the performance on the secondary market of the same bond in the period preceding the auction cut-off time.	12.00

Table 12: Evaluation Criteria of Specialists in Government bonds. Year 2015

Parameter		Description	Max score
Primary Market	Qualitative evaluation Bidding Continuity	This criteria evaluates the regularity of participation of Specialists in all the auctions of Government bonds. The indicator measures the number of times in which the Specialist, in auctions, did not bid for a quota of at least 4The indicator is made so as to proportionally penalize (by up to a maximum of 4 points) those Specialists that more frequently did not respect the minimum level of participation in the auctions.	0.00

Table 12: Evaluation Criteria of Specialists in Government bonds. Year 2015

Parameter		Description	Max score
Secondary Market	Quality quotation index	QQI is an indicator based on high frequency snapshots (that mimic continuous monitoring), made on each market day, on the order book of each bond, for each Specialist. For each snapshot, the ranking of the Specialist in the order book of the bond with respect to the best ranked Specialist, both for the bid and ask sides, is recorded. To calculate the indicator, those snapshots, both on the bid and ask sides, that reveal buy and/or sale price proposals associated with (visible) quantities that are equal to at least 5 million euros, will be considered, with the exception of the BTPi segment where all proposals are evaluated. For each bond, the average ranking of the Specialist is calculated, relative to the market day. To calculate the average ranking, each position in the order book (in terms of ranking with respect to the best Specialist) is weighted with decreasing coefficients that are in proportion to the position in the order book with respect to the best price, in order to reward more those dealers that continuously show the best prices both for the bid and the ask sides. The absence of the Specialist from the order book determines a worsening of the average rank and thus of the performance measured by the QQI, having taken into account, in any case, the safeguard mechanism, if the Specialist is technically suspended having just settled a contract. Lower QQI values, which indicate an average overall positioning closer to the best prices, denote a better performance. The daily rankings relative to each bond are	8.00

Table 12: Evaluation Criteria of Specialists in Government bonds. Year 2015

Parameter		Description	Max score
Secondary Market	Cash Volumes traded Market Share	Given the number of open market days during the reference period, the Cash traded volumes parameter is calculated with two subsequent weightings. The first takes into account the type of bonds traded whose volumes are weighted according to the weights presented in the table 14, without distinguishing between off-the-run and on-the-run. Afterwards, the volumes traded by the operator, thus weighted, are proportioned to the total volume of cash traded in the trading venues selected, taking into account if the trade was as filler or aggressor. Volumes traded as fillers are weighted 1 while those traded as aggressors are weighted 0.50. The best Specialist is assigned a score of 8 points. All the other Specialists are proportionally assigned a score between 0 and 8. Those Specialists with a market share less than that of the average of market makers that are neither Specialists nor Candidate Specialists are assigned a score equal to 0.	8.00

Table 12: Evaluation Criteria of Specialists in Government bonds. Year 2015

Parameter	Description	Max score
Secondary Cash Bond Market Traded as Filler	The parameter measures the ability of each Specialist to trade, as filler, the highest possible number of bonds on the selected trading venue, taking into account the financial characteristics of the bonds. For the calculation of the parameter, bonds traded as filler, from each Specialist, are analyzed for different segments (by type/class of maturity), as in QQI indicator. For each segment a ranking is carried out and a standardized maximum score is assigned to the best and in proportion to the others. The sum of the scores obtained in each segment by each Specialist represents the reference indicator of the parameter. To the best Specialist 4 points are assigned. A score between 0 and 4 is proportionally assigned to the other Specialists.	4.00

Table 12: Evaluation Criteria of Specialists in Government bonds. Year 2015

Parameter		Description	Max score
Secondary Market	Cash Large in size trades	The parameter measures the contribution of each Specialist to provide size to contracts traded as filler, on the selected trading venue, taking into account the characteristics of the bonds. For the calculation of the parameter, bonds are analyzed for different segments (by type/class of maturity), as in QQI indicator. For each segment all contracts larger than or equal to a threshold size are selected. The threshold size, for each segment, is defined by averaging the size of contracts traded during the observation period, to which a buffer is added calculated as a percentage of the average. Having selected the contracts for each segment, then Treasury calculates the share of each Specialist as filler. For each segment the Specialists are then ranked giving a maximum standardized score to the better and in proportion to the others. The sum of the scores obtained on all segments by each Specialist represents the reference indicator of the parameter. The Specialist with the highest indicator is given a score of 2 points. All other Specialists is assigned a score proportional between 0 and 2.	2.00

Table 12: Evaluation Criteria of Specialists in Government bonds. Year 2015

Parameter	Description	Max score
Secondary Repo Market Market Share	Given the number of open market days during the reference period, the parameter is calculated, both for the General Collateral segment and for the Special Repo segment, as a percentage of volumes traded trough ordinary contracts or Request-for-quote type of contracts, weighted for the duration of the contract, of the overall total of the segment. In weighting for the duration, contracts with a duration above 90 days will be considered as 90-day contracts. The best Specialist, on each segment, is assigned a maximum score of 3 points. A score between 0 and 3 is proportionally assigned to the other Specialists with a market share above that of the average of market makers that are neither Specialists nor Candidate Specialists. Those Specialists with a market share less than that of the average of market makers that are neither Specialists nor Candidate Specialists are assigned a score equal to 0.	6.00

Table 12: Evaluation Criteria of Specialists in Government bonds. Year 2015

Parameter		Description	Max score
Secondary Market	Contribution to the efficiency of the market (Bank of Italy)	The bonds quoted are divided for each open market day into 7 classes according to their segment and their degree of liquidity. For each class the following parameters, indicative of each primary dealers contribution to overall market efficiency, are considered: average spread weighted for page exposition time; volume of applications received; number of bonds quoted; number of bonds traded; sum of the quoted quantities weighted for page exposition time. To permit the comparison of non-homogeneous quantities, insomuch as they refer to bonds with different financial characteristics and degrees of liquidity, processes of standardization of data used for analysis are carried out. The daily parameters, calculated for each dealer within the context of each class of liquidity, are subsequently aggregated on a period basis in order to complete a comparative evaluation of the behavior of all the main dealers in the market. A comprehensive ranking is thus drawn up, which constitutes the basis for the Treasurys attribution of points. 6 points are assigned to the best Specialist. A score between 0 and 6 is proportionally assigned to the other Specialist.	6.00

Table 12: Evaluation Criteria of Specialists in Government bonds. Year 2015

Parameter		Description	Max score
Secondary Market	Cash Volumes traded on Electronic System	This parameter, calculated each quarter, assesses the Specialists trading activity on electronic trading systems. This indicator, whose calculation takes into account information included in the European harmonized report format (HRF), is calculated as the percentage of volumes traded by the operator of the total of electronic trading systems, analyzed for different segments (by type/class of maturity), as shown in table 14, without distinction between on-the-run and off-the-run. Trading volumes on strips, whether they take place in electronic or non-electronic markets, are measured with a weight equal to that of the segment BTP 15 years. The best Specialist is assigned a score of 4 points. A score between 0 and 4 is proportionally assigned to the other Specialists.	4.00
Secondary Market	Distributional capacity in the Cash Market HRF	The parameter evaluates the overall ability of the Specialist to distribute the complete range of instruments issued by the Treasury. The indicator is calculated each quarter on the basis of information in the HRF, that provides details of trading activity for: bond type and residual maturity, geographical area and type of counterparty, trading system. 2 points are assigned to the Specialist with the best performance. A score between 0 and 2 is proportionally assigned to the other Specialists.	2.00

Table 12: Evaluation Criteria of Specialists in Government bonds. Year 2015

Parameter		Description	Max score
Secondary Market	Distributional capacity in the Repo Market HRF	This is a synthetic indicator that measures the quality of the trading activity of Government bonds outside wholesale regulated markets, on the repo segment, with regards to the diversification of bond types, of counterparties and of systems used. The parameter is calculated each quarter on the basis of data communicated by the Specialist according to the format defined by the Treasury together with the Bank of Italy. 2 points are assigned to the Specialist with the best performance. A score between 0 and 2 is proportionally assigned to the other Specialists.	2.00
Organizational structure		The evaluation of the Organizational Structure given by the Treasury is made yearly and assigns up to 8 points. The parameter takes into account the overall assessment given by the Treasury on the Specialists activity, with reference to aspects concerning the reliability of the organizational structure and the advisory and research ability on themes related to the management of public debt. In assigning points, the contribution to the efficient functioning of the primary and secondary markets, which is not directly measurable with the indicators mentioned in the preceding articles, is also assessed.	8.00

Table 12: Evaluation Criteria of Specialists in Government bonds. Year 2015

Parameter	Description	Max score
Exchange and Buy-Back	The participation of each Specialist in buyback and exchange operations is assessed up to a maximum of 5 points. The maximum score that can be assigned, in any case not below 3 points, will be set by the Treasury on the basis of the number and overall value of operations conducted during the year. The performance of each Specialist will be evaluated in proportion to the best operator. Specialists that within the deadlines set for the settlement of exchange or buyback transactions fail to deliver, even partially, the share of bonds sold in the transaction, will be penalized. This penalty will result in a deduction from the score that the Specialists will be assigned on the parameter at year end, equal to 10% of the maximum score potentially assigned at year end (0.3 - 0.5) for each fail, up to a maximum of points achieved by the Specialist.	3.00 - 5.00
Total score		98.00 - 100.00

Table 13: Coefficients for QQI index. Year 2015.

Ranking in the order book	**Coefficient**
1	0
2	5
3	8
4	9
5	10
...	...
Absent	28

Table 14: Weights for TV index. Year 2015.

Bond	**BOT**			**CTZ**	**BTP**						**CCT**
	3m	**6m**	**12m**	**24m**	**3y**	**5y**	**7y**	**10y**	**15y**	**30y**	**7y**
On-the-run	0.25	0.50	1.00	2.50	2.75	4.50	6.50	7.50	12.00	17.00	8.00
Off-the-run					1.375	2.25	3.25	3.75	6.00	8.50	8.00
BTP€i					4.00	6.50	8.50	9.50	14.00	21.00	

10.2 Changes in evaluation criteria. Year 2016

Table 15: Changes to the Evaluation Criteria of Specialists in Government bonds. Year 2016

Parameter	Description
Primary Market Quota	I) A positive score (>0) is obtained if the primary market share is between 3,5% - 6,5% (instead of the 2015 range of 3% - 6%) II) The maximum score assigned is reduced by one point moving from 33 to 32 points III) In calculating the quantitative indicator on the primary market - primary market share, the weights assigned to the nominal and inflation securities on maturities longer than 10 years are increased. The weight of CCTs/CCTeus is almost aligned to their maturity at issuance. The weight of nominal 3 and 5 year BTPs and of CTZs is slightly reduced. Table 16 presents the new coefficients.
Primary Market Qualitative Evaluation AAI	I) The threshold share (the quota above which a Specialist is considered ”aggressive”) for the purposes of calculation of AAI, when the prices of the bid offered at auction are higher than the reference price of the secondary market, is increased to 5.30% II) The maximum score assigned is reduced by two points, moving from 12 to 10 points
Primary Market Bidding Continuity	I) The minimum share of participation at each auction, in order not to be penalized with a reduction in points, is increased from 4% to 5% II) The maximum penalization is unchanged to -4 points

Table 15: Changes to the Evaluation Criteria of Specialists in Government bonds. Year 2016

Parameter	Description
Secondary Market - QQI	I) The weight of quoting activity on nominal BTPs with a maturity longer than 10 years is increased with respect to the other segments. The weight assigned to this category is doubled while the others are left unchanged II) The minimum size required (previously 5 millions) for the evaluation of quotation activity on nominal BTPs with a maturity longer than 10 years is removed III) The coefficients for weighting the positions in the order book are modified to increase the distance between the second and subsequent rankings, by assigning to the third position a coefficient equal to 8 (against the current 6). Subsequent positions after the third are ranked consistently with the ordinary pace of 1 (9,10,11 etc..) . The weighting of the first two positions remains unchanged (0 and 5) IV) The maximum score assigned is increased by one point from 8 to 9 points
Secondary Market - Volumes traded	I) The weight of several segments is changed, increasing that of nominal and inflation segments longer than 10 years while reducing that of CTZs, nominal 3 and 5 year BTPs as well as CCTs (as reported on the table 16) II) The maximum score assigned is unchanged
Secondary Market - Number of bonds traded as filler	I) The weight of trading activity on nominal BTPs longer than 10 years is increased with respect to the other segments. The weight assigned to this category is doubled while the others are left unchanged II) The maximum score assigned is unchanged

Table 15: Changes to the Evaluation Criteria of Specialists in Government bonds. Year 2016

Parameter	Description
Secondary Market - Large in size contract	I) The size of the contracts threshold beyond which is considered a positive contribution to the market depth is determined by the average of the size of the contracts made in the period of observation II) The weight of trading activity nominal BTPs longer than 10 years is increased with respect to the other segments. The weight assigned to this category is doubled while the others are left unchanged III) The maximum score assigned is unchanged
Secondary Market - Volumes traded in other electronic platforms	I) The weight of several segments is changed, increasing that of nominal and inflation ones longer than 10 years while reducing that of CTZs, nominal 3 and 5 year BTPs as well as CCTs (as reported on the table 16) II) For the calculation of the parameter, trading activity executed with final investors (BtC) is furtherly rewarded III) The maximum score assigned is increased by two points moving from 4 to 6 points
Secondary Market - Volumes in MTS Repo	I) The total maximum score unchanged at 6 points - is distributed differently among the General Collateral segment and the Special Repo one: up to 2 points for the best Specialist in the GC segment and up to 4 points to the best Specialist in the SR segment. Currently the scores for the two segments were equivalent (3 and 3)

Table 15: Changes to the Evaluation Criteria of Specialists in Government bonds. Year 2016

Parameter	Description
Secondary Market - Repo Volumes traded outside MTS Repo	I) Calculation of the parameter and the maximum score assigned to the best Specialist are unchanged

Table 16: Weights for TV index. Year 2016.

Bond	**BOT**			**CTZ**	**BTP**						**CCT**
	3m	**6m**	**12m**	**24m**	**3y**	**5y**	**7y**	**10y**	**15y**	**30y**	**7y**
On-the-run	0.25	0.50	1.00	2.00	2.50	4.00	6.50	7.50	14.00	20.00	7.00
Off-the-run					1.375	2.25	3.25	3.75	7.00	10.00	7.00
BTP€i					4.00	6.50	8.50	9.50	16.00	24.00	

1. The overall evaluation of the primary market is reduced from 45 to 42 points. The overall evaluation of the secondary market is conversely increased from 42 points to 45 points

2. The score assigned to the primary market share changes from 33 to 32 points while the score assigned to the qualitative assessment of the bidding behavior in auction changes from 12 to

10 points

3. On the secondary market, volumes traded according to the HRF data (outside MTS platform) are evaluated with 2 points more, while the QQI parameter is increased by 1point

10.3 Italian Treasury issuance activity (2013 - 2017).

Table 17: Treasury issued amounts in BTPs 10y and 15y segments in September-April period during last five years.

	Sep 13 - Apr 14	**Sep 14 - Apr 15**	**Sep 15 - Apr 16**	**Sep 16 - Apr 17**	**Average**
BTP 10y	22.050 (mm)	23.250 (mm)	21.750 (mm)	20.250 (mm)	21.825 (mm)
BTP 15y	6.000 (mm)	8.000 (mm)	5.956 (mm)	4.386 (mm)	6.114 (mm)

10.4 Descriptive statistics of outcome variables

Table 18: Descriptive statistics of outcome variables

ISIN	Description	Stats	BA	Q	VWVA	PI	VAR	V2B	A2B	Vol MM	Perc MM
	BTPS 9.00%	Mean	0.021	107.054	0.033	7.018	0.003	45.379	5.464	0.875	0.013
		P50	0.021	105.042	0.033	6.932	0.002	46.072	5.517	0.000	0.000
IT0000366655		SD	0.003	8.882	0.003	0.969	0.001	2.750	0.154	2.475	0.037
	01/11/2023	Min	0.017	95.748	0.028	5.591	0.002	40.054	5.280	0.000	0.000
		Max	0.028	119.903	0.040	8.949	0.004	49.278	5.626	7.000	0.106
	BTPS 4.50%	Mean	0.019	119.170	0.032	4.901	0.002	48.321	5.923	31.063	0.042
		P50	0.019	113.780	0.031	5.071	0.002	48.796	5.901	21.750	0.026
IT0004953417		SD	0.005	8.814	0.005	1.212	0.001	3.735	0.091	25.809	0.029
	01/03/2024	Min	0.012	111.923	0.025	3.213	0.001	43.339	5.820	5.000	0.017
		Max	0.025	132.227	0.039	6.517	0.004	54.222	6.064	74.500	0.092
	BTPS 3.75%	Mean	0.019	118.369	0.034	4.774	0.002	44.131	5.541	43.875	0.070
		P50	0.019	115.128	0.033	4.747	0.002	44.179	5.525	40.000	0.045
IT0005001547		SD	0.003	7.892	0.004	0.790	0.001	5.852	0.173	34.696	0.068
	01/09/2024	Min	0.015	108.872	0.029	3.744	0.001	35.565	5.261	0.000	0.000

Table 18: Descriptive statistics of outcome variables

ISIN	Description	Stats	BA	Q	VWVA	PI	VAR	V2B	A2B	Vol MM	Perc MM
		Max	0.025	130.552	0.041	6.138	0.004	51.541	5.788	112.000	0.180
	BTPS 2.50%	Mean	0.022	116.622	0.039	4.930	0.003	45.585	5.753	75.563	0.116
		P50	0.022	113.634	0.038	4.989	0.002	46.175	5.781	67.750	0.110
IT0005045270		SD	0.004	10.908	0.006	0.961	0.001	4.416	0.081	46.576	0.057
	01/12/2024	Min	0.015	106.190	0.030	3.427	0.001	39.150	5.628	29.000	0.037
		Max	0.027	131.700	0.047	6.007	0.005	52.473	5.864	163.000	0.225
	BTPS 5.00%	Mean	0.018	114.509	0.041	4.922	0.012	42.722	5.541	49.625	0.070
		P50	0.017	110.170	0.042	4.736	0.012	43.517	5.502	41.500	0.074
IT0004513641		SD	0.003	10.813	0.005	0.898	0.002	5.201	0.097	18.852	0.023
	01/03/2025	Min	0.013	104.433	0.034	3.643	0.009	32.868	5.448	33.500	0.037
		Max	0.023	129.665	0.048	6.171	0.016	49.162	5.685	85.000	0.098
	BTPS 1.50%	Mean	0.023	111.648	0.042	4.871	0.003	40.756	5.518	171.813	0.208
		P50	0.021	108.483	0.042	4.647	0.003	41.432	5.544	173.750	0.198
IT0005090318											

Table 18: Descriptive statistics of outcome variables

ISIN	Description	Stats	BA	Q	VWVA	PI	VAR	V2B	A2B	Vol MM	Perc MM
		SD	0.005	8.944	0.006	1.000	0.001	6.914	0.156	69.465	0.073
	01/06/2025	Min	0.016	102.907	0.033	3.536	0.001	31.565	5.263	73.000	0.130
		Max	0.029	123.506	0.051	6.238	0.005	52.819	5.672	301.500	0.363
		Mean	0.022	114.105	0.043	5.012	0.003	40.591	5.529	116.313	0.101
	BTPS 2.00%	P50	0.024	112.750	0.043	5.215	0.003	40.413	5.571	129.500	0.090
IT0005127086		SD	0.004	4.380	0.005	0.833	0.001	6.355	0.188	44.088	0.037
	01/12/2025	Min	0.017	110.463	0.036	3.783	0.002	29.822	5.222	55.500	0.061
		Max	0.027	123.514	0.050	5.984	0.005	50.011	5.763	172.500	0.174
		Mean	0.026	106.253	0.056	7.120	0.023	37.385	5.447	32.188	0.080
	BTPS 4.50%	P50	0.025	102.887	0.053	6.907	0.015	37.973	5.452	35.250	0.067
IT0004644735		SD	0.004	8.492	0.012	0.964	0.017	4.596	0.157	20.593	0.076
	01/03/2026	Min	0.022	94.433	0.043	6.219	0.012	30.983	5.228	0.000	0.000
		Max	0.033	117.889	0.077	8.755	0.050	44.084	5.612	58.000	0.244

Table 18: Descriptive statistics of outcome variables

ISIN	Description	Stats	BA	Q	VWVA	PI	VAR	V2B	A2B	Vol MM	Perc MM
	BTPS 7.25%	Mean	0.037	99.670	0.071	12.192	0.050	31.230	5.115	3.500	0.021
		P50	0.036	99.365	0.069	11.723	0.051	29.255	5.103	2.500	0.023
IT0001086567		SD	0.007	5.388	0.009	2.175	0.003	5.667	0.337	4.652	0.019
	01/11/2026	Min	0.031	91.653	0.059	10.194	0.046	25.105	4.653	0.000	0.000
		Max	0.051	106.334	0.090	16.602	0.054	39.768	5.525	14.000	0.048
	BTPS 6.50%	Mean	0.042	97.085	0.076	13.190	0.050	32.687	5.156	2.563	0.023
		P50	0.040	95.132	0.075	12.552	0.049	34.647	5.183	1.000	0.020
IT0001174611		SD	0.010	7.052	0.011	3.006	0.006	5.006	0.246	3.849	0.025
	01/11/2027	Min	0.034	89.973	0.064	10.659	0.044	24.556	4.693	0.000	0.000
		Max	0.065	106.691	0.101	20.193	0.060	38.179	5.415	11.000	0.052
	BTPS 4.75%	Mean	0.048	97.099	0.090	13.553	0.049	28.143	4.836	14.938	0.050
		P50	0.043	95.175	0.088	12.315	0.048	27.831	4.831	10.250	0.053
IT0004889033		SD	0.013	5.397	0.015	3.509	0.005	5.357	0.562	18.690	0.045
	01/09/2028	Min	0.036	90.306	0.069	10.206	0.042	18.864	4.015	0.000	0.000

Table 18: Descriptive statistics of outcome variables

ISIN	Description	Stats	BA	Q	VWVA	PI	VAR	V2B	A2B	Vol MM	Perc MM
		Max	0.077	105.674	0.121	21.411	0.058	35.017	5.623	57.000	0.107
	BTPS 5.25%	Mean	0.054	94.794	0.092	15.769	0.053	31.881	4.962	3.125	0.028
		P50	0.049	96.107	0.093	14.406	0.053	30.355	4.949	2.250	0.023
IT0001278511		SD	0.014	4.775	0.016	3.823	0.005	7.720	0.710	3.346	0.029
	01/11/2029	Min	0.041	88.135	0.073	12.208	0.047	21.014	4.033	0.000	0.000
		Max	0.084	101.893	0.125	23.961	0.065	43.113	5.771	8.500	0.074
	BTPS 3.50%	Mean	0.060	97.561	0.113	15.052	0.061	27.908	4.746	17.563	0.064
		P50	0.056	96.331	0.110	14.183	0.059	24.919	4.722	18.000	0.045
IT0005024234		SD	0.015	7.324	0.018	3.428	0.008	6.443	0.631	14.364	0.080
	01/03/2030	Min	0.042	89.945	0.086	11.293	0.051	21.186	4.008	2.000	0.011
		Max	0.092	108.441	0.148	22.624	0.071	38.155	5.473	39.500	0.254
	BTPS 6.00%	Mean	0.053	89.326	0.091	16.610	0.055	27.993	4.746	1.188	0.003
		P50	0.050	87.725	0.089	15.587	0.054	27.657	4.757	0.000	0.000
IT0001444378											

Table 18: Descriptive statistics of outcome variables

ISIN	Description	Stats	BA	Q	VWVA	PI	VAR	V2B	A2B	Vol MM	Perc MM
		SD	0.013	9.283	0.015	3.822	0.007	4.261	0.492	3.359	0.008
	01/05/2031	Min	0.040	78.814	0.073	13.227	0.047	22.514	4.191	0.000	0.000
		Max	0.081	103.354	0.122	25.091	0.067	34.166	5.325	9.500	0.023
	BTPS 1.65%	Mean	0.069	89.131	0.139	14.091	0.061	23.886	4.639	26.813	0.066
		P50	0.063	85.263	0.136	12.757	0.062	22.451	4.575	15.500	0.069
IT0005094088		SD	0.019	13.120	0.023	3.453	0.011	5.671	0.599	31.963	0.028
	01/03/2032	Min	0.052	76.417	0.113	11.240	0.048	18.086	3.928	10.500	0.019
		Max	0.104	108.974	0.183	20.820	0.082	34.940	5.377	105.000	0.109

10.5 Rankings 2007 - 2016

Year	1	2	3	4	5
2016	MPS CS	JP Morgan	Banca Imi	Unicredit	Bnp Paribas
2015	MPS CS	JP Morgan	Banca Imi	Unicredit	Citi
2014	MPS CS	Unicredit	JP Morgan	Citi	Barclays
2013	Citi	Unicredit	HSBC	JP Morgan	Banca Imi
2012	Barclays	Banca Imi	JP Morgan	Credit Agricole	Unicredit
2011	Barclays	Banca Imi	Unicredit	JP Morgan	Deutsche Bank
2010	Barclays	Deutsche Bank	Citi	Soc Gen	RBS
2009	Barclays	Soc Gen	Credit Agricole	Deutsche Bank	Bnp Paribas
2008	Soc Gen	Bnp Paribas	UNICREDIT	Banca Imi	JP Morgan
2007	Banca Imi	Barclays	Soc Gen	JP Morgan	Bnp Paribas

Table 19: Rankings 2016 - 2007. Five top specialists.