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Investor behavior under market stress: evidence from the Italian sovereign bond market

by Onofrio Panzarino*

Abstract

Drawing on data from primary dealers, this analysis compares how different types of investors in Italian government bonds react to changes in past yields, and provides new evidence on the role played by non-banks, alongside banks. The analysis covers the seven-year period 2014-2020, which includes episodes of severe market stress, such as the 2018 Italian market turmoil and the outbreak of the COVID-19 crisis in March 2020. The evidence shows that investors' reactions to past yield changes differ consistently based on the sector to which they belong. Asset managers and hedge funds tend to respond procyclically to yield movements, i.e. they buy securities when prices rise (and vice versa), whereas banks do not, and thus they play a more stabilizing role on the market. Other non-bank investors, such as insurance companies, pension funds and non-financial entities, tend to have a muted response to past yield changes.

JEL Classification: G11, G12, G15, G20, G23.

Keywords: government bonds, investors' behavior, market functioning, market liquidity.

Sintesi

Basandosi sui dati dei *primary dealer*, lo studio confronta il modo in cui le diverse tipologie di investitori in titoli di Stato italiani reagiscono a un rialzo dei tassi d'interesse e fornisce nuove evidenze sul ruolo svolto da soggetti non bancari, oltre che dalle banche. L'analisi copre i sette anni compresi tra il 2014 e il 2020, che includono episodi di elevato *stress* finanziario, come le turbolenze del maggio 2018 e quelle dovute alla pandemia di Covid-19 nel marzo 2020. Le evidenze raccolte indicano che le reazioni degli investitori alle variazioni di rendimento si differenziano a seconda del settore di appartenenza. I fondi comuni e quelli speculativi (*hedge fund*) tendono a rispondere in modo prociclico, ossia acquistano titoli quando i prezzi salgono (e viceversa), mentre le banche non lo fanno, svolgendo così un ruolo stabilizzatore sul mercato. Altri operatori non bancari, come le imprese assicurative, i fondi pensione e i soggetti non finanziari, tendono a reagire alle variazioni dei tassi d'interesse in modo molto contenuto.

* Bank of Italy, Directorate General for Markets and Payment Systems.

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1. Introduction[1]

In March 2020, the spread of the COVID-19 pandemic triggered an exceptional economic shock at the global level. Downward revisions of growth expectations and heightened risk aversion led to sharp market movements and extreme investors' behavior (FSB, 2020a). Global financial markets and their functioning were severely affected.

Many asset classes experienced large and sudden price drops, amid heightened market volatility. Liquidity conditions quickly deteriorated across markets, leading to impaired market functioning even for most liquid securities, like government bonds. US Treasuries, which are widely recognized as one of the most liquid asset class at the global level, suffered very poor liquidity conditions around mid-March, reaching levels that were not seen since the global financial crisis (Fleming and Ruela, 2020). According to some observers, in the tensest days the market became essentially dysfunctional (Group of Thirty, 2021). Same patterns were observed also in other government bond markets, as in the UK (Hauser, 2020; 2021; Czech *et al.*, 2021), in the euro area (Schnabel, 2020; Moench *et al.*, 2021) and in other countries (Eren and Wooldridge, 2021). Market liquidity also deteriorated significantly in Italy (Bank of Italy, 2020a), which at the time was one of the countries most affected by the pandemic. In response to the turmoil, central banks stepped in and took massive actions to reestablish and sustain market functioning. According to the FSB (2020a), the policy response was 'speedy, sizeable and sweeping'; in other words, it was considered by far unprecedented.[2] Absent central bank interventions, it was generally recognized that the stress in the financial system would have worsened significantly.

The March 2020 turmoil questioned the resilience of core financial markets and their ability to keep functioning under stressed circumstances (Schrimpf *et al.*, 2020; Eren *et al.*, 2020; Hofmann *et al.*, 2020). In particular, it was challenged the idea that government bond markets could still be seen as reliable safe havens during periods of market turmoil (Duffie, 2020). The material deterioration in market quality took place against the backdrop of a large sell-off, which involved sovereign securities and was widespread across jurisdictions (see, for example, Eren and Wooldridge, 2021, and FSB, 2020a). Divestments were concentrated over short time periods and made more difficult for primary dealers (PDs), which typically act as relevant market makers in these core markets, to keep providing liquidity to each other and to other investors.

In particular, the crisis' experience has made it clear that in contexts of high uncertainty and market turbulence PDs may have to cope with exceptionally large, one-sided investment flows. On the one hand, questions have been raised about dealers' ability as well as their willingness to intermediate the

[1] I'm grateful to Claudio Impenna, Giuseppe Grande, Gaetano Marseglia, Pietro Stecconi, Gioia Guarini, Luca Arciero, Giovanna Cicardo and one anonymous referee for valuable comments and suggestions. All the errors are my own. The views expressed in the paper do not necessarily represent those of the Bank of Italy.

[2] In response to the severe financial distress, monetary authorities took highly expansionary measures. Among the numerous initiatives, central banks expanded their asset purchase programs of public and private sector securities, launched new refinancing operations, lowered key policy rates, loosened collateral eligibility criteria, revised or reactivated swap line agreements and temporarily lowered capital requirements to strengthen banks' ability to provide market-making activities (Bank of Italy, 2020a; ECB, 2020). Between 15 and 31 March, the Federal Reserve purchased $775 billion in U.S. government debt securities. On 18 March, the Eurosystem announced a €750 billion of its pandemic emergency purchase program (PEPP), which was characterized by considerable flexibility in terms of timing and composition of purchases between assets and between countries (Bank of Italy, 2020a); the plan was subsequently increased to €1,350 billion.

market under stressed circumstances.[3] It was argued that the remarkable selling pressure experienced during the March 2020 turmoil could have outstripped their balance sheet capacity to provide liquidity and hence contributed to market dysfunction (Eren *et al.*, 2021; Czech *et al.*, 2021). To corroborate this argument, it was noted that over the last decade the stock of government securities in many countries[4] continued to significantly grow, while large bank balance sheets did not, remaining limited since 2008 (Duffie, 2020; Hauser, 2021). In addition, bank dealers may also have faced constraints to intermediate securities under market stress, due to internal risk control measures and greater risk aversion in the presence of high volatility.[5] On the other hand, the sell-off has been so extreme that it has posed questions concerning what market structure – as well as capital allocated by dealers to the market-making business – could have provided the capacity to absorb such a widespread selling pressure. This aspect more generally hinges on the role played by different investor types across financial markets and their trading behavior, which shape the response of the market to external shocks and affect its resilience during stress episodes.

This study investigates this aspect more structurally in the context of the Italian sovereign bond market. Using a unique dataset on dealers' transactional data, this paper examines the trading behavior of different types of investors over a seven-year sample period, from January 2014 to December 2020, which includes episodes of severe market stress, such as the 2018 Italian market turmoil and the outbreak of the COVID-19 crisis in March 2020.[6] The data employed in this study are ideally suited for this task; they contain PDs' transactions, covering secondary-market activity for all outstanding securities, and include a sector classification for each counterparty in a trade, which enables to disentangle trading activity among different industries. These features allow to analyse the heterogeneity in investment behavior, on a relatively high frequency[7] and across different sectors, by using actual transaction data.

The analysis shows that the response of different investor types to past yield changes is far from homogenous. Asset managers and hedge funds tend to respond in a procyclical manner to past yield changes: on average, the week following a yield rise (price drop) they sell securities, and vice versa; during stress episodes, sales can even triple. In contrast, banks do not procyclically react to short-term changes in yields and play a more stabilizing role on the market, even under stressed market conditions. The response of insurance companies, pension funds and other non-financial entities is much more muted.

The remainder of this paper is structured as follows. Section 2 briefly recalls the related literature and empirical evidence on investors' behavior. Section 3 provides a description of the structure of the

[3] The terms dealers and PDs will be used interchangeably in the rest of the paper.
[4] Duffie (2020) and Hauser (2021), for example, document the growing imbalance between the size of sovereign bond markets and bank primary dealers' holdings in US and UK government securities, respectively.
[5] For bank dealers, binding constraints could result from internal risk management, regulatory requirements to safeguard the banking system, and operational challenges of moving to remote working arrangement (Eren and Wooldridge, 2021; Czech *et al.*, 2021). See Lanotte *et al.* (2016) for a discussion on the prudential treatment of public sector exposures in the banking regulation.
[6] In May 2018, after the outcome of the general election in Italy, the yields on Italian government securities recorded a marked and persistent rise, reflecting the sharp increase in risk premiums stemming from uncertainty about the economic and fiscal policy stance (Bank of Italy, 2018a). Liquidity conditions sharply deteriorated on the secondary market and prices of Italian government securities incorporated a significant debt redenomination risk, which was not present in other euro-area countries (Bank of Italy, 2018b).
[7] Thus far, the empirical literature in this field has been largely limited to the use of quarterly market prices and holdings data (such as, e.g., Abassi *et al.* (2016), Timmer (2018) and Della Corte and Federico (2019); see Sections 2 and 4.1).

sovereign bond market, with a focus on the role played by PDs. Section 4 describes the data, provides summary statistics and outlines the empirical strategy adopted in the study. Section 5 presents the empirical findings on the heterogeneous response of the different types of investors to past yield changes. Section 6 provides some robustness tests. Section 7 concludes.

2. Related literature

The literature devoted to exploring the behavior of investors in relation to price dynamics is long-standing. Understanding what effect investors have on asset prices is of paramount importance and has major implications, both economically and politically.

A number of seminal works[8] on trading behaviors and market efficiency discuss, for instance, the co-existence of several trading strategies and different types of investors across financial markets, such as positive feedback investors and other rational speculators. Positive feedback investors are identified as agents that buy securities when prices rise (and sell them when prices fall) and are often seen as a destabilizing force on the market, given their procyclical behavior that could accentuate price dynamics. Positive feedback trading is rational if investors are risk adverse and their investment horizon is short (DeLong *et al.*, 1990). Indeed, chasing market trends could be highly profitable in the short run, given that asset returns are generally positively autocorrelated in the near term (see, for example, Carhart, 1997, Cutler *et al.*, 1990, and Moskowitz *et al.*, 2012). Moreover, selling in response to price declines may, for example, prove effective in limiting portfolio losses.

Given the presence of positive feedback investors, it might be also rational for other speculators to take the opposite side of the trade. Other investors may indeed earn positive profit by trading against them, for example on the expectation of future fundamentals, rather than on the history of past returns (Cutler *et al.*, 1990; DeLong *et al.*, 1990). This (countercyclical) behavior is often seen as a stabilizing force on the market, as it may counter the deviation of prices from fundamentals and so stabilize them.

More generally, not all investors have access to the same information set, follow the same trading strategy, take the same investment horizon and have the same balance sheet structure.[9] Consequently, when prices rise (fall), someone may prefer to chase price trends in the short run by buying (selling) securities, while others can do the opposite or remain passive.

Procyclical behaviors could amplify price dynamics and, in extreme cases, push prices away from fundamentals. On the one side, unidirectional selling pressure when prices drop could accentuate price declines and trigger new divestments, leading to self-sustaining mechanisms that may involve cascading fire sales (Shleifer and Vishny, 2011). On the other side, when prices increase, chasing the trend could further inflate trade prices, leading to 'financial bubbles' and market crashes.[10]

[8] See, for example, Friedman (1953), Kyle (1985), Campbell and Kyle (1988), and DeLong *et al.* (1990).
[9] For example, different institutions holding the same securities could have different exposure to assets' illiquidity risk, depending on the maturity of their liabilities (Diamond and Rajan, 2011).
[10] Abreu and Brunnermeier (2003) predict that return-oriented investors aiming to speculate on high returns, while understanding that the market will eventually collapse, could rather prefer to keep 'riding the bubble' as it continues to

Despite the relevance of these arguments for market resilience, financial stability, and other policy outcomes, empirical evidence on who and why is buying and selling as a response to price moves has always had to cope with the availability of proper granular data to analyze investors' behavior. Future works could highly benefit from an increased availability of wider and more detailed datasets, covering the trading activity of different types of investors in many asset classes (such as, for instance, derivatives and secured money markets).[11]

A number of empirical works examines market participants' investment choices and their trading behavior under both stressed and not stressed circumstances. The analyses also question whether the different types of investors tend to act as amplifiers of price movements or, on the contrary, as market stabilizers. Several studies focus on the banking sector. Some examples are the work of Abbassi *et al.* (2016), exploring the behavior of banks that have more trading expertise with respect to other ('non-trading') banks, and the work of Hanson *et al.* (2015), examining the role of 'traditional banks' as patient fixed-income investors.[12] The empirical evidence available on the trading behavior of banks' in response to past returns is however not univocal. Abassi *et al.* (2016), for example, document that, during the global financial crisis, German banks with higher trading expertise increased their investments in the securities that experienced the biggest price drops, with the strongest impact in low-rated and long-term securities. In line with this finding, Czech and Robert-Sklar (2019) found that dealer banks investing in UK corporate bonds switched to be countercyclical during a stress episode included in their sample period (i.e. the so-called 'taper tantrum'). In contrast to these findings, Timmer (2018) found that banks could instead respond in a procyclical manner to past returns. Empirical results could however differ across studies depending on a range of factors, such as, for instance, different sample periods, country coverage, data frequency, and traded securities. For instance, security-level characteristics, such as the country and the sector of issue, the maturity, or the credit rating, may represent another source of heterogeneity in trading behavior.[13] This study finds that banks on average behave countercyclically, which is consistent with Czech and Roberts-Sklar (2019), but in contrast with Timmer (2018). Besides different sample periods and country coverage, this study takes advantage of the higher frequency available in the dataset (i.e. weekly sovereign bond transaction data), whereas Timmer (2018) is based on quarterly holdings data; another difference is that while this study focuses on government securities (and, for instance, Czech and Roberts-Sklar (2019) on the sterling corporate bond market), Timmer (2018) examines investor behavior on a broader range of fixed income securities (i.e. beyond sovereign bonds).

grow, as this generates high profits. In their model, investors face a trade-off, as those who 'get out of the market' just prior to the crash make the highest profit, while others who leave the market very early make some profit, but forgo much of the higher rate of appreciation of the bubble; those who instead stay in the market too long lose most of the capital gains that result from the bubble' appreciation. Investors' choice may rely on a range of factors, such as their risk aversion, or their information on assets' fundamentals.

[11] Closing data gaps objectives have been generally ranked top in the policy makers' agenda since the global financial crisis, for example, as part of the work to better understand, monitor and address risks posed by non-bank entities to the financial system (FSB, 2020b). For instance, transactional data on derivatives and securities financing transactions have become available in Europe and have opened up new avenues for analysis (ECB, 2019).

[12] Other studies focusing on banks' behavior are Diamond and Rajan (2011), Greenwood *et al.* (2015), Shleifer and Vishny (2011).

[13] Timmer (2018), for instance, found that while insurance companies and pension funds both act countercyclically with respect to investment grade bonds and non-investment grade bonds, their cyclical behavior can differ in magnitude across rating types.

Finally, another source of heterogeneity in trading behavior could even emerge at the within-sector level. Timmer (2018), for example, argued that better capitalized banks could act in a countercyclical fashion, as they are relatively 'less sensitive' to losses on their security holdings in the short run (while the strategy pays off at longer horizons); he found that banks with tighter capital constraints acted relatively more procyclically than others.[14] Apicella et al. (2022), while examining the investment decisions of the Italian insurance sector before and after the COVID-19 pandemic, found that during severe crisis periods the ability of insurers to act as shock absorbers is negatively correlated with their capital level: less capitalized insurers were not able to play a stabilizing role after the pandemic outbreak.

Another stream of literature is instead devoted to the non-banking sector, which is also receiving a growing interest in the light of the greater role played by these entities in government bond markets (Eren and Wooldridge, 2021). A number of empirical studies have investigated the trading behavior of investment funds and identified their response to price dynamics as procyclical. Using German data on securities holding statistics, Timmer (2018) shows that investment funds tend to respond procyclically to past returns. Czech and Roberts-Sklar (2019) document that, during times of market stress, asset managers sell corporate bonds in response to a sharp rise in yields, thus potentially amplifying price moves. Raddatz and Schmukler (2012) show that mutual funds' investment behavior tends to be procyclical: investment funds reduce their exposure to countries in bad times and increase it during good times. More recent works have documented funds' behavior during the March 2020 turmoil. Czech *et al.* (2021) highlight that, in March 2020, open-ended funds experienced the largest outflows since the global financial crisis, which forced them to sell large quantities of gilts and corporate bonds.[15] Vissing-Jorgensen (2021) documents that US Treasury sales by mutual funds in the first quarter of 2020 were large in historical terms (e.g., superior to the selling pressure experienced at the peak of the global financial crisis); funds also experienced large outflows at the time. Claessens and Lewrick (2021) analyze a sample of mutual funds registered in Luxemburg – which is home to one of the largest open-end fund industries at the global level – during the March 2020 turmoil and find that redemptions were elevated and led to procyclical asset sales that added to pressures on bond prices and liquidity conditions.

This study also contributes to the hedge funds literature. Hedge funds are highly leveraged investors that typically pursue relative value strategies (Eren and Wooldridge, 2021),[16] with credit provided by prime brokers[17] through repos and/or synthetically through the use of derivatives. Because these

[14] According to Abbassi *et al.* (2016), the capital level of banks could be used as proxy for their risk-bearing capacity; the authors argue that banks with higher capital can buy more of the securities that have larger price drops during a crisis, as higher equity capital provides buffers to absorb potential negative shocks in these riskier securities.

[15] The net corporate bond sales of the asset management sector started in late February, but significantly increased in mid-March, with a peak daily net sell volume of almost £500 million (on 16 March).

[16] Relative value strategies generally target price differences between government bonds from two different markets, specifically potential mispricing across different points along the yield curve in a single government bond market, or exploit arbitrage strategies between different market segments within the same asset class, such as cash vs futures (basis trade).

[17] Prime brokerage is a bundle of services provided by investment banks and broker-dealers to sophisticated investors, typically hedge funds, institutional investors and family offices, in exchange for a fee (Branzoli *et al.*, 2021). Prime brokers provide two main types of leverage to their clients. First, financial (or balance sheet) leverage through securities financing transactions (SFTs). Second, synthetic (or off-balance sheet) leverage, which is associated with the underwriting of derivative contracts.

strategies typically profit from tiny price differences, high leverage is necessary to make the trades worthwhile. There is evidence (see, for example, Schrimpf *et al.*, 2020, and Cunliffe, 2020) that also the hedge funds could have contributed to the March 2020 turmoil, by selling a relevant amount of government bonds, after they suffered mark-to-market losses on their portfolios (for example, for those funds trading the so-called cash-futures basis; Kruttli *et al.*, 2021) and higher funding costs (e.g. elevated margin requirements), which forced them to unwind their trading positions. Most of the works focused on the US Treasury market, albeit the same dynamics may have been at play in other sovereign markets too.[18] Divestments also reflected their degree of leverage[19] and were undertaken by the most leveraged hedge funds (Eren and Wooldridge, 2021). This paper adds to this literature by examining the trading behavior of hedge funds' and asset managers' in the context of the Italian sovereign bond market, both in 'normal' times and in periods of stress.

Less evidence is instead available on the trading behavior of other non-bank entities, such as insurance companies, pension funds and other non-financial investors (see, for example, Becker and Ivashina, 2015, and Chodorow-Reich and Ghent, 2021). A number of studies documented that life insurers and pension funds are long-term investors with stable liabilities, which generally lead them to act in a countercyclical fashion (Timmer, 2018; Czech and Roberts-Sklar, 2019; Chodorow-Reich and Ghent, 2021; de Haan and Kakes, 2011) and to rebalance their investment portfolios in favor of the higher yielding securities (which may have experienced temporary price drops). Although insurance corporations tend not to be procyclical on average, during phases of market turmoil these institutions may nevertheless exhibit flight-to-quality behavior, leading them to act in a truly procyclical fashion. For instance, some studies have documented the procyclical behavior played by the insurance sector during the sovereign debt crisis of 2011-12, both with reference to the Dutch market (Bijlsma and Vermeulen, 2016) and the euro area as a whole (Rousova and Giuzio, 2019; Della Corte and Federico, 2019). In the same vein, Apicella et al. (2022), which examined the impact of the COVID-19 crisis on Italian insurers' investment decisions, found that while insurance companies on average increase their exposure to securities whose price has fallen, their ability to weather shocks diminished after the pandemic outbreak.

This paper takes a market-wide perspective of the trading behavior of different types of investors in Italian government securities. In this respect, it is more related to works exploring investment patterns across sectors, such as, for instance, Timmer (2018), Czech and Roberts-Sklar (2019) and Della Corte and Federico (2019). In line with those studies, the present work shows that the response of different investors to past yield changes is far from homogenous, particularly under stressed circumstances. Several factors could intervene to explain this heterogeneity, as it will be further discussed in Section 5, which will illustrate the empirical findings obtained for each sector.

[18] For example, according to Czech *et al.* (2021), hedge funds sold gilts in March 2020, potentially contributing to the selling pressure in the UK sovereign bond market, albeit they found little evidence for such behaviors on a large scale.
[19] Most of the US Treasury sales by hedge funds during March 2020 were concentrated in the top decile of hedge funds by leverage (Eren and Wooldridge, 2021); these funds reduced their US Treasury exposures by $203 billion (OFR, 2020).

3. The Italian government bond market: the institutional setting

Government bonds play a pivotal role in the financial ecosystem. They represent a primary source of funding for Governments and are widely used by intermediaries and final investors to pursue a number of trading interests; they offer a fixed income stream in the form of interest payments that can be attractive for investors who are looking for stable and predictable returns; they can help market participants to diversify their portfolio, as they typically have a low correlation with other asset classes (such as stocks and commodities) and can thus help to mitigate overall portfolio risk; as a key collateral asset, they represent a fundamental source of funding for both bank and non-bank entities (particularly as markets have migrated towards secured lending); they serve as fundamental benchmark for the pricing of a wide range of other financial instruments, like corporate bonds; as highly-liquid assets, they also play a critical role in capital and liquidity regulatory requirements for a number of financial institutions, such as banks and money market funds.

Sovereign bonds are traded by a wide range of investors, on a multitude of trading venues and over-the-counter (OTC). Trading is facilitated by the presence of PDs.[20] These are primary financial institutions, which are appointed by sovereign issuers to participate in Treasury auctions and to promote and distribute government securities among domestic and international investors (AFME, 2020). Their role is helpful in supporting the functioning and development of government bond markets, which accrues several benefits for both debt issuers and final investors. They represent an essential channel of interaction between the primary market, where they devote capital to the underwriting activity, and the secondary market, where they typically act as critical liquidity providers (for instance, they may operate as market makers across various venues, by providing bid-offer prices on a continuous basis). By sustaining market liquidity conditions, they reduce the cost of borrowing for sovereign issuers, enhance the price discovery processes – which leads to more informative prices and greater market efficiency – and lower transaction costs for final investors.

Their role is also helpful to broaden the investor base, by reducing market participants' search costs and by enriching the range and variety of final investors. A relevant portion of their trading activity takes place in the so-called dealer-to-customer segment, where PDs provide liquidity to end investors, such as mutual funds, insurance companies and pension funds. On this market segment, they play a key intermediation role, namely, by buying and selling securities from/to customers to meet customers' trading needs (Fleming *et al*., 2016). By matching bonds' supply and demand, PDs facilitate the transfer of risky exposure among final investors, which is functional to a more efficient allocation of their investment portfolio. To accommodate clients' willingness to trade, PDs accumulate temporary inventories (i.e. by buying and selling securities for their own accounts), which are both risky and costly.[21] PDs could access interdealer markets (and trade among themselves) to manage inventory risk (Reiss and Werner, 1998).

Italian sovereign bonds are issued by the Treasury Department of the Ministry of Economy and Finance (MEF) on behalf of the Italian government.[22] PDs in Italian government securities – so-called

[20] Fleming *et al*. (2016) and Benos and Zikes (2018) explore the role of PDs in the US and UK government bond market, respectively; but the role of dealers is pivotal for the functioning of other markets too, such as corporate bonds (Czech and Roberts-Sklar, 2019) and equities (Benediktsdottir, 2006).
[21] The market-making business is a balance-sheet intensive activity and PDs should finance their trading positions that are not closed by the end of the trading day (and carried out overnight).
[22] The Italian Department of the Treasury issues government securities and manages central government liabilities.

Specialists – are banks or investment firms that meet a number of requirements defined by the Italian Treasury. Obligations for PDs are widely envisaged by sovereign issuers and may vary from country to country (EC, 2021). In Italy, these criteria are stated in a number of ministerial decrees, and address: PDs' participation to primary auctions (e.g. with a subscription of a share greater than 3% of the total amount issued); their activity on the secondary market, where they should ensure on a continuous time basis sound liquidity conditions on relevant trading venues (for instance, they should operate as market makers on the MTS market, which is a regulated interdealer market); their organizational structure; and their capital base.[23] The Italian Treasury also conducts an overall assessment of Specialists' performance on an annual basis,[24] which is based on an ongoing monitoring of their individual performances; the Bank of Italy also takes part to the evaluation process. By meeting the requirements, the Specialists enjoy some privileges, among which is the exclusive access to reserved re-openings of issued securities and the possibility to be selected to manage syndicated issuances.[25] At the end of 2022, 19 financial institutions qualified as Specialists in Italian Government Securities.[26]

4. Empirical analysis: data and methodology

4.1 Data

This study exploits PDs' transactional data to explore the buying and selling behavior of different types of investors. Each PD reports[27] all transactions in Italian government bonds carried out: (*a*) on the primary and secondary markets; (*b*) on electronic trading platforms or OTC; (*c*) with clients (in the dealer-to-customer segment) or other PDs (in the interdealer segment). This dataset constitutes the primary data source used in this study. The reporting scheme includes information regarding (*1*) the traded security (ISIN), (*2*) the trade date, (*3*) the sign of the transaction (i.e., whether it is a purchase or a sale transaction), (*4*) the traded quantity (at the bond par value), (*5*) the country of the counterparty and (*6*) its sector – namely, if it is a bank, an asset manager, a hedge fund, an insurance company, a pension fund, or a non-financial entity, like corporate and retail investors. Transaction prices are not reported.

The dataset thus covers all trades in Italian sovereign bonds by which at least one of the two counterparties is a PD, providing an extensive, albeit not full, picture of the market. As this paper

[23] For example, PDs should be in possession of a net regulatory capital equal to at least €50 million, of a suitable organizational structure and of a satisfactory knowledge of the functioning of the market from a normative, technical and organizational point of view; their contribution to the efficient functioning of the secondary market should be undertaken through a continuous and widespread (i.e. on a large basket of securities) activity of quotation and trading on both cash and repo segments. These requirements are stated in the so-called Specialists Decree, published on 11 November 2011, and the so-called Specialists Evaluation Criteria Decree, which are both available on the MEF website.

[24] The assessment relies on qualitative and quantitative indicators concerning four main areas: (i) primary market, (ii) secondary market (included repo), (iii) buybacks - exchange transactions, and (iv) organizational structure. If the Italian Treasury verifies that a Specialist is not complaint with the requirements, the Specialist loses its status (Specialist Decree, art.10; see footnote 23 for further details).

[25] See articles 4 and 9 of Specialists Decree (see footnote 23).

[26] The list of Specialists in Italian government bonds is available on the MEF website. The number of Specialists has slightly decreased over the sample period, passing from 20 (in January 2014) to 16 operators (December 2020). The pattern has been common to many other sovereign bond markets (AFME, 2021).

[27] The reporting scheme is consolidated at the European level. See Euro Market Activity Report (EMAR) for more details.

intends to explore the trading behavior of end investors, it focuses in the dealer-to-customer market, where PDs trade with their clients (see Section 3); trades conducted among PDs in the interdealer segment are not considered in this study. To examine the investment behavior of the different sectors, the following metric – hereinafter dubbed 'net buy metric' – is used:

$$NetBuy_{i,t} = Buy_{i,t} - Sell_{i,t} ,$$

where $Buy_{i,t}$ ($Sell_{i,t}$) refers to the amount of Italian securities bought (sold) by sector i in week t and expressed in billions of euro. This measure is intended to explore whether an entire sector is an overall net buyer, or net seller, of the Italian government securities in a given week. The trading activity is reported at the nominal amount, therefore the net purchases indicator does not reflect valuation effects related to changes in bond prices, but only the difference between actual sales and purchases made by market participants.

One feature of this dataset is that it allows to analyze investment flows in a relatively high frequency setting, particularly when compared to studies based on balance sheet figures, which are typically available at lower frequencies, e.g. on a monthly or quarterly basis. The higher frequency makes the metric more reactive to changes in investors' behavior in response to market dynamics, which is remarkable given that market shocks could have different lengths and be very rapid. For instance, the two episodes of more acute financial stress included in the dataset – on May 2018 and March 2020 – were particularly intense; in both cases, the period of greater market stress lasted few weeks, before liquidity conditions started to recover (Bank of Italy, 2018b). In these circumstances, low sampling frequencies may capture market dynamics only partially and risk to underestimate investors' response to shocks: if the sampling frequency is particularly low, it is likely that after the shock the market may, or at least start to, recover during the same observation period. For example, in response to the COVID-19 crisis in March 2020, monetary and fiscal authorities provided a massive and prompt response to restore market liquidity. The reaction of the market was fast too, and market quality quickly recovered afterwards.

Another novelty of the dataset is that it provides a sector breakdown for each counterparty in a trade, regardless of whether it is a domestic or a foreign entity. In official monthly statistics, a sector-level breakdown is available for resident investors only.[28] This study could thus unveil novel evidence on the trading activity conducted by foreign investors in Italian sovereign securities, which is substantial. However, one drawback of the dataset is that counterparties cannot be distinguished at a finer level than the macro sector to which they belong. For this reason, the analysis cannot exploit within-sector variation in investors' responses to past yield changes.[29]

[28] Official statistics based on balance of payments and the international investment position data do not allow a sector-level breakdown for foreign holders of Italian sovereign bonds. Della Corte and Federico (2016), by combining the information available in other, more recent, data sources, i.e., the Eurosystem's Securities Holdings Statistics (SHS) and the IMF's Coordinated Portfolio Investment Survey (CPIS), extended the sector-level breakdown to non-resident euro-area investors. According to their estimates, at the end of 2015, roughly 60 per cent of foreign holdings in Italian government securities were held by entities domiciled in the euro area.

[29] For example, within the asset manager sector, it is not possible to distinguish between different types of investment funds (e.g. whether they are open-end or close-end), neither to control for entity-level characteristics (like firm size, etc.).

4.2 Descriptive statistics

Table 1 provides summary statistics on trading activity by dealers in the dealer-to-customer market, broken down by institutional sector and country of residence of counterparties. Over the sample period, the weekly average trading volume was around €52 billion and has increased slightly in recent years. Most of the dealer trading activity is attributable to the non-banking sector and, in particular, to the investment fund industry. In the period under exam, asset managers and hedge funds[30] accounted for almost 60 per cent of the total trading activity (43 and 15 per cent, respectively). Their market share has grown considerably, reaching 67 per cent in 2019 (in 2014 it was around 50 per cent); the increase has been largely driven by the growing activity of the hedge fund sector and is another illustration of the greater variety of non-bank financial institutions that have become increasingly present in government bond markets over the last decade, alongside banks (see, for instance, Eren and Wooldridge, 2021). The increasing activity of hedge funds may also reflect the great expansion of the sector globally that has been observed in recent years.[31]

Non-dealer banks have been the counterpart for around 36 per cent of the transactions over the sample period, while the share of insurance companies and pension funds have been far more modest (around 3 per cent). According to securities holding statistics data, insurance companies and pension funds feature among the greatest security holders of the Italian government debt. The amount of government securities held by insurance companies and pension funds headquartered in the euro-area is indeed material (Bank of Italy, 2021; Della Corte and Federico, 2016) and, for instance, comparable[32] with bond holdings of the banking sector. Drawing on transactional data, insurance companies and pension funds have instead a much lower market share, particularly when compared to the banking sector (of which the share shown in Table 1 does not take into account all the trading activity carried out by banks[33]). Despite holding a significant amount of securities, insurance companies and pension funds are among the less active traders and seem to act more like 'patient'[34] fixed-income investors. The market share of other non-financial entities, such as corporates and retail investors, is quite modest too.

In contrast, investment funds are both relevant bond-holders and very active traders;[35] they are also to a large extent domiciled abroad. As shown in Table 1, a relevant portion of the trading activity is indeed conducted by non-resident investors, which accounts for about two thirds of the total turnover over the 2014-2020 sample period; also, more than 60 per cent of the foreign activity has been undertaken by entities outside the euro area (as, for example, by asset managers and hedge funds).

[30] PDs report in a separate manner trades conducted with asset managers, which includes asset management companies, mutual funds, real estate investment companies, and foundations, and trades with hedge funds, which are generally defined as speculative investment funds, including leverage funds.
[31] According to the FSB (2020b), hedge funds held more than $5.6 trillion of assets under management globally in 2019, from about $3.2 trillion in 2015; around 80 per cent of reported global hedge fund assets are in the Cayman Islands. In Europe, the hedge fund market is small, with assets under management accounting for around 3 per cent of the overall European fund industry (ESRB, 2020).
[32] Della Corte and Federico (2016) estimate that, at the euro-area level, banks and all insurance corporations and pension funds held 13.9 and 11.5 per cent of foreign holdings of Italian government debt, at the end of 2015, respectively.
[33] Part of the banks' trading activity takes place in the interdealer segment, which is not considered/covered in this study.
[34] In the spirit of Hanson *et al.* (2015).
[35] Della Corte and Federico (2016) estimate that, at the end of 2015, the largest holders of Italian debt securities were 'other financial intermediaries', which predominantly include non-money market funds.

4.3 Methodology: the baseline model

To investigate whether institutions act procyclically or countercyclically depending on past yield moves, their trading behavior has been explored through the following (baseline) specification, which builds on the work of Timmer (2018) and Czech and Roberts-Sklar (2019):

$$NetBuy_{i,t} = \sum_{s=1}^{5} \beta_s * Sector_s^i * \Delta Yield_{t-1} + \cdots$$
$$+\rho\, NetBuy_{i,t-1} + \gamma\, NetIssuance_t + \theta\, Controls_{t-1} + \alpha_i + \varepsilon_{i,t} \quad (1)$$

Consistent with these studies, a panel regression has been adopted to examine the impact of a change in yields on the buying and selling behavior of various market participants. To compare the response of different investor types, it has been added a set of indicator variables that identify specific sectors; the analysis distinguishes between five sectors: banks, insurance companies and pension funds, asset managers, hedge funds and a sector composed by non-financial entities, i.e. including corporate and retail investors. These variables are then interacted with past yield changes to examine whether each type of investor trades more or less, pro or countercyclically, to yield moves (with respect to others). $NetBuy_{i,t}$ are the net purchases of Italian government bonds by sector i in the week t (as defined in Section 4). $Sector_s^i$ are the above-mentioned indicator variables (one for each sector), which have been added to the specification to compare the magnitudes of the effect of yield changes across the different investor types (each variable equals one when $i = s$ and zero otherwise). $\Delta Yield_{t-1}$ is the weekly[36] change in the ten-year government bond yield and is lagged by one week to avoid endogeneity; it is the variable of interest: when interacted with $Sector_s^i$, it provides a measure of the sensitivity of investment flows to past yield moves (for each sector). $NetIssuance_t$ reports the amount issued on the primary market[37] and is added to the specification as control variable, as investors' decisions and their trading behavior could be affected by Treasury's issuances, e.g. reflecting rollover activity.[38] $Controls_{t-1}$ includes a number of market variables,[39] all measured in first differences and lagged by one week to avoid endogeneity: the VIX volatility index, the 2-10 year term spread (a measure of the yield curve slope, which captures interest rates movements other than

[36] Following Czech and Roberts-Sklar (2019), this study takes advantage of the higher frequency available in the dataset by estimating all regressions at the weekly. The weekly frequency is helpful to have a balance between the need to capture slower moving investors, while preserving a sufficiently high observation frequency.

[37] The amounts issued on the primary market reflect the primary commitment of sovereign issuers to finance the government borrowing needs and are treated as exogenous with respect to market participants' trading behavior and their risk preferences (non-observable), in line with other studies (see, for instance, Fleming and Rosenberg, 2008); treasury auctions on the primary market also typically follow a pre-scheduled calendar in order to be highly 'regular and predictable' , which explicitly seek to minimize strategic investment behavior based on private information (see, e.g., Garbade, 2007), besides reducing costs to taxpayers. The variable includes the amounts issued (at nominal value, in billions of euro) on primary auctions (first and subsequent tranches) minus redemptions (during the same week); the so-called 'reopening auctions' (which typically take place the day following the ordinary auction and reserved to Specialists) and syndications (commonly adopted for longer-term securities) are also considered. Results are robust to the choice to include, or not, different variables to measure primary market activity (see Section 6).

[38] Treasury's auctions typically take place in the week in which the securities mature in order to facilitate the rollover of trading positions.

[39] Data on (end-of-day closing) bond yields, sovereign CDS spreads, VIX index, Euribor rates and other publicly available information (such as total issuance and bond outstanding) are from Refinitiv.

'parallel shifts'), and the 6-month Euribor rate (adjusted for changes in the 10-year yield).[40] Finally, the specification also includes a dummy variable that identifies quarter-ends and sector fixed effects (to control for time-invariant heterogeneity in the cross-section of sectors).

4.4 Methodology: stress episodes

Since investors may modify their behavior in times of severe market stress, the model has been extended to capture possible nonlinearities in the relationship between trading activity and past yield changes across different investor types. An indicator variable is introduced to identify periods of financial turmoil and is interacted with the lagged changes in yields. The empirical specification is as follows:

$$NetBuy_{i,t} = \sum_{s=1}^{5} (\beta_s + \pi_s\, Stress_{t-1}) * Sector_s^i * \Delta Yield_{t-1} + \cdots$$
$$+\rho\, NetBuy_{i,t-1} + \gamma\, NetIssuace_t + \theta\, Controls_{t-1} + \alpha_i + \varepsilon_{i,t} \quad (2)$$

where $Stress_{t-1}$ is a dummy variable, which is equal to one if the week is among those experiencing higher market stress over the sample period (and zero otherwise). Two approaches are followed to identify stress periods. In one case (Model 2a), the indicator variable is set equal to one in two parts of the sample period characterized by severe market turbulence: the Italian market turmoil in May-June 2018 and the outbreak of the COVID-19 pandemic in March 2020. In both crises, market liquidity conditions on the Italian sovereign bond market deteriorated significantly (Bank of Italy, 2018b; 2020b). In each case, the indicator variable selects one-month time windows centered on the two most tense days of the crisis, i.e. 29 May 2018 and 12 March 2020, respectively.[41] Alternatively (Model 2b), periods of extreme stress in the sovereign debt market are identified through the prices of the Italian 5-year sovereign credit default swaps (CDS); in particular, the indicator variable is set equal to one when the weekly first difference of the Italian CDS spread is in the top decile of its sample distribution (that is, it is higher than 13 basis points, according to its distribution in the seven-year 2014-2020).[42]

[40] To avoid multi collinearity, I first regress the weekly changes in the 6-month Euribor rate on those of the ten-year bond yield and then I use the residuals of this regression in the panel specification.

[41] On May 28, 2018, the President of the Italian Republic entrusted a senior figure with the task of forming a new government; soon afterwards, two of the three political parties that had received the highest shares of votes in the March 2018 general election announced that they would not support such government. This resulted in a steep increase in the risk of new and highly uncertain elections. On 11 March 2020, the World Health Organisation (WHO) officially declared the COVID-19 outbreak a pandemic. At approximately the same time, a number of countries announced strict containment measures involving lockdowns, border closings and quarantine requirements; extreme investors behavior (e.g., 'dash for cash') and sharp market movements emerged across global financial markets (FSB, 2020a).

[42] Using different percentiles (e.g., 1st, 5th, 15th) gives comparable results.

5. Results

The results are shown in Table 2. Model column (1) shows the estimates of the sector-specific coefficients β_s in Equation (1) that relate to the interaction between the sector indicator variables and the lagged change in yields (i.e. '$Sector_i^s * \Delta Yield_{t-1}$'), along with the estimates of the other coefficients. For each sector and without distinguishing between stress episodes, the relative β coefficient measures the sensitivity of that sector's net purchases of Italian government bonds to an increase in yields over the past week and thereby provides an indication on whether that sector tends to act procyclically or countercyclically. Model column (2a) shows the estimates of the sector-specific coefficients β_s and π_s in equation (2) when stress periods are identified with two one-month time windows centered on 29 May 2018 and 12 March 2020. The additional effect of yield changes in stressed conditions is measured by parameter π_s. Similarly, Model column (2b) shows the estimates of the sectoral coefficients β_s and π_s in equation (2) when stress periods are identified with the dummy for very high sovereign CDS premia.

Figure 1 provides another metric of investor heterogeneity, namely, expected net purchases (purchases minus sales, in billions of euros) of Italian government bonds by investor type following a 10 basis point increase in yields the previous week, both under normal and stressed circumstances.

Table 2 and Figure 1 clearly show that the reaction of net investment flows to past changes in yields is heterogeneous across sectors and diverges further during times of greater market stress. When bond yields rise, asset managers and hedge funds on average sell securities the following week, while banks do not and instead tend to react countercyclically to past yield moves; insurance companies and pension funds tend not to significantly change their trading behavior, even under stressed conditions. In the following paragraphs, the empirical findings obtained for each sector are discussed.

5.1 Investment funds

Model (1) estimates show that the investment fund sector tends to react procyclically to price moves: the week after a 10 basis points rise in bond yields, asset managers and hedge funds on average make net sales by 200 and 160 millions of euro, respectively. Under stressed market conditions, their procyclical behavior further intensifies and net sales can even triple, as evidenced by the estimates from Models (2a) and (2b).

These results are consistent with other empirical evidence (see Section 2). In the literature, different explanations have been advanced that can account for the procyclical behavior by fund managers.

Above all, mutual funds are exposed to injections and redemptions from investors and their performance is subject to close monitoring. Flows into and out of mutual funds are indeed strongly related to their past performance, previous research shows (Chevalier and Ellison, 1997; Morris and Shin, 2015; Chen *et al.*, 2010; Feroli *et al.*, 2014). Mutual funds' performance is also measured periodically, typically on a monthly or quarterly basis (Timmer, 2018). This short-term monitoring imposes constrains on fund managers and limits their ability to take investment positions that may turn to be profitable only in the long run. Fund managers are also concerned about their relative performance with respect to their peers. As a result, benchmarking and relative performance mechanisms can lead fund managers to reduce the investment horizon and focus on short-term returns (Signorini, 2019). In the short run, it is also rational for funds' managers to pursue so called positive

feedback (or momentum) strategies – i.e. chasing market trends by buying securities when price rise (and sell them when prices fall) –, since assets' prices are generally positively autocorrelated at short(er) time horizons (Cutler *et al.*, 1990; Moskowitz *et al.*, 2012; see Section 2 for reference).

In addition, studies examining the relationship between funds' performances and investors' inflows also show that the flow-to-performance relation could be asymmetric, that is outflows from investors are more sensitive to bad performance, than inflows to good performance (see, for instance, Goldstein *et al.*, 2017). Asset managers and, particularly, open-end mutual funds allow investors to add or redeem their shares at very short notice (even at a daily basis; Claessens and Lewrick, 2021), which exposes these entities to liquidity risks. Mutual funds' procyclical behavior during crisis episodes can indeed reflect the need, for fund managers, to sell assets to meet redemptions (Goldstein *et al.*, 2017; Jiang *et al.*, 2020). Timmer (2018), for example, has documented that mutual funds that face more outflows act relatively more procyclically with respect to other funds. Investors' redemptions may also result to be self-fulfilling, as investors might have incentives to redeem their shares just because they expect other investors will do so, thus exposing mutual funds to 'run-like' risks (Goldstein *et al.*, 2017).[43] Hedge funds are exposed to redemption risks as well (Klaus and Rzepkowski, 2009), despite they usually foresee a number of restrictions to redeem shares, in contrast to open-end mutual funds providing daily liquidity to investors (ECB, 2007). Large investor redemptions can also affect hedge funds' performance in the medium term, as fund managers have to maintain a large cash position to mitigate the impact of withdrawals (see, for example, Nanda *et al.*, 2000).

The procyclical behavior of the investment fund sector may also rely on other factors. In the case of hedge funds, for instance, it is often called into question their level of leverage, which is typically higher than other non-bank financial institutions (Eren *et al.*, 2021), as well as their reliance on short-term financing, which expose these entities to liquidity risks, too (Chan *et al.*, 2005). In response to adverse shocks or if credit conditions tighten, hedge funds could be forced to sell assets to reduce their leverage, even if market conditions are not favorable (Ewerhart and Valla, 2007). Exiting positions may result in negative feedback loops à la Brunnermeier and Pedersen (2009), as the (quickly) unwinding of trading positions generates selling pressures that depress prices and increase market volatility, potentially leading to higher funding costs for hedge funds (e.g. due to higher margins requested by prime brokers) and a consequent need to deleverage; a downward price spiral of the kind has been extensively documented in the US Treasury market during the March 2020 turmoil (see Section 2).

Concerning mutual funds, Raddatz and Schmukler (2012) emphasize that funds' investments are quantitatively driven not only by injections and redemptions of the underlying investors, but also by managerial changes in country weights and cash.[44] Shek *et al.* (2018) found that bond sales may result from 'discretionary sales' by fund managers, above those implied by redemptions from ultimate investors. Huang *et al.* (2020) argued that government securities play a relevant role in liquidity

[43] Redemptions are generally honored at fair value. Given that fund managers may be forced to sell assets at reduced prices to meet investor redemptions, alert investors could seek to anticipate other investors' redemptions to exit first from their investment, at favorable prices; first-mover advantage in fund redemptions is examined in a number of studies (see, for example, Aramonte *et al.*, 2021, and Claessens and Lewrick, 2021).

[44] The authors argue it is not the case that investors drive all the action and managers act as passive agents, allocating the injections they receive into countries according to some rough fixed weights. Neither ultimate investors nor fund managers are contrarian investors and both respond to country returns and crises and adjust their investments substantially, e.g., generating large reallocations during crises.

management practices (e.g., to meet investor' redemptions) adopted by fund managers, and showed that in times of stress mutual funds could first sell more liquid government securities to generate cash, thus contributing to pressures in those markets.

5.2 Banks

The results obtained for the banking sector show that, under both normal and stressed circumstances, banks, on average, do not procyclically react to past yield changes. In contrast, they do increase bond purchases. During episodes of market stress, net buys are even higher.

These findings provide additional evidence, in a relatively high frequency setting, on the trading behavior of the banking sector in fixed-income markets. They are consistent with previous results showing that banks can act as countercyclical investors in response to price dynamics, even under stressed circumstances, albeit empirical evidence is not unique[45] and might reflect a range of factors (see Section 2).

A first possible explanation of banks' contrarian behavior is that they try to pursue profitability over the medium term. Fixed-income securities offering higher yields are more attractive for 'more patient' investors, like banks, that opt to buy and hold them to maturity. For banks that are willing and able to hold bonds to maturity on their balance sheets, the higher yields offered by securities during periods of declining prices have a positive impact on their profitability. Shleifer and Vishny (2010) have shown that, during crises, the low(er) prices of temporarily distressed assets allow to achieve higher returns, which can be also superior to other banking businesses, like traditional lending. Banks may therefore choose to pursue the most profitable investment. For example, with reference to Italian banks, Angelini *et al.* (2014) shows that, after the sovereign debt crisis in 2011-12, the (risk-adjusted) returns obtained from bond portfolios (consisting largely of Italian sovereign bonds) were higher than those obtained on bank loans and helped support banks' income statements. More generally, as noted in Section 2, countercyclical investors could profit from buying bonds when prices fall (yields rise), and selling them afterwards, following a price increase. Albeit suffering losses in the short run, this investment strategy may pay off in the medium term, when prices begin to recover. Diamond and Rajan (2011), for example, predict that banks load up on liquidity risk in order to profit from high returns when the depressed value of illiquid assets recovers after crisis periods. For instance, Timmer (2018) has documented that investors that kept (or even kept buying) debt securities during the 2010-12 sovereign debt crisis, temporarily suffered losses in the short run, but consistently outperformed other investors in the medium term that instead were selling bonds at the time.

A related explanation is that banks can rely on stable sources of funding and for this reason are less exposed to liquidity risks, which allows them to pursue investment strategies over longer time horizons. As predicted in some studies (Hanson *et al.*, 2015; Diamond and Rajan, 2011), banks can create money-like claims that rely on deposit insurance, which allows bank depositors to remain 'sleepy'; hence banks are less sensitive to market moves in the short run and can behave as 'patient' fixed-income investors, i.e. by holding illiquid fixed-income assets to maturity and/or even becoming

[45] As discussed in Section 2, security-level characteristics, within-sector differences, structure of the data (such as data frequency) and sample period are potential sources of heterogeneity.

'illiquidity seekers' during stress events, thus playing a market stabilization role when compared to other non-bank entities (Hanson *et al.*, 2015).

A second explanation is more specific to banks in times of stress. Sovereign debtors and their national banking systems are closely linked by a number of channels, which can be both direct and indirect.[46] Given this and the "pervasive" nature of sovereign risk, when the sovereign is in trouble, so is the entire domestic economy. In the event of a default on domestic sovereign debt, banks would be in serious difficulty – not only because of the holdings of domestic government debt – and may feel that by investing in sovereign debt they would incur in little, if any, additional risk.

Summing up, while in normal (non crisis) times banks tend to reduce their exposure to domestic sovereign bonds, this may not be the case in crisis periods, when banks can have a comparative advantage at holding fixed-income assets, which may experience temporary price dislocations but at the same time have only modest fundamental risk (Hanson *et al.*, 2015).

5.3 Other Non-Bank entities

This study also presents evidence regarding the trading behavior of insurance companies, pension funds and other non-financial institutions in response to past yield changes. The share of Italian debt held by these sectors is material (see Section 2).

The literature suggests these entities act as 'passive investors' (in the spirit of DeLong *et al.*, 1990), pursuing 'buy-and-hold' portfolio strategies over long-term investment horizons. Chodorow-Reich and Ghent (2021) depict insurance companies as 'asset insulators', i.e. institutions with stable, long-term liabilities that can ride out transitory dislocations in market prices. The liability side of insurance companies and pension funds is indeed recognized as relatively more stable with respect to other types of investors, which enables them to act in a countercyclical fashion and to absorb losses in the short-run (Timmer, 2018).

Consistent with these predictions, the results in this study show that the response of insurance companies and pension funds to past yield changes are neither economically, nor statistically significant (Figure 1); their response to past change in yields looks rather modest, especially in comparison with banks and investment funds.

During stressed market conditions, their trading behavior seems to become slightly procyclical, which is also in line with other findings in the literature. For instance, Bijlsma and Vermeulen (2016), Rousova and Giuzio (2019) and Apicella et al. (2022; see Section 2) found that during particularly turbulent times insurance companies may exhibit flight-to-quality behavior or be less able to act as shock absorber, arguably as the abrupt fall of asset prices might reduce insurers' balance sheet capacity to withstand short-term losses on their security holdings. However, in the estimates shown in Table 2 and Figure 1 the coefficients on the interaction between the crisis dummies and the change in yields are barely significant.

[46] For an extensive review about the close interlinkages through which sovereign risk affects banking risk, see Angelini *et al.* (2014). In particular, beyond direct exposure, banks' vulnerability to the domestic sovereign is also due to indirect channels, such as loans to domestic businesses and households (the quality of which may seriously deteriorate in times of sovereign stress) and the cost of funding.

Finally, the results obtained for the non-financial sector, including corporate and retail investors, are also not economically sizeable, albeit statistically significant. The overall effect points to a slightly countercyclical behavior; however, in times of crisis this contrarian behavior disappears, as the non-financial sector apparently follows the crowd.[47] These findings are in line with some evidences available for the non-financial sector, by which these entities can keep their overall exposure mostly unchanged over time, even during crisis periods (Della Corte and Federico, 2019).[48]

6. Robustness

This study explores the general impact of a change in yield on the trading activity of different types of investors, while controlling for a range of factors. To assess the robustness of the above results, a series of alternative estimates was conducted. The main findings are summarized in Table 3. Results turn out to be robust to: (i) various specifications and choices of specific control variables (see, for instance, columns (2)-(4) and (6), where the macroeconomic variables are not included in the specification); (ii) the inclusion of other lags (beyond the first) of the change in yields (columns (12)-(14));[49] (iii) the choice of different variables to measure activity on the primary market (for example, if gross issuances are considered at the place of net issuances; see columns (8)-(11));[50] (iv) the inclusion of a control variable, measuring, for each week, the total number of PDs, which has slightly changed[51] over the sample period (column (7) shows that the results remain mostly unchanged and the variable is not statistically significant); (v) the choice of different percentiles (e.g., 1st, 5th, 15th) to identify stress episodes in Model (2b).[52]

Finally, another concern is the possibility that the results are biased by the inclusion of a lag of the dependent variable (LDV). In the baseline regression it has been chosen to include an LDV to account for possible persistent patterns in the net buy variable,[53] given that end investors can spread net purchases over time (while implementing their trading decisions) so as they seek to reduce the market impact of their trades. However, it is widely recognized that estimating a dynamic panel equation (i.e. with an LDV) through OLS can result in biased estimates if the number of 'individuals' is high and the time dimension of the panel is 'small' (Nickell, 1981). While recognizing this is not the case in this study – where the time dimension is indeed large and the application of the 'within-groups'

[47] The results of additional regressions conducted for robustness (see Section 6), not reported here for brevity, showed that, for non-financial investors, the coefficients on the interaction terms with the crisis dummies are in some cases not statistically different from zero.
[48] Lanotte *et al.* (2016) argue that in times of 'crisis', households – unlike domestic financial intermediaries – may have neither the resources nor the ability to behave in a contrarian way. Angelini *et al.* (2014) document that in the 2008-2012 period, government bond holdings in Italian securities (computed as a share of total financial assets) increased for all the main Italian institutional sectors (including non-financial corporations), except households.
[49] Notably, the coefficients associated to the first lag remain both significant and pretty stable, even while adopting less parsimonious specifications, and up to three lags of the yield variable are added to the specification; for certain types of investors, the coefficients on the change in yields remain (statistically) significant for more than one week (and the sign of the coefficient can also remain unchanged across weeks). By adding more lagged changes in bond yields seems not to materially increase the explanatory power of the model.
[50] Both net and gross issuances are highly significant across various specifications; if they are excluded from the regressions, there is a reduction in the explanatory power of the model.
[51] See footnote 26.
[52] These results are not reported for the sake of brevity and are available upon request.
[53] Not including an LDV can lead to biased estimates due to an omitted variable.

estimator should result in unbiased estimates (see, for instance, Hall and Urga (2000) for a discussion of the topic)[54] – Table 3 shows that the results are basically unchanged (see, for instance, columns (4)-(6) and (10)-(14)) when the LDV is excluded from regressions (in line with specifications adopted in Timmer (2018) and Czech and Roberts-Sklar (2019)).

7. Conclusions

Using detailed data on PDs' transactions, this study explores the trading behavior of different types of investors in Italian government bonds. The analysis compares their responses to past yield changes, during normal and stressed circumstances, and unveils novel evidence on the relevant role played in government bond markets by banks and non-bank investors.

The non-banking sector has considerably grown over the last decade and its relevance for the real economy and financial stability has consequently increased. Non-bank investors are a very heterogeneous set of players, with differences in business models, balance sheet structure, governance aspects, and regulatory frameworks, within and across jurisdictions. Having a wider and more diverse investor base is in principle a very welcome development. However, as highlighted once again by the March 2020 turmoil, buy-side investors that are highly leveraged, or that face short-term liabilities, could procyclically respond to market dynamics, seeking liquidity just when it is most needed, and thus contributing to market turmoil (FSB, 2020a). In contrast, long-term institutional investors, such as pension funds and insurance companies, can be less reactive to transient fluctuations in the market value of assets and more able to lean against the wind, given their relatively more stable liability side and source of funding. The results presented in this study clearly highlight also banks' tendency to play a contrarian role in the domestic government bond market, in the light of the strong relationship between sovereign debtors and their national banking systems.

All in all, market resilience hinges on the size and diversity of the investor base. Well-functioning markets should allow timely and efficient market access to participants who wish to buy or sell securities, even during periods of heightened financial stress (Markets Committee, 2019). This study documents that the response of different investor types to past price dynamics is heterogeneous, but also prone to procyclicality. Any measures that can counteract procyclical behavior by investors under market stress and strengthen contrarian strategies are worth being explored.

[54] Nickell (1981) derives a formula for the bias and shows that the bias approaches zero when the time dimension approaches infinity.

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Table 1

Trades by primary dealers in the dealer-to-customer segment of the Italian government bond market

Summary statistics on the trading activity in Italian government bonds carried out by primary dealers in the dealer-to-customer segment. Data are broken down by country of residency and sector of their counterparties, i.e., if it is a bank, an asset manager,[55] a hedge fund, an insurance company, a pension fund, or a non-financial entity. The dataset runs from January 2014 to December 2020. Trading activity is reported at nominal values. 'Total turnover' refers to the average gross trading volume in the Italian sovereign bond market, per week, in billions of euro. The first 7 columns refer to individual years, while the 8th column shows the figures for the entire sample; the last three columns provide a geographical breakdown by the country of residency of the counterparties, i.e. among resident and foreign investors that are located inside or outside the euro area.

Turnover	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**Full Sample**	**IT**	**EA**	**RoW**
Total (per week in € billion)	59.3	48.4	42.7	49.7	50.7	51.1	53.0	51.8	17.6	12.7	21.4
by sector:											
Non-Dealer Banks	25.4	18.3	16.2	15.9	15.4	14.3	20.1	18.5	10.6	5.4	2.5
Non-Financials	3.0	1.8	2.2	2.5	1.3	1.2	0.9	1.8	1.0	0.5	0.3
Asset managers	24.4	22.9	19.0	21.9	23.3	23.6	22.1	22.3	5.5	6.2	10.6
Hedge funds	4.9	3.9	3.8	7.9	9.1	10.5	8.2	7.8	0.0	0.2	7.6
Insurance and pension funds	1.6	1.5	1.5	1.4	1.6	1.5	1.5	1.4	0.5	0.5	0.4
by sector:											
Non-Dealer Banks	43%	38%	38%	32%	30%	28%	38%	36%	57%	29%	14%
Non-Financials	5%	4%	5%	5%	3%	2%	2%	3%	56%	26%	18%
Asset managers	41%	47%	44%	44%	46%	46%	42%	43%	25%	28%	48%
Hedge funds	8%	8%	9%	16%	18%	21%	16%	15%	0%	3%	97%
Insurance and pension funds	3%	3%	3%	3%	3%	3%	3%	3%	36%	36%	28%

[55] Asset managers include mutual funds, asset management companies, real estate investment companies, and foundations, according to the reporting scheme (see Section 4), while hedge funds are defined as speculative investment funds, including leverage funds.

Table 2

The interest-rate sensitivity of the net purchases of Italian government bonds by type of investor

The dependent variable $NetBuy_{i,t}$ is the difference between the purchases and sales of Italian government bonds that counterparties belonging to sector i carried out in week t with primary dealers. The sample period runs from January 2014 to December 2020. '$\Delta Yield_{t-1}$' is the weekly change in the 10-year Italian government bond yield, lagged by one week. For each sector i, the variable '$Sector_s{}^i$' is an indicator variable that is set equal to one when $i = s$, and is equal to zero otherwise. '$NetIssuances_t$' is the amount of bonds issued on the primary market (at the nominal value, in billions of euro) minus redemptions. 'ΔVIX', 'ΔEuribor 6M' and 'ΔTermSpread' are the lagged first differences of the CBOE's VIX index, the adjusted 6-month Euribor rate (residuals of a regression of changes in 6-month Euribor rates on changes in 10-year government bond yields, to avoid multi collinearity) and the yield spread between 10-year and 2-year Italian government bonds, respectively. A dummy variable is added to control for quarter-end effects. Fixed effects are included at the sector level. 'Model 1' column shows the results of the baseline regression (Equation (1)), while columns 'Model 2a' and 'Model 2b' show the results of two extended specifications (Equation (2)) that include an indicator variable to identify periods of financial turmoil (dummy variable for two one-month time windows centered on 29 May 2018 and 12 March 2020 and dummy variable for premia on 5-year Italian sovereign CDSs that are above the top decile of the sample distribution, respectively). Standard errors are robust to heteroscedasticity and reported in parentheses. Significance levels: ***: 1% level; **: 5% level; *: 10% level.

Dependent Variable	**Model (1)**	**Model (2a)**		**Model (2b)**	
NetBuy	Baseline	Crisis (2018, 2020)		CDS stress	
		in normal periods	additional effect in stressed periods	in normal periods	additional effect in stressed periods
Δyield $_{t-1}$ * Non-dealer Banks	2.780***	2.216***	5.080***	1.820***	3.846***
	(0.288)	(0.262)	(0.553)	(0.230)	(0.499)
Δyield $_{t-1}$ * Non-Financials	0.661***	0.830***	-0.903***	0.821***	-0.448**
	(0.089)	(0.127)	(0.166)	(0.173)	(0.161)
Δyield $_{t-1}$ * Asset Managers	-1.981***	-0.509**	-10.928***	-0.729***	-4.586***
	(0.192)	(0.132)	(0.340)	(0.142)	(0.303)
Δyield $_{t-1}$ * Hedge Funds	-1.658***	-0.645***	-7.498***	-0.892***	-2.798***
	(0.172)	(0.119)	(0.340)	(0.145)	(0.203)
Δyield $_{t-1}$ * Ins. & Pens. Funds	-0.034	0.105	-0.696**	0.123	-0.442*
	(0.088)	(0.125)	(0.188)	(0.172)	(0.172)
NetBuy $_{t-1}$	0.036	0.017		0.022	
	(0.060)	(0.061)		(0.057)	
Net Issuances $_t$	0.035*	0.035*		0.035*	
	(0.013)	(0.013)		(0.013)	
ΔTermSpread $_{t-1}$	-0.170	-0.465		-0.340	
	(0.162)	(0.359)		(0.360)	
ΔVIX $_{t-1}$	-0.005	0.003		-0.004	
	(0.008)	(0.003)		(0.006)	
ΔEuribor 6M $_{t-1}$	-0.150	0.308		-0.089	
	(1.315)	(0.924)		(1.212)	
Quarter-end $_t$	-0.100*	-0.106*		-0.109*	
	(0.040)	(0.042)		(0.042)	
R-squared	0.054	0.081		0.061	
Observations	1830	1830		1830	

Figure 1

Expected net purchases (purchases minus sales) of Italian government bonds by investor type following a 10 basis point increase in yields.

The figure shows the response of the net purchases of Italian government bonds (in billions of euros) by different type of investors to a 10 basis point increase in the yield on the benchmark 10-year BTP in the previous week. The analysis is carried out on weekly data, running from January 2014 to September 2020. Results marked as 'Full period' are obtained from estimating equation (1), while 'Crisis periods' and 'CDS stress' show the results of two extended specifications that include an indicator variable to identify periods of financial turmoil (dummy variable for two one-month time windows centered on 29 May 2018 and 12 March 2020 and dummy variable for premia on 5-year Italian sovereign CDSs that are above the top decile of the sample distribution, respectively). Squares are point estimates; dashed bars are 90 per cent confidence intervals.

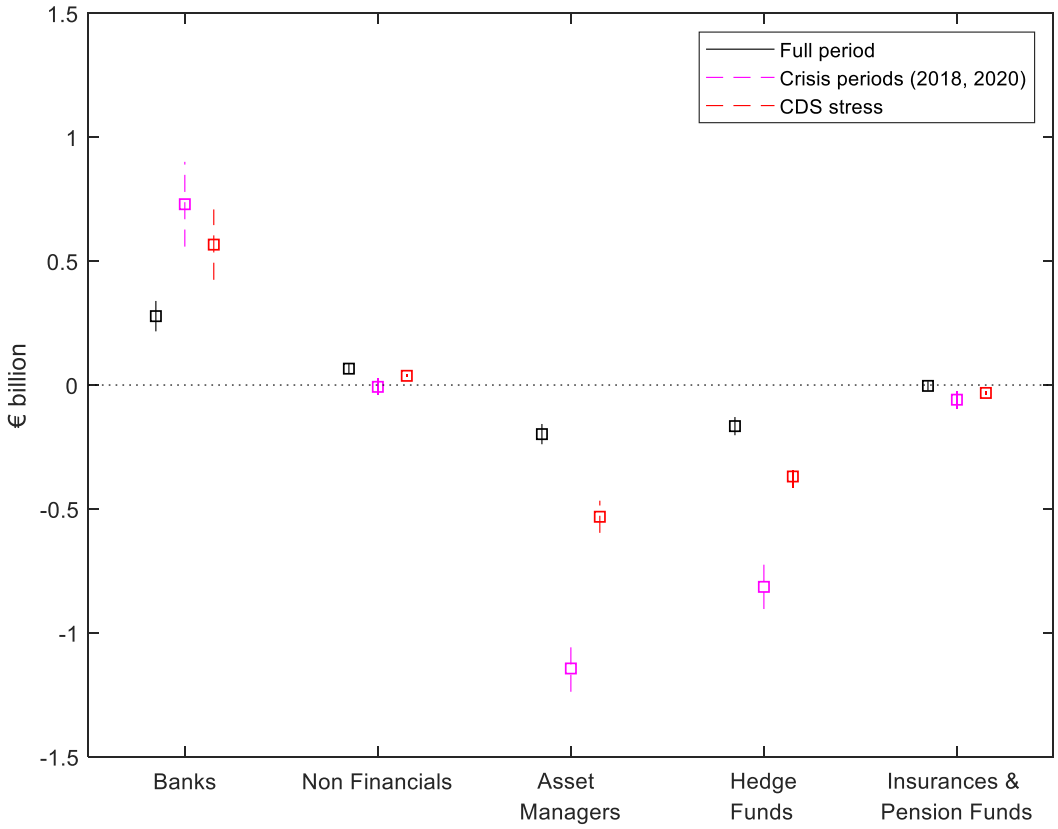

Table 3

Robustness tests

This table provides a number of robustness tests. The dependent variable $NetBuy_{i,t}$ is the difference between the purchases and sales of Italian government bonds that counterparties belonging to sector i carried out in week t with primary dealers. The sample period runs from January 2014 to December 2020. '$\Delta Yield_{t-1}$' is the weekly change in the 10-year Italian government bond yield, lagged by one week. For each sector i, the variable '$Sector_s^i$' is an indicator variable that is set equal to one when $i = s$, and is equal to zero otherwise. '$NetIssuances_t$' is the amount of bonds issued on the primary market (at the nominal value, in billions of euro) minus redemptions. 'ΔVIX', 'ΔEuribor 6M' and 'ΔTermSpread' are the lagged first differences of the CBOE's VIX index, the adjusted 6-month Euribor rate (residuals of a regression of changes in 6-month Euribor rates on changes in 10-year government bond yields, to avoid multi collinearity) and the yield spread between 10-year and 2-year Italian government bonds, respectively. A dummy variable is added to control for quarter-end effects. Fixed effects are included at the sector level. Standard errors are robust to heteroscedasticity and reported in parentheses. As robustness checks have been estimated several alternative regressions; for instance, columns (2)-(4) and (6) exclude the macroeconomic variables from regressions; column (7) include a control variable, measuring, for each week, the total number of PDs; in columns (8)-(11) different variables are used to measure primary market activity; columns (12)-(14) include other lags (beyond the first) of the change in yields. Significance levels: ***: 1% level; **: 5% level; *: 10% level.

Dependent Variable	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
NetBuy							
Δyield $_{t-1}$ * Non-dealer Banks	2.780***	2.729***	2.700***	2.884***	2.935***	2.709***	2.777***
	(0.288)	(0.258)	(0.285)	(0.066)	(0.085)	(0.003)	(0.287)
Δyield $_{t-1}$ * Non-Financials	0.661***	0.611***	0.437***	0.612***	0.664***	0.438***	0.657***
	(0.089)	(0.068)	(0.013)	(0.066)	(0.085)	(0.003)	(0.084)
Δyield $_{t-1}$ * Asset Managers	-1.981***	-2.031***	-2.311***	-2.142***	-2.091***	-2.317***	-1.986***
	(0.192)	(0.202)	(0.187)	(0.066)	(0.085)	(0.003)	(0.190)
Δyield $_{t-1}$ * Hedge Funds	-1.658***	-1.708***	-1.976***	-1.806***	-1.755***	-1.981***	-1.663***
	(0.172)	(0.182)	(0.163)	(0.066)	(0.085)	(0.003)	(0.170)
Δyield $_{t-1}$ * Ins. & Pens. Funds	-0.034	-0.084	-0.261***	-0.086	-0.035	-0.261***	-0.038
	(0.088)	(0.069)	(0.007)	(0.066)	(0.085)	(0.003)	(0.083)
NetBuy $_{t-1}$	0.036	0.036	0.002				0.036
	(0.060)	(0.060)	(0.064)				(0.061)
Net Issuances $_t$	0.035*	0.035*		0.034*	0.034**		0.035*
	(0.013)	(0.013)		(0.013)	(0.012)		(0.013)
ΔTermSpread $_{t-1}$	-0.170				-0.175		-0.178
	(0.162)				(0.162)		(0.170)
ΔVIX $_{t-1}$	-0.005				-0.005		-0.005
	(0.008)				(0.008)		(0.008)
ΔEuribor 6M $_{t-1}$	-0.150				-0.166		-0.160
	(1.315)				(1.293)		(1.321)
Quarter-end $_t$	-0.100*	-0.107**	0.054	-0.115*	-0.108*	0.054	-0.100*
	(0.040)	(0.038)	(0.044)	(0.045)	(0.048)	(0.048)	(0.040)
Num. PDs $_t$							-0.016
							(0.038)
R-squared	0.054	0.055	0.017	0.054	0.053	0.017	0.053
Observations	1830	1830	1830	1830	1830	1830	1830

Dependent Variable NetBuy	**(8)**	**(9)**	**(10)**	**(11)**	**(12)**	**(13)**	**(14)**
Δyield $_{t-1}$ * Non-dealer Banks	2.230***	2.189***	2.871***	2.924***		2.921***	2.873***
	(0.238)	(0.254)	(0.066)	(0.085)		(0.082)	(0.081)
Δyield $_{t-1}$ * Non-Financials	0.621***	0.582***	0.600***	0.653***		0.657***	0.656***
	(0.088)	(0.076)	(0.066)	(0.085)		(0.082)	(0.081)
Δyield $_{t-1}$ * Asset Managers	-1.646***	-1.684***	-2.155***	-2.101***		-2.089***	-2.049***
	(0.246)	(0.228)	(0.066)	(0.085)		(0.082)	(0.081)
Δyield $_{t-1}$ * Hedge Funds	-1.368***	-1.406***	-1.819***	-1.765***		-1.756***	-1.764***
	(0.225)	(0.206)	(0.066)	(0.085)		(0.082)	(0.081)
Δyield $_{t-1}$ * Ins. & Pens. Funds	-0.061	-0.100	-0.099	-0.046		-0.042	-0.033
	(0.091)	(0.078)	(0.066)	(0.085)		(0.082)	(0.081)
Δyield $_{t-2}$ * Non-dealer Banks					1.229***	1.213***	1.205***
					(0.055)	(0.049)	(0.049)
Δyield $_{t-2}$ * Non-Financials					-0.178**	-0.182**	-0.183**
					(0.055)	(0.049)	(0.049)
Δyield $_{t-2}$ * Asset Managers					-1.841***	-1.831***	-1.825***
					(0.055)	(0.049)	(0.049)
Δyield $_{t-2}$ * Hedge Funds					-1.348***	-1.340***	-1.342***
					(0.055)	(0.049)	(0.049)
Δyield $_{t-2}$* Ins. & Pens. Funds					-0.160**	-0.160**	-0.159**
					(0.055)	(0.049)	(0.049)
Δyield $_{t-3}$ * Non-dealer Banks							1.572***
							(0.022)
Δyield $_{t-3}$ * Non-Financials							0.044
							(0.022)
Δyield $_{t-3}$ * Asset Managers							-1.306***
							(0.022)
Δyield $_{t-3}$ * Hedge Funds							0.266***
							(0.022)
Δyield $_{t-3}$ * Ins. & Pens. Funds							-0.274***
							(0.022)
NetBuy $_{t-1}$	0.156*	0.156*					
	(0.062)	(0.062)					
Net Issuances $_{t}$					0.034*	0.034*	0.034*
					(0.012)	(0.012)	(0.012)
Gross Issuances $_{t}$	0.102*	0.099*	0.089*	0.089*			
	(0.041)	(0.039)	(0.033)	(0.034)			
Redemptions $_{t}$		0.011	0.010				
		(0.006)	(0.005)				
Redemptions $_{t-1}$				-0.007			
				(0.004)			
ΔTermSpread $_{t-1}$	-0.618*	-0.646*	-0.621*	-0.603*	-0.193	-0.164	-0.165
	(0.245)	(0.256)	(0.229)	(0.221)	(0.479)	(0.161)	(0.162)
ΔVIX $_{t-1}$	-0.004	-0.006	-0.006	-0.005	-0.003	-0.003	-0.003
	(0.008)	(0.008)	(0.008)	(0.008)	(0.009)	(0.006)	(0.006)
ΔEuribor 6M $_{t-1}$	-0.788	-0.852	-0.846	-0.816	-0.049	-0.042	-0.045
	(1.256)	(1.252)	(1.269)	(1.289)	(1.263)	(1.162)	(1.142)
Quarter-end $_{t}$	0.094	0.145	0.088	0.062	-0.090	-0.092	-0.090
	(0.072)	(0.090)	(0.054)	(0.049)	(0.075)	(0.058)	(0.047)
R-squared	0.221	0.223	0.203	0.201	0.040	0.059	0.063
bservations	1830	1830	1830	1830	1830	1830	1830

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