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Abstract

We use UK transaction-level data on nominal bond, inflation-linked bond and inflation swap markets to study trading behaviour and prices in inflation markets. Our empirical analysis yields five main results: (i) there is persistent inflation mispricing over the 2018–22 period, with nominal gilts on average 135 basis points more expensive (per £100 notional) than their synthetic counterparts constructed from inflation swaps and inflation-linked bonds; (ii) hedge funds respond to changes in mispricing but their response does not constitute arbitrage – they adjust their bond portfolios appropriately, but do not hedge these trades in the inflation swap market; (iii) inflation markets are largely segmented with liability-driven investors and pension funds (LDI-P) dominating the inflation swap market, and many clients that are active in bond markets are absent in the inflation swap market; (iv) LDI-P activity is a key driver of inflation mispricing – the sector's orderflows in inflation-linked bonds and (to lesser extent) nominal bonds and inflation swaps contribute significantly to day-to-day variations in mispricing; (v) the generally weak link between market-based measures of inflation expectations and survey-based measures is strengthened once we clean market prices from the effect of LDI-P trading activity.

Key words: Bond markets, inflation swaps, mispricing, arbitrage, pension funds.

JEL classification: E31, G12, G23.

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1 Introduction

The relative mispricing of inflation-linked government bonds, nominal bonds and inflation swaps is one of the largest examples of the violation of the law of one price ever documented in the academic literature (Fleckenstein, Longstaff, and Lustig, 2014). This poses a major puzzle to classical finance theory, and it also poses a major challenge for macroeconomists and policy makers to back out the markets' inflation expectations from observed prices in inflation markets. What determines this mispricing? What is the role of preferred habitat investors such as pension funds in driving the mispricing? Do speculators trade on this mispricing as predicted by textbook arbitrage strategies? Our paper uses granular datasets from the UK to answer these questions.

Our empirical analysis starts by confirming that there is persistent mispricing in a large scale across these three markets in the UK during the recent period.[1] That is, the prices of nominal bonds are systematically higher than their synthetic counterparts constructed from inflation swaps and inflation-linked bonds. The main contribution of our paper is to use a granular, transaction-level datasets merged across the UK nominal bond, inflation-linked bond and inflation swap markets to study the determinants of this mispricing and trading activity in general during the period 2018-2022. The explanation that we explore is that the mispricing is driven by the trading activity of the pension funds and liability-driven investors (LDI-P sector henceforth) who aim to duration hedge their long-term liabilities that are often in the form underfunded pension claims.

To underscore the relevance of this explanation, we show stylised facts on the sector's trading activity in nominal and inflation-linked bonds markets as well as LDI-P positioning in the inflation swap market, confirming the dominance of the sector in these markets. Specifically, the LDI-P sector (alongside hedge funds) make up the bulk of trading volume in gilt markets, and the sector is the largest receiver of inflation in the UK inflation swap market.[2] Motivated by the importance of the LDI-P sector in UK inflation markets, we use regression analysis to explore how the sector's balance sheet position and trading activity determine variation in our estimated mispricing measure. We also analyse how hedge funds (a natural proxy for arbitrageurs) react to changes in the mispricing and whether they trade according to textbook arbitrage strategies. Moreover, we explore macroeconomic and policy implications by estimating how our results affect the ability to extract information on inflation expectations from these markets.

Our empirical analysis yields five key findings. First, there is a persistent inflation mispricing in the UK: over the 2018-2022 period, nominal gilts are on average 135 basis points more expensive (per £100 notional) than their synthetic counterparts constructed from inflation

[1] This is consistent with previous evidence from the US (Fleckenstein, Longstaff, and Lustig, 2014; Siriwardane, Sunderam, and Wallen, 2022) as well as other countries (Fleckenstein, 2013; Kita and Tortorice, 2021).

[2] See Pinter (2023) for a detailed analysis of the LDI-P sector and of these markets in the context of the 2022 UK gilt market crisis.

swaps and inflation-linked bonds. This is consistent with previous estimates of the mispricing in the UK (Vilas-Boas 2013; Kita and Tortorice 2021). We find substantial variation in mispricing both over time and across bonds: our aggregate mispricing measure reaches levels exceeding 400 bps during the middle of our sample, while occasionally displaying negative values on certain trading days. Average mispricing is substantial larger at long maturities (longer than 30 years), whereas find no significant mispricing at short maturity (less than two years). Our empirical design exploits both the time-series and cross-sectional variation in mispricing.

Second, inflation markets are largely segmented in terms of client participants: the LDI-P sector dominates trading activity in the inflation swap and inflation-linked bond market, and many clients that are active in the nominal bond market are absent in the inflation swap market.[3] The LDI-P sector accounts for over 50% of the trading volume in the client-dealer segment of the inflation-linked bond market, and the sector explains the majority of client's positioning (in terms of net notional) in the inflation swap market, with dealers paying the floating rate (linked to RPI inflation) to the LDI-P sector in exchange for the fixed (inflation swap) rate. The dominance of the LDI-P sector in these markets motivates our focus on the sector's trading activity as a potential driver of the mispricing.

Third, we show that LDI-P activity in inflation market is a significant driver of variations in the mispricing. As a first step, we analyse the dynamics of the aggregate balance sheet of the LDI-P sector by exploiting monthly changes in the amount of underfunding in the spirit of Klingler and Sundaresan (2019).[4] We find that a 1% increase in underfunding increases the aggregate mispricing series by around 19 bps. This effect is more pronounced in states when the LDI-P sector is in surplus compared to deficit states. As a second step, we analyse daily variation in net purchases (*orderflow* henceforth) of nominal bonds, inflation-linked bonds (*linkers* henceforth) and inflation swaps by the LDI-P sector. We find that LDI-P orderflow in all three markets has a significant effect on our measure of mispricing, consistent with a demand-driven explanation: an increase in nominal bond orderflow increases mispricing, i.e. pushes up the price of nominal bonds further compared to their synthetic counterparts; an increase in linker orderflow reduces mispricing; and increased LDI-P purchases of inflation in the swap market increases mispricing (by pushing up the inflation swap rate compared to breakeven inflation). These effects are virtually unaffected by informational events (such as CPI or RPI announcements or monetary policy shocks) or by primary issuances of gilts.

Moreover, among the three markets, linker orderflow has the economically strongest effect on our mispricing measure. We also analyse the effect of LDI-P orderflows on inflation prices more broadly such as nominal yields, real yields, breakeven inflation (i.e. different between nominal yields and real yields) and inflation swap rates. We find important price effects across

[3] A series of regulatory reforms in the late 1990s and early 2000s had a strong impact on the LDI-P firms' asset allocation strategies, linking them more closely to developments in their liabilities. This gave rise to an increased demand for nominal and inflation-linked bonds as well as interest rate and inflation swaps in order to hedge changes in the real value of liabilities (Blake, Sarno, and Zinna, 2017).

[4] Klingler and Sundaresan (2019) estimated the role of pension fund underfunding in explaining negative interest rate swap spreads.

these markets: while increased LDI-P orderflow in linkers has the strongest effect on breakeven inflation, it also has a significant effect on inflation swap rates. In contrast, increased LDI-P purchases of inflation swaps have a more moderate effect on both breakeven inflation and inflation swap rates. These results highlight the importance of jointly analysing bond market and inflation swap market activity to accurately quantify the link between trade flows and inflation prices.

Fourth, hedge funds respond to changes in this mispricing by adjusting both their nominal and inflation-linked bond portfolios appropriately, that is, they sell nominal gilts and buy linkers when the mispricing increases. However, these adjustments do not classify as arbitrage as hedge funds do not hedge these bond market trades in the inflation swap market. We argue that the absence of the implementation of arbitrage strategies is attributable to funding frictions. The textbook arbitrage strategy would typically require the use of repurchase agreements and variation margins on the swap, both of which would pose non-negligible risks during the lifetime of the arbitrage. For example, roll-over risk on repos would be significant if one were to try to arbitrage away the mispricing, say, at the ten-year tenor, given that repos with maturity longer than two years are virtually non-existent. Consistent with this, we find that there is no significant inflation mispricing for bonds with less than two years of maturity. Overall, the volatility in our measure of inflation mispricing as well as associated margins and roll-over risks in funding markets could explain why hedge funds refrain from implementing fully fledged arbitrage trades.

Fifth, we explore the aggregate implications by connecting our results with the vast literature on inflation expectations.[5] We document that changes in inflation expectations measured by the Bank of England Inflation Attitudes Survey exhibit weak correlations (pairwise correlation coefficients of 0.02-0.1) with changes in market-based measures of inflation expectations such as breakeven inflation of different maturities. We show that once the effects of LDI-P orderflows are purged out of inflations breakevens, the correlation between market-based and survey-based measures of inflation expectations substantially improves (0.34-0.44). While these results are intuitive, we interpret them as suggestive evidence given the limited time-series variation in the quarterly survey series.

Related Literature Our paper draws on two main strands of literature. First, we extend the work Fleckenstein (2013) and Fleckenstein, Longstaff, and Lustig (2014), which documented the violation of the law of one price in inflation markets, finding large and persistent mispricing across nominal bond, inflation-linked bond and inflation swap markets in the US and other countries.[6] Subsequent studies corroborated the existence and persistence of this

[5] See Ang, Bekaert, and Wei, 2007; Chernov and Mueller, 2012; Bauer, 2015; D'Amico, Kim, and Wei, 2018; Weber, D'Acunto, Gorodnichenko, and Coibion, 2022 among many others.

[6] Articles published previously in practitioners' outlets (Madigan 2009; Clark 2010) discussed that the mispricing materialised clearly during the collapse of Lehman Brothers, when banks began to sell inflation linked bonds that were part of hedges. At the same time, due to the crisis, other investors were replacing inflation-linked bonds with more liquid nominal bonds.

mispricing in the US market (Haubrich, Pennacchi, and Ritchken, 2012; Christensen and Gillan, 2012; Bretscher, 2015; Driessen, Nijman, and Simon, 2017; Dittmar, Hsu, Roussellet, and Simasek, 2019; Siriwardane, Sunderam, and Wallen, 2022). In the context of international markets, Vilas-Boas (2013) and Kita and Tortorice (2021) extended the analysis to UK market, de Séverac and da Fonseca (2018) to the French market, Levy (2017) to the Israeli market and Simon (2012) to G7 countries.[7]

Our paper is consistent with these results in that we find large and persistent mispricing in the UK during the recent time period (2018-2022). Compared to the papers above, which typically use aggregate data on prices, our main contribution is to complement information on prices with granular, transaction-level datasets on all three fixed income markets that underlie the mispricing measure. This allows us to establish a connection between trading behaviour and the mispricing, which is novel in the literature.

Second, we relate to the literature that emphasises the role of pension fund activity in affecting financial markets and interest rates in particular (Greenwood and Vayanos, 2010; Scharfstein, 2018; Greenwood and Vissing-Jorgensen, 2019; Klingler and Sundaresan, 2019; Giese, Joyce, Meaning, and Worlidge, 2021). The role of the LDI-P sector was particularly prominent in driving the 2022 gilt market crisis, where extreme orderflows of the sector resulted in significant price impact and liquidity effects (Hauser, 2022; Breeden, 2022; Pinter, 2023). The question remains, however, whether LDI-P orderflows have a significant price impact in normal times (Kashyap, 2023). We contribute to this literature by showing that LDI-P trading activity has a significant role in explaining mispricing (and inflation prices more broadly) in normal times.

Among the reasons cited for the mispricing and its persistence, several papers mention differences in liquidity as one of the main determinants (e.g. Haubrich, Pennacchi, and Ritchken, 2012; Bretscher, 2015; Driessen, Nijman, and Simon, 2017).[8] The literature also cites the theory of slow-moving-capital theory that affects arbitrageurs' ability to arbitrage away mispricing (Gromb and Vayanos 2002; Mitchell, Pedersen, and Pulvino 2007; Brunnermeier and Pedersen 2009; Duffie 2010; Ashcraft, Garleanu, and Pedersen 2011). We argue that our results are consistent with both of these theories, if one thought of day-to-day variation in LDI-P orderflows as proxies for liquidity shocks, which hedge funds (and other clients) find difficult to absorb (due the relative size of the LDI-P sector and the markets' segmented nature).

In contemporaneous work, Bahaj, Czech, Ding, and Reis (2023) also studies UK inflation

[7] Most relevant to our study are Vilas-Boas (2013) and Kita and Tortorice (2021) who extended the analysis to the UK (among other countries). Vilas-Boas (2013) uses five bond pairs finds an average mispricing of 450 bps for the period 2008-2009 and 15.5 bps for the period 2006 to 2011. Out of the five bond pairs, two pairs have a negative average mispricing, indicating that for this two pairs the linker bonds were relatively more expensive than their nominal counterparts. Kita and Tortorice (2021) found in the UK market an average mispricing of 192 bps using five bond pairs for the period 2007 to 2012. For all five bond pairs, they find a positive average mispricing.

[8] The explanation is related to the illiquidity risk embedded in inflation-linked bonds (Pflueger and Viceira, 2016; Campbell, Sunderam, and Viceira, 2017; D'Amico, Kim, and Wei, 2018; Kaminska, Liu, Relleen, and Vangelista, 2018).

markets by focusing on the inflation swap market. Our work is different in that we undertake a joint analysis of the UK inflation swap, nominal gilt and inflation-linked gilt markets, and study how the joint interaction of these three markets determines relative inflation mispricing.

2 Data Sources

This section describes the aggregate day level price data as well as the trade-level data used in our study.

2.1 Aggregate Price Data

For studying the daily inflation arbitrage strategy in the UK market we use daily close prices of the three asset classes involved in this arbitrage: the nominal bonds (gilts), the inflation linked bonds (linkers) and RPI inflation swaps. The collected data covers the period January-2018 to August-2022.

Each nominal bond has been matched to the inflation linked bond that has the closest maturity date. We only consider bond pairs with a maturity mismatch of 100 days or less. This matching creates 12 bond pairs.The nominal bond set is composed of 12 nominal bonds issued by the United Kingdom Treasury between 2005 to 2020, and with maturities between 2019 to 2055. The inflation linked bonds set is composed of 12 bonds issued between 1992 to 2018, and with maturities between 2019 to 2055. All these inflation linked bonds are indexed to the UK Retail Price Index (RPI). The daily closing prices for these two sets of bonds come from Bloomberg as well as the Strip prices used in the calculation. The inflation swaps information we used corresponds to the fixed leg swap rate of RPI inflation swaps. These rates come from Bloomberg and cover the maturities 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 15, 20, 25, 30, 35, 40 and 45 years. We linearly interpolate for intermediate maturities and include seasonal adjustments.

Additionally, for studying the relation between inflation mispricing and the UK Pension Fund Sector funding conditions in section 5.1, we use the monthly estimates of UK Pension Funds aggregate assets and liabilities from the Pension Protection´s Fund PPF 7800 Index. As control variables, we use the Libor-OIS spread, the 25Y to 1Y nominal curve slope, the 25Y to 1Y inflation swap curve slope, the total ratio of UK linkers and gilts to GDP, the MOVE bond volatility index, the VIX volatility index, the log of the UK´s Economic Policy Uncertainty Index (EPU), the last two RPI inflation measures and year fixed effects. With the exception of the yield curve data which come from the Bank of England, and the total ratio of linkers and nominal gilts to GDP that comes from Thomson Reuters, all the other control variables are sourced from Bloomberg.

2.2 *Transaction-Level Data*

2.2.1 *Government Bond Transactions*

To study inflation mispricing, we use a detailed transaction-level dataset which contains information on the identity of both sides of a trade. Our sample is from the MIFID II database, covering the period from January 2018 to March 2023. The dataset is sourced by the UK Financial Conduct Authority, and includes information on client identities, transaction times, prices and quantities, the International Securities Identification Numbers and buyer-seller flags.[9] Firm identification in the MIFID II database is performed by using the Legal Entity Identifier (LEI).

Our analysis focuses on transactions that occur between clients and designated market makers, called Gilt-Edged Market Makers (GEMMs). GEMMs are the primary dealers in the UK government bond market, and the majority of client-dealer trades are intermediated by them.[10] After filtering out all duplicates, erroneous entries, we are left with approximately 5 million client-dealer trades, nominal bond transactions making up for about two thirds of theses trades and inflation-linked bond trades accounting for the remaining one third. We identify around 4600 funds (LEIs) that cover the majority of trading volume between clients and dealers in both segments of the government bond markets. We classify these clients by types into three groups: (i) hedge funds, (ii) asset managers with liability-driven investment (LDI) remit as well as pension funds, and (iii) others (including foreign central banks, commercial banks, building societies etc.).

2.2.2 *Inflation Swap Transactions*

We extract transaction-level data on inflation swaps from a subset of the EMIR trade repository dataset, DTCC and Unavista - two of the largest EMIR trade repositories.[11],[12] To identify inflation swap contracts in the EMIR TR data, we use the classification of the financial instrument (CFI) code and we search for codes with "SRG" as the first three characters.[13] This identifies interest rate swaps where the underlying asset is an inflation rate index. We then keep contracts where the floating rate leg is the retail price index (RPI), which is the price index used by inflation-linked bonds in the UK.[14] We combine state reports from January 2019 to August 2022. Each state report provides information on outstanding swap contracts at a given point in time. The dataset includes information for each contract on the notional, swap rate, contract maturity, currency, execution date, trade direction, initial and variation margins

[9]For further details on the MIFID II dataset, see the Reporting Guidelines. Recent applications of the datasets can be found in Pinter, Wang, and Zou (2022); Jurkatis, Schrimpf, Todorov, and Vause (2022); Kondor and Pinter (2022) among others.

[10]For further details on the identities of GEMMs, see https://www.dmo.gov.uk/responsibilities/gilt-market/market-participants/.

[11]Further information can be found on the website of the Bank of England.

[12]See Cenedese, Ranaldo, and Vasios (2020) for a recent analysis of swap contracts in these datasets.

[13]For further details on the CFI classification, see the link.

[14]For this reason, the outstanding notional on CPI-linked swaps is much smaller in the UK than for RPI-linked swaps.

posted and received and whether the contract has been cleared, among other bits of information. Importantly, the LEI codes of both counterparties are observable for almost all contracts. This allows us to merge inflation swap transactions with government bond transactions.

3 Stylised Facts on UK Gilt and Inflation Swap Markets

This section presents stylised facts on the trading activity and positioning of different client types in the UK gilt and inflation swap markets. In each of these markets, we focus on the client-dealer segment and we exclude inter-dealer gilt trades as well as swap contracts cleared through a central clearing counterparty. We distinguish between three types of clients: clients in the LDI-P sector, hedge funds and other clients (including building societies, foreign entities among others).

3.1 The Gilt Market

Conventional (nominal) and inflation-linked bonds are issued by the Debt Management Office (DMO) on behalf of the UK government. When clients trade in the UK gilt market, they can observe quotes of all dealers on electronic trading platforms. These quotes are typically indicative, which means that trades of smaller sizes could get executed at these prices. Larger trades still require bilateral communication and negotiations between clients and dealers, i.e. the gilt market still retains its traditional over-the-counter (OTC) characteristics, with primary dealers handling the majority of client trades.[15]

Panel A of Figure 1 shows the total annual trading volume in our sample of client-dealer trades in the gilt market (including both nominal and inflation-linked bonds). The bar chart decomposes volume in the LDI-P sector, hedge funds and other clients. Total annual volume averages around £4 trillion over the 2018-2022 period, and the hedge fund sector has the highest trading activity followed by LDI-PI sector during this period. Overall, these two sectors generate more than 60% of gilt trading volume in the client-dealer segment.

[Figure 1]

Panel B of the Figure 1 breaks down the aggregate volume figures into four maturity segments: 0-5, 5-11, 11-25 and above 25 years of maturity. We find that the LDI-P sector concentrates its aggregate trading activity in the UK gilt market on the longest maturities 11-25 and above 25 years. On the other hand, hedge funds and other clients concentrate their aggregate trading activity on the shortest maturities 0-5 and 5-11 years.

Figures 2 and 3 present the figures for the inflation-linked and nominal gilt markets, separately. Panel A of Figure 2 shows that the annual trading volume of inflation-linked bonds

[15]See Benos and Zikes (2018) and Kondor and Pinter (2022) for further details about the institutional arrangements of the UK gilt market.

averages around £0.8 trillion, with the LDI-P sector generating most of the trading activity. As shown by Panel B, the LDI-P sector's share is particularly large in the longer maturity segments, consistent with these firms using long-term inflation-linked bonds to hedge against both discount rate risk and inflation risk in liability managements (Blake, 2003; BMO, 2018; Pinter, 2023).

[Figure 2]

Figure 3 shows the stylised factors for the nominal gilt market. Panel A of Figure 3 shows that the annual trading volume of nominal gilts averages around £3 trillion, with the hedge fund sector being the most active one after 2018 with trading volumes of around £1.6 trillions on 2021 and 2022. The LDI-P sector maintained a relatively stable trading volume of approximately £0.7 trillion per year during the 2018-2022 period. As shown by Panel B, and similar to inflation-linked bonds, the LDI-P sector's share is particularly large in the longer maturity segments 11-25 and above 25 years.

[Figure 3]

3.2 The Inflation Swap Market

Inflation swaps are bilateral contractual agreements, whereby one party agrees to pay floating-rate payments linked to inflation, whereas the other party agrees to pay a predetermined (inflation swap) rate during the life of contract. Similar to gilts, inflation swaps are traded over-the-counters, with many of the GEMMs playing an active role in their intermediation of inflation swaps as well. The inflation swap market in the UK started to grow rapidly since the early 2000s, and this growth was primarily driven by the need of pension funds to hedge long-term liabilities in real terms (Hurd and Relleen, 2006).

Panel A of Figure 4 shows the total distribution of net positions in the UK inflation Swap Market. The most important takeaway from Panel A is that dealers and LDI investors hold the largest net positions in the market, which dwarf the net positions of all other client types. The LDI-P sector net position increased during the period 2018-2022 from approximately £50 billions in 2018 to around £170 billions in 2022. Specifically, LDI-P sector holds inflation protection supplied by the dealer sector, which is consistent with UK pension funds needing to hedge their liabilities against inflation risk.

[Figure 4]

Panel B of Figure 4 below shows the distribution of net position across the four maturity buckets 0–5, 5-11, 11-25 and above 25 years. The key message is: across all maturity segments, LDI-P sector holds inflation insurance supplied by the dealer sector. A large fraction of LDI-P sector net position in the inflations swap market is concentrated in the 11-25 years maturity bucket, while the maturities above 25 years feature the smallest net position. Outside the LDI-P and dealer sector, hedge funds hold a sizeable inflation protection net position of around £7 billions in the shortest maturity bucket 0-5 years.

4 Documenting Inflation Mispricing

This section shows the aggregate mispricing between inflation linked swapped bonds and nominal bonds over the period 2018m1-2022m8. We find that during this period, per 100 GBP of face value, nominal gilts were on average 135 basis points more expensive than their synthetic counterparts obtained from inflation linked gilts, RPI inflation swaps and zero-coupon gilt strips. Details in Table-1 below.

[Table 1]

While the aggregated series suggests that nominal gilts are most of the time more expensive than their synthetic counterparts, there are a few periods in which this relation reverses, e.g. at the start of 2018. We also studied whether the mispricing is weaker in particular months, days or weekdays during the year. We find that the mispricing was particularly weaker during the months of November and January and on the days 19th of each month. In addition, the mispricing tended to be on average higher during the last week of each month. Details are presented in Table A.4 of the Appendix.

[Figure 5]

In terms of the individual bond pairs, among the 12 pairs of nominal-linked bonds studied during this period, most of them exhibit a mispricing of around 130 bps or above. Only two bond pairs, maturing around 2040 present an average negative mispricing. Details in Table-2 below.

[Table 2]

5 Determinants of Inflation Mispricing

5.1 Time-series Evidence from Pension Fund Underfunding

In this section we investigate the relationship between the mispricing and the balance sheet dynamics of the UK pension sector. Specifically, we test the hypothesis that pension funds' investment activity affects bond and inflation swap prices, consistent with the mispricing described in section 4. To test this hypothesis, we use the pension fund funding measure of Klingler and Sundaresan (2019), which is a scaled difference between the liabilities and assets of the sector:

$$UFR_t = \frac{Liabilities_t - Assets_t}{Assets_t}. \tag{5.1}$$

This UFR_t measure proxies the amount of underfunding (or overfunding) of the sector. A positive measure indicates an excess of liabilities over assets (deficit), while a negative measure indicates an excess of assets over liabilities (surplus). We transform measure 5.1 into monthly growth rates, $\triangle UFR_t = (UFR_t - UFR_{t-1})$, and estimate the following time-series regression to quantify the relationship between changes in inflation mispricing and changes in pension sector underfunding:

$$\triangle Mispricing_t = c + \triangle UFR_t + controls + \varepsilon_t. \tag{5.2}$$

Following Klingler and Sundaresan (2019), we further investigate whether the link between changes in the mispricing and the underfunding measure are coming from underfunded states or states in which the aggregate UK pension system is in surplus:

$$\triangle Mispricing_t = c + \triangle UFR_t^+ + \triangle UFR_t^- + controls + \varepsilon_t, \tag{5.3}$$

where $\triangle UFR_t^+ = \triangle UFR_t * 1_{UFR_t>0}$ denotes changes in underfunding in the underfunded states, and $\triangle UFR_t^- = \triangle UFR_t * 1_{UFR_t \leq 0}$ denotes changes in underfunding in the surplus states. Te estimate regressions 5.2–5.3, we use data at monthly frequency, covering the period from January 2018 to August 2022. We also test whether the results hold up in a longer sample, covering the period from August 2008 to August 2022. The mispricing measure is extended back to August 2008 following the same steps as in Section 4.[16] The monthly estimates of UK pension funds' aggregate assets and liabilities come from the Pension Protection´s Fund PPF 7800 Index.[17]

The results in panel A of Table 3 show that on average an increase of the underfunding measure $\triangle UFR_t$ has a positive and statistically significant effect on the mispricing measure across all sets of controls during the period January 2018 till August 2022. According to these results (panel A, column 9), a one unit increase in $\triangle UFR_t$ translates to approximately a +0.19 increase in inflation mispricing. In the monthly data, the $\triangle UFR_t$ measure fluctuated between +4.0% to a -5.1%, which according to our model translates to a change in mispricing between +76 bps to -96 bps.

Results corresponding to regression 5.3 are presented in in panel B of Table 3, indicating that the relation between changes in mispricing and pension funds underfunding measure was concentrated in states in which the UK pension system was in surplus $\triangle UFR_t^-$. During this period (panel B, column 9), a one unit increase in the underfunding measure in surplus states

[16]We extend the bond pairs set – previously described – with two additional bond pairs that matured in 2017. See Appendix A.2 for further details.

[17]Regression controls include LIBOR - OIS spread, the 25Y to 1Y nominal gilt curve slope, the 25Y to 1Y UK RPI inflation swap curve slope, the total ratio of UK linkers and gilts to GDP, the MOVE bond volatility index, the UK FTSE volatility index (IVIUK), the log of the UK´s Economic Policy Uncertainty Index, last two RPI inflation measures, the US Treasury Liquidity Index (GVLQUSD) as proxy for global treasury market liquidity, the 10-year bid-ask spread of gilts and inflation linked linkers as proxy for local treasury market liquidity and year fixed effects. All variables are in first differences, with the exception of the log of the UK Economic Policy Uncertainty Index and the last two month RPI percentage changes. With the exception of the yield curve data used as controls which come from the Bank of England, and the total ratio of (gilts + linkers) to GDP that comes from Thomson Reuters, all the other control variables come from Bloomberg.

translated approximately in a +0.22 increase in inflation mispricing. The coefficient associated with the underfunding measure in deficit states $\triangle UFR_t^+$ is economically smaller, although still statistically significant.

[Table 3]

Table 4 presents the results for the longer sample period (2008m8-2022m8). On average, the relation between changes in the underfunding measure and the mispricing remains statistically significant although somewhat weaker compared to the shorter period 2018-2022. Panel A (column 9) shows that a one unit increase in the underfunding measure $\triangle UFR_t$ translates to an approximately +0.15 increase in the mispricing series during this extended period. Panel B also show that the relation between changes in the underfunding measure and the mispricing was stronger during surplus states $\triangle UFR_t^-$, with the difference in estimates across states ($\triangle UFR_t^-$ surplus states, $\triangle UFR_t^+$ deficit states) being economically larger than for the shorter period (Table 3).

[Table 4]

5.2 *Evidence from Gilt and Inflation Swap Orderflow*

5.2.1 *Time-series Regressions*

To estimate how the buying or selling pressures of the LDI-P sector in government bond and inflation swap markets may affect our aggregate measure of mispricing, we run the following time-series regression:

$$\Delta_{t-t,t+T} Misspricing_t = \beta_1 \times OF_{N,t} + \beta_2 \times OF_{L,t} + \beta_3 \times OF_{S,t} + \varepsilon_t, \quad (5.4)$$

where $\Delta_{t-1,t+T} Misspricing_t$ is the change in mispricing from day $t-1$ to day $t+T$; $OF_{N,t}$, $OF_{L,t}$ and $OF_{S,t}$ are the LDI-P orderflow (net purchase) in nominal gilts, linkers and inflation swaps, respectively, scaled by total sectoral volume over the same time period. Panel A of Table 5 presents the results, with columns (1), (2) and (3) including one regressor at a time, and column (4) includes all three regressors. We find that all coefficients have the predicted sign: LDI-P purchases of nominal bonds and inflation swaps are associated with an increase in the mispricing, whereas sales of linkers reduce the mispricing. Specifically, a unit increase in the scaled orderflow in nominal bonds, linkers and inflation swaps is associated with an increase in mispricing by 12.2 bps, -22.6 bps and 3.4 bps. As shown by column (4), the coefficients change little when we include all regressors in the regression.

[Table 5]

Panels B and C of Table 5 decompose the effects into the orderflow of LDI managers and pension funds, separately. We find that the results are economically and statistically more significant for LDI managers compared to pension funds. Specifically, a unit increase in the scaled orderflow of LDI managers in nominal bonds, linkers and inflation swaps is associated with an increase in mispricing by 9 bps, -15.4 bps and 5.5 bps. For pension funds, only the coefficient on linkers is statistically significant (-9.3 bps).

We explore whether LDI-P orderflows have a persistent impact on mispricing, Figure 6 shows the results for longer time horizons ($T = 0, 1, \ldots, 10$). We find the strongest and most persistent effect in linkers with the impact reaching a peak after about three trading days without any sign of reversal. The effect of nominal orderflow is also persistent albeit weaker, whereas the effect of inflation swap orderflow has the most transient effect on mispricing.

[Figure 6]

Figure 7 decomposes the sectoral orderflow into the orderflow of LDI managers and of pension funds. The figure shows that the LDI managers nominal gilts, linkers and inflation swaps orderflow effects are stronger and more persistent compared to the ones originated from pension funds orderflows. Panel A of Figure 7 shows that the LDI managers orderflow effects are persistent across the three asset classes. With a unit increase in the scaled orderflow of LDI managers in nominal gilts, linkers and inflation swaps having an effect in the mispricing of around +10 bps, -15 bps and +5 bps respectively after ten days. In relation to the pension funds orderflows, panel B of Figure 7 indicates that the effect of the linkers orderflow is persistent with a ten days effect in the mispricing of around -10 bps, while the nominal orderflow effect in the mispricing halves after the eight day to around +5 bps and the inflation swaps orderflow effect approaches zero after the fourth day.

[Figure 7]

The Role of Macroeconomic News One possible criticism of the regression specification 5.4 is that macroeconomic news such as announcements about inflation or the stance of monetary policy may affect the behaviour of the LDI-P sector while directly affecting mispricing. If arbitrage activity is limited, then shocks (such as macroeconomic news) hitting one market could increase relative mispricing across markets (Vayanos and Gromb, 2012). To address this, we adopt two strategies. First, we aim to directly measure and control for shocks to inflation and monetary policy. Second, we exploit the cross-sectional variation in mispricing and LDI-P orderflows across bond maturities which allows us to control for macroeconomic news with time fixed effects.

To measure inflation news, we use the surprise component of UK CPI and RPI inflation releases, building on the methodology of Gurkaynak, Sack, and Swanson (2005) and Swanson and Williams (2014). The inflation surprise is defined as the actual inflation announcement less the median figure of the Bloomberg´s markets participant survey. Details are provided in Appendix A.3. To measure monetary policy shocks, we follow the high frequency approach to the identification of monetary policy surprises as implemented by Braun, Miranda-Agrippino, and Saha (2022).[18] Specifically, we use their estimated monetary policy "target" and "path" shocks as additional determinants of inflation mispricing.[19]

[Table 6]

We include these three additional time-series as control variables in model 5.4, with the results presented in Table 6. Compared to column (4) of Table 5, we find virtually no difference in the estimated coefficients corresponding to LDI-P orderflows. Moreover, we find no relation between inflation shocks and inflation mispricing. The effect of monetary policy target shocks has some statistical significance, with an unexpected risk in the Bank rate lowering mispricing. The effect of path shocks has the opposite sign, though the effects are statistically insignificant.[20]

Time-series regression are subject to limitations that other aggregate shocks (e.g. shocks to the intermediary sector) that affect the LDI-P sector may have a direct effect on mispricing too. To address this, we next turn to a panel regression setting, where we exploit cross-sectional heterogeneity in the maturity of assets underlying out measure of mispricing, while controlling for aggregate factors via time fixed effects.

5.2.2 Panel Regressions

To estimate the relationship between mispricing and LDI-P orderflows in a panel setting, we run different versions of the following regression:

$$\Delta_{t-t,t+T} Misspricing_{j,t} = \mu_t + \delta_j + \beta_1 \times OF_{N,j,t} + \beta_2 \times OF_{L,j,t} + \beta_3 \times OF_{S,j,t} + \varepsilon_{j,t}, \quad (5.5)$$

where μ_t is a day fixed effect controlling for the linear effect of aggregate news such as macroeconomic shocks, and δ_j is a bond fixed effect, corresponding to the bond pair that is used to construct the mispricing measure. For constructing inflation swap orderflows, we use swap trades that are within a two-year maturity window compared to the average maturity of the corresponding bond pair.[21]

[Table 7]

Table 7 presents the results. Columns (1)-(2) present the estimates for the LDI-P sector without and with day fixed effects. We find that linker orderflow has the most significant effect

[18] Braun, Miranda-Agrippino, and Saha (2022) in turn build on Altavilla, Brugnolini, Gürkaynak, Motto, and Ragusa (2019), Cesa-Bianchi, Thwaites, and Vicondoa (2020) and Swanson (2021) among other contributions in the rapidly expanding monetary economics literature.

[19] As in Swanson (2021), the "target" shocks denote unexpected changes in conventional monetary policy (changes in the target instrument), whereas "path" shocks capture unexpected changes in expectations about the future path of the federal funds rate (e.g. forward guidance).

[20] See Section 6 of Fleckenstein (2013) for a detailed analysis of the effect of QE announcements on inflation mispricing in the US.

[21] For example, if on a given day the bond pair has an average maturity of 17 years, then we use swap trades between 15 years and 19 years of maturity to construct the corresponding swap orderflow.

on the mispricing (with estimated coefficients of -0.027 and -0.019), whereas the coefficients on nominal orderflow and inflation swaps are insignificant, but the point estimates have the expected sign. Columns (3)-(4) and (5)-(6) break down the sector into LDI and pension funds, indicating that when the LDI sector is buying nominal gilts or inflation protection, this activity increases the mispricing. According to Column (4), a unit increase in the LDI nominal gilt and inflation swap orderflow translates respectively in a statistically significant mispricing effect off +1.4 bps and +1.7 bps in the cross section. In relation to the pension funds sector, according to Column (6) a unit increase in its linkers orderflow translates in a statistically significant mispricing effect of -1.2 bps in the cross section.

The cross-sectional units in Table 7 are based on the bond pairs that are used to construct our aggregate mispricing measure (Figure 5). However, this is a tight specification given the nature of fixed income markets: it is plausible to assume that orderflows in adjacent bond and swap maturities may also also have an effect on inflation mispricing. To account for this possibility, we change the cross-sectional units from bond pairs to five maturity segments (0-5, 5-10, 10-20, 20-30 years and above 30 years of maturity), and we recompute daily bond and swap orderflows at this level. We also compute the (unweighted) average daily mispricing measure at this level. We then estimate this modified version of regression 5.5, and present the results in Table 8.

[Table 8]

We find that all estimated coefficients have the same sign as in Table 7, and the statistical and economic significance of the effects is increased for almost all estimates. We find that linker orderflow (per volume) has the largest effect on inflation mispricing, and there is no visible difference between effect of LDI managers and pension funds.

Our mispricing measure is a composite of nominal yield, real yields and inflation swap rates. A natural question arises regarding whether which component of the mispricing measure is most affected by LDI-P orderflows. Analysing this issue can also address the question of (Fleckenstein, Longstaff, and Lustig, 2014) regarding which market the mispricing originates from.

5.2.3 Explaining Yields and Inflation Swap Rates

To estimate the relationship between LDI-P orderflows and market rates, we replace the left-hand-side variable of 5.5 with inflation swap rates, nominal yields, real yields and breakeven inflation rates. Table 9 presents the effect of LDI-P orderflows in swap rates, table 10 presents the effect of LDI-P orderflows in nominal yields, table 11 presents the effect of LDI-P orderflows in real yields and table 12 presents the effect of LDI-P orderflows in bond breakeven inflation.

The results show that in addition to the natural within market orderflow price impact effect there are spillover effects across market, suggesting that these markets are interconnected. Furthermore, we observe some heterogeneity in the effects of orderflow originated in the LDI sector versus the one coming from the pension fund sector.

Table 9 shows that swap rates are affected by the aggregate LDI-P inflation swap market orderflow, the aggregate nominal orderflow of LDI-P investors and by the LDI sector linker orderflow. Specifically, column (2) shows that a unit increase in the scaled LDI-P inflation swaps orderflow as well as nominal gilt orderflow are associated with a +0.2 bps increase in inflation swap rates. Considering the LDI sector alone, column (4) indicates that a unite increase in the scaled LDI sector linker orderflow is associated to a +0.2 bps increase in inflation swap rates, surpassing the direct effect of the LDI inflation swaps orderflow.

[Table 9]

In relation to nominal yields, table 10 shows that in addition to the direct nominal bond orderflow effect on nominal rates, there is a secondary spillover effect from pension funds linkers orderflow. In concrete, column (2) shows that a unit increase in the scaled LDI–P nominal orderflow has a direct effect of -0.3 bps on nominal yields, channel which according to column (4) is stronger for the portion of the nominal gilt orderflow originated in pension funds. Column (6) shows a secondary effect in the opposite direction of +0.1 bps coming from pension funds linkers orderflow.

[Table 10]

For real yields, table 11 shows a direct linker orderflow effect on real rates primarily driven by the LDI sector. According to column (4), a unit increase in LDI linkers orderflow is associated to a -0.4 bps decrease in real yields, while according to column (6) a similar unit increase in linkers orderflow originated in pension funds has no statistically significant effect on real yields. Nevertheless, there is a spillover effect on real rates originated in pension funds trading activity in nominal gilts. According to column (6), a unit increase in pension funds nominal gilts orderflow is associated with a decrease of -0.3 bps in real rates. When considering the LDI-P sector as a whole, column (2) shows that this indirect nominal gilts orderflow effect on real rates is even more important than the direct linker orderflow.

[Table 11]

Table 12 shows that bond breakeven inflation rates are affected by the direct effect of inflation linked orderflow and the indirect effect of inflation swaps orderflow originated in the LDI-P sector as a whole. However, nominal gilts LDI-P orderflow does not have a statistically significant effect. Specifically, as shown in column (2) a one unit increase in the scaled orderflow of the LDI-P sector in linkers as well as in inflation swaps is associated to a +0.2 bps increase in bond breakeven inflation. Columns (4) and (6) show that these two channels are stronger when the orderflow originates from the LDI sector rather than the pension fund sector.

[Table 12]

5.2.4 Controlling for Primary Issuance and Central Bank Asset Purchases

Previous research has found a statistically significant connection between inflation mispricing and the primary issuance of government bonds. For example, Fleckenstein, Longstaff, and Lustig (2014) finds that the supply of both nominal and inflation-linked bonds has a significantly negative relation to mispricing. Given that the LDI-P sector is a main end-buyer of primary issuances in the UK (Lou, Pinter, and Uslu, 2022), a possible identification concern is that bond supply may directly affect LDI-P trading activity as well as mispricing. To address this, we include in our baseline panel regression additional controls capturing the issuance of nominal or inflation-linked bonds by the DMO. Tables A.5–A.6 in Appendix present the results, indicating that there are virtually no changes to the estimated coefficients corresponding to LDI-P orderflows. The estimated coefficients on the issuance variables are most statistically insignificant, though the point estimates are almost always negative, consistent with the findings of Fleckenstein, Longstaff, and Lustig (2014).

In addition, we also check whether the results are affected by central bank asset purchases. We therefore include as additional control variable a dummy taking value one if the Bank of England purchases gilts in the given maturity segment on the given day.[22] Given that these purchases only include nominal gilts (and not linkers) in our sample period, we would expect the purchases to have a positive effect on mispricing. Table A.7 in the Appendix confirms that the estimated coefficients on asset purchases are positive (albeit statistically insignificant); importantly the estimated effects pertaining LDI-P orderflows are unaffected.

6 The Behaviour of Hedge Funds

In this section, we study the reaction of hedge funds to inflation mispricing, given that hedge funds seem a natural proxy for textbook arbitrageurs.[23] Our main result is that hedge fund do react to changes in inflation mispricing by adjusting their bond portfolios appropriately, i.e. by selling more nominal bonds and buying more linkers when mispricing increases. However, they do not hedge these bond trades with inflation swaps, which we interpret as their reaction being speculative in nature and not constituting arbitrage in a textbook sense. We discuss the possible reasons as to why hedge funds may not be implementing the full arbitrage across the three markets.

6.1 Reaction to Changes in Mispricing

To study whether hedge funds simultaneously trade in the bond market and in the inflation swap market to exploit inflation mispricing, we merge all transactions across these three markets for each available legal entity identifier in the hedge fund sector.

[22]Data on asset purchases are obtained from the Bank of England's website.

[23]Previous research shows that hedge funds are more likely to trade on information than the LDI-P sector (Kondor and Pinter, 2022).

Table 13 shows summary statistics on the number of transactions from our merged dataset, covering the period 2018m1-2022m6, across the three categories nominal gilts, linkers and inflation swaps. In constructing this table, we discretised the maturity curve, by creating equidistant maturity buckets with one-year maturity defined by the bucket 0.5-1.5 years, two-year maturity defined by the bucket 1.5-2.5 years etc. If a hedge fund has nominal gilts, linker and swap transactions in the same maturity bucket, then it is classified as trading in all three markets – a necessary condition for trading according to the textbook arbitrage strategy aimed at profiting from inflation mispricing.

[Table 13]

We collapse the data at the fund-day-maturity level and present the relevant summary statistics in Table 13. We find that 86% of observations correspond to only trading in one market at a time. Importantly, only 0.27% of firm-day-maturity trade units feature trades from all three markets, i.e. the linker, nominal gilt and inflation swap markets. Another words, the necessary condition for observing a hedge fund implementing the inflation arbitrage trade is unlikely to be satisfied.

To quantify the directional response of the hedge fund sector, we estimate how orderflows in nominal gilts $OF_{N,t}$, linkers $OF_{L,t}$ and inflation swaps $OF_{S,t}$ react to changes in mispricing :

$$OF_{a,j,t} = \mu_t + \delta_j + \beta \times \Delta Misspricing_{j,t} + \varepsilon_{j,t}, \tag{6.1}$$

where μ_t is a day fixed effect, δ_j is a maturity fixed effect, and $OF_{a,j,t}$ is the orderflow measure – aggregated for the hedge fund sector – for market $a = \{nominal\ bond, linker, swap\}$ at maturity bucket j. The variable $\Delta Misspricing_{j,t}$ is the daily change in our mispricing measure at the maturity-day level. The results are presented in Table 15, indicating a significant reaction in hedge fund orderflow in nominal gilts and linkers: a unit increase in the mispricing is associated with a coefficient of -0.105 (column 2) with selling activity in nominal gilts and with a coefficient of +0.097 (column 4) with buying activity in linkers, i.e. they sell the relatively expensive asset and buy the relatively cheaper asset.

[Table 15]

Importantly, we see no reaction in hedge fund trading in inflation swaps following a change in inflation mispricing, indicating a lack of arbitrage activity in our sample. Overall, these results imply that hedge funds react to changes in inflation mispricing by adjusting their bond portfolios in a speculative manner without hedging their inflation exposure in the swap market.

6.2 Funding Constraints

What can explain the lack of arbitrage behaviour by hedge funds in our sample?[24] A natural explanation we explore relates to limits to arbitrage (Shleifer and Vishny, 1997). First, the

[24]We would like to thank Matt Roberts-Sklar for his useful comments that helped us improve on this section.

implementation of the inflation arbitrage would require the hedge fund to short sell the bond, if the fund does not have the bond in its inventory. Short selling the bond would entail sourcing the bond on the repo market by executing a reverse repo transaction.[25] To eliminate the risk associated with rolling over the repo contract during the life of the arbitrage trade, the maturity of the repo would need to match the maturity of the bond pairs underlying the arbitrage trade. In practice, such long-term repo contracts are virtually non-existent, and hedge funds in particular tend to use short-maturity repos. To show this, we compute summary statistics on the average maturity of hedge funds repos from the Sterling Money Market Data (SMMD), a proprietary dataset of the Bank of England. SMMD is a transaction-level dataset that covers the most significant segments of the sterling money markets.[26]

[Table 14]

Table 14 presents summary statistics based on all available hedge fund transactions in our sample of repo contracts over the 2018m1-2022m9 period. We find that around 95% of hedge fund repos have a maturity less than one month and more than a third of new contracts are overnight or one-day repos. This suggests that unless the inflation mispricing concentrates in the short-maturity segment of the yield curve, hedge funds would face significant roll-over risk during the life of the arbitrage trade.

Given that roll-over risk imposes a greater risk, the longer the maturity of the arbitrage trade, one may expect the mispricing to be less pronounced at short-maturities. To test this hypothesis, we reconstruct our measure of inflation mispricing for bond pairs less than two years of maturity.[27] In our sample period, this reduces the arbitrage opportunities universe to three bond pairs, as shown by Table 17 below.

[Tables 16–17]

These bonds present an average mispricing of -8 bps during the period, rendering the strategy unprofitable most of the time, as shown by Table 16 and Figure 8. There are shorter periods with a median duration of 7 to 89 days per bond in which the strategy would be profitable, although investors would have to react fast enough to profit from them (table 17). The most recent bond pair that enters the subsample in 2022 shows a more profitable mispricing that sharply jumps around July 2022.[28]

[25]The fund would source the nominal bond cashflows by swapping the inflation linked bonds cashflows into fixed payments as described by the basic arbitrage strategy. The cash needed as collateral for the reverse repo transaction will come from repoing the inflation linked bond against cash. The repo rate compensation obtained by the investor for posting cash against the nominal bond (reverse repo transaction) will cover the costs of the compensation demanded by the inflation linked repo transaction. See Figure A.2 for a summary of the arbitrage trade.

[26]The dataset includes, for each transaction, information on trade volume, pricing and collateral. In addition, the LEI codes of both counterparties are provided, which allows us to have a consistent merge across the gilt and swap market datasets. See Van Horen and Kotidis (2018); Gerba and Katsoulis (2021); Huser, Silvestri, and Veraart (2023) for recent applications of the dataset.

[27]This is motivated by the constraint related to the maximum maturity of fixed term repo transactions.

[28]The ISINs for this bond pair are GB00BFWFPL34 and GB00B85SFQ54.

[Figure 8]

Overall, these results suggest that roll-over risk in repo markets is a likely contributor to why hedge funds do not implement inflation trades, as predicted by textbook arbitrage strategies.

Costs of Inflation Swap Trading In addition to repos, trading in inflation swaps may entail addition costs that could hinder hedge funds' capacity to to fully implement inflation arbitrage trades. For example, it may be possible that the specific swap trades that an individual hedge fund would face is less favourable than average or quoted swap rates. This could be due to adverse selection effects associated with informational trading (Glosten and Milgrom, 1985). To explore this possibility, we quantify whether the transaction costs in inflation swaps might be different for hedge funds compared to other clients, by estimating the following trade-level regression:

$$Cost_i = I_{HF} + controls + \varepsilon_i, \tag{6.2}$$

where we measure transaction costs as the difference between the trade-specific swap rate and the average rate for the corresponding maturity, $Cost_i = [Rate_i - \overline{Rate}_{MatB,Day}]$, and I_{HF} is an indicator variable denoting whether the client is a hedge fund. The results in Table 18 show that on average hedge funds face higher rates when buying or selling inflation. In the context of the strategy which requires the investor to sell inflation, this represents an advantage of around 2 bps per year for hedge funds and asset managers compared to other investor types.

[Table 18]

In relation to the 135 bps average mispricing of the arbitrage strategy, discussed in section 4, these transaction costs do not represent an impediment for the implementation of the arbitrage, quite the opposite. For this type of cost to be an impediment, these costs would need to be around -13 bps per year for bond pairs with maturities up to 10 years and around -7 bps per year for bond pairs with maturities up to 20 years.

Although transaction costs in inflation swaps do not appear to be a constraint for implementing the inflation arbitrage, variation margins pose additional risks that hinder the arbitraging activity. That is, changes in the mark-to-market value of the swap contracts would require the hedge fund to post variation margins (in form cash) on a daily basis, which imposes large capital demands on holding the arbitrage trade until maturity.[29]

Overall, the volatility in our measure of inflation mispricing (and the underlying fixed-income prices) as well as associated margins and roll-over risks in funding markets could explain why hedge funds refrain from implementing fully fledged arbitrage trades.

[29] See the quickly expanding literature on how variation margins affect arbitrage activity and financial stability in general, e.g. Duffie, Scheicher, and Vuillemey (2015); Siriwardane (2019); Biais, Heider, and Hoerova (2020); Barth and Kahn (2021).

How do Hedge Funds Actually Trade Inflation Swaps? While giving a full characterisation of hedge fund behaviour in UK inflation swap markets is outside the scope of this paper, a closer inspection of the data gives some interesting insights. We find that inflation swap trading activity in the hedge fund sector is concentrated among a few investors, which is consistent with recent evidence on the large market concentration in UK interest rate derivatives markets (Pinter and Walker, 2023). The sector is dominated by a small number of hedge funds that seem to take large speculative positions based on their future inflation expectations. The sector changed from being an aggregate payer of inflation (till 2021) to being an aggregate receiver of inflation by early 2022 (Figure 4). Our discussions with market practitioners suggest that this change in the sector was driven by certain dominant discretionary funds expecting a faster acceleration in inflation than the rest of the market. Accordingly, we find in the data an increase in the frequency of "steepner" trades, where the given fund would enter simultaneously into two swap contracts, receiving (paying) inflation on the shorter (longer) maturity contract.[30]

7 Inflation Expectations: Surveys vs Market Prices

To explore the aggregate implications of our results, we connect our results with the vast literature on inflation expectations.[31] Specifically, we check how changes in survey measures of inflation expectations correlate with changes in market-based measures such as breakeven inflation of different maturities. As a survey measure of inflation expectations, we use the Bank of England Inflation Attitudes Survey which is at quarterly frequency. Specifically, we employ the median responses to the question "How much would you expect prices in the shops generally to change over the next 12 months?" (see Appendix A.6 for further details). Our sample period for this analysis is 2018Q1-2023Q1.[32]

We observe that there is a weak link between survey-based and market-based inflation expectations, as illustrated by the left panel of Figure 9. The corresponding R^2 values are 0.10, 0.06 and 0.04 for the 5-year. 7-year and 10-year breakevens.

[Figure 9]

To illustrate that some of the discrepancy between the survey-based and market-based inflation expectations is driven by LDI-P trading activity, we purge out the LDI-P orderflow effects from breakvens by running the following regression:

$$\Delta Breakeven_t = c + \sum_{j=0}^{10} [\beta_{1,j} \times OF_{N,t-j} + \beta_{2,j} \times OF_{L,t-j} + \beta_{3,j} \times OF_{S,t-j}] + \varepsilon_t, \quad (7.1)$$

[30]See Section A.5 in Appendix for a short summary of these strategies in the context of bond market trading.

[31]See Ang, Bekaert, and Wei (2007); Chernov and Mueller (2012); Bauer (2015); D'Amico, Kim, and Wei (2018); Weber, D'Acunto, Gorodnichenko, and Coibion (2022) among many others.

[32]For this, we extended our transaction-level dataset to the end of March 2023.

where we regress the realised breakevens on the LDI-P nominal gilt, linker and inflation scaled orderflows over the previous two trading weeks. We then extract the estimated residual ε_t as a proxy for the cleaned version of breakeven and checks the correlation with the survey-based measures.

The right-hand-side of Figure 9 illustrates the resulting correlation between the cleaned breakevens (ε_t) and the median inflation expectations from the Bank of England Inflation Attitudes Surveys. The correlation jumps from 0.10 to 0.44 in panel (a), from 0.06 to 0.40 in panel (b) and from 0.04 to 0.34 in panel (c).

While these results are intuitive, we interpret them as suggestive evidence given the limited time-series variation in the quarterly survey series.

8 Conclusion

In this paper, we revisit the widely documented phenomenon of the relative mispricing across nominal and inflation-linked bonds and inflation swaps in the context of the UK, where granular, trade-level datasets are available. Compared to the existing literature, this allows us to move beyond analysing aggregate data and to zoom in on how clients actually trade in inflation markets. We document that these markets are dominated by pension funds and liability-driven investors who actively trade across these three markets in order to hedge liabilities. This motivates our main hypothesis, that LDI-P trade flows are a key source of variation in inflation mispricing, which is strongly supported by the data.

Table and Figures

Tables

Table 1: **Average Mispricing Statistics**

Mean	Median	SDev	Min	Max	Median Pairs	Total Pairs	N
1.35	1.32	0.78	-1.15	4.35	9	12	1179

Notes: This table presents summary statistics of the weighted mispricing series between January-2018 to August-2022. N corresponds to the number of days. Mispricing is in percentage units, 1.35 means 1.35%.

Table 2: **Mispricing by Bond Pair**

Nominal	Inflation L.	Maturity	Mismatch	Mean	Median	SDev	Min	Max	N
GB00B4YRFP41	GB00BBDR7T29	2019	76	-0.02	0.01	0.25	-0.76	0.52	424
GB00BL68HG94	GB00B1Z5HQ14	2023	70	-0.07	0.23	0.77	-2.63	1.19	603
GB00BFWFPL34	GB00B85SFQ54	2024	31	0.95	0.98	0.46	-0.21	2.41	1036
GB00BL68HJ26	GB00BYY5F144	2026	51	1.50	1.53	0.43	0.49	2.40	567
GB00B16NNR78	GB00B128DH60	2027	15	2.87	2.88	0.59	1.36	4.87	1179
GB00BFX0ZL78	GB00BZ1NTB69	2028	73	3.27	3.14	0.82	1.43	5.95	1060
GB00BL68HH02	GB0008932666	2030	92	4.11	3.81	1.06	2.49	6.57	581
GB00BZB26Y51	GB00B1L6W962	2037	76	0.27	0.15	0.82	-1.46	3.77	1179
GB00BJQWYH73	GB00BGDYHF49	2041	73	1.22	1.12	1.02	-0.86	4.47	658
GB00B1VWPJ53	GB00B3MYD345	2042	15	-0.03	-0.26	1.34	-2.89	4.97	1179
GB00B84Z9V04	GB00B7RN0G65	2044	60	-0.24	-0.53	1.25	-2.62	5.01	1179
GB00B06YGN05	GB00B0CNHZ09	2055	15	4.56	4.59	3.35	-2.68	14.37	1179

Note: This table present summary statistics on inflation mispricing for each pair of bonds considered in the aggregated series between January-2018 to August-2022. Mismatch corresponds to the number of days mismatch between the nominal and inflation linked bond maturities. N corresponds to the number of observation days in the sample of each matched pair. Mean, Median, SDev (standard deviation), Min and Max correspond to the mispricing statistics. Mispricing is in percentage units, 1.50 means 1.50%.

Table 3: Pension Funds Funding and Mispricing Regressions (2018m1-2022m8)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A: Explanatory Variable $\triangle$UFR									
$\triangle$UFR	0.143***	0.179***	0.179***	0.179***	0.179***	0.166***	0.165***	0.184***	0.193***
	(2.74)	(5.71)	(5.88)	(5.05)	(5.13)	(4.23)	(3.97)	(4.68)	(3.50)
N	56	56	56	56	56	56	56	56	56
R_a^2	0.135	0.528	0.519	0.499	0.491	0.481	0.481	0.498	0.468
Panel B: Explanatory Variables $\triangle$UFR$_-$ and $\triangle$UFR$_+$									
$\triangle$UFR$_-$	0.174***	0.209***	0.209***	0.211***	0.211***	0.199***	0.203***	0.216***	0.227***
	(2.85)	(4.43)	(4.35)	(4.23)	(4.23)	(3.75)	(3.29)	(4.76)	(3.46)
$\triangle$UFR$_+$	0.119*	0.158***	0.158***	0.151**	0.150**	0.142**	0.135**	0.159**	0.168**
	(1.74)	(3.48)	(3.56)	(2.66)	(2.65)	(2.27)	(2.24)	(2.41)	(2.21)
N	56	56	56	56	56	56	56	56	56
R_a^2	0.124	0.524	0.514	0.495	0.486	0.476	0.477	0.491	0.461
Rates	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
T. Debt	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Vol	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
EPU	No	No	No	No	Yes	Yes	Yes	Yes	Yes
RPI	No	No	No	No	No	Yes	Yes	Yes	Yes
Liquidity$_1$	No	No	No	No	No	No	Yes	Yes	Yes
Liquidity$_2$	No	No	No	No	No	No	No	Yes	Yes
Year FE	No	No	No	No	No	No	No	No	Yes

Note: This table regresses changes in the inflation mispricing series on changes of pension funds' funding measure of Klingler and Sundaresan (2019) on a monthly basis for the period 2018m1 to 2022m8. The monthly estimates of UK pension funds' aggregate assets and liabilities come from the Pension Protection´s Fund PPF 7800 Index. Regression controls include LIBOR - OIS spread, the 25Y to 1Y nominal Gilt curve slope, the 25Y to 1Y UK RPI inflation swap curve slope, the total ratio of UK linkers and Gilts to GDP, the MOVE bond volatility index, the UK FTSE volatility index (IVIUK), the log of the UK´s Economic Policy Uncertainty Index, last two RPI inflation measures, the US Treasury Liquidity Index (GVLQUSD) as proxy for global treasury market liquidity, the 10-year bid-ask spread of gilts and linkers as proxy for local market liquidity and year fixed effects. All variables are in first differences, with the exception of the log of the UK Economic Policy Uncertainty Index and the last two month RPI percentage changes.

Table 4: Pension Funds Funding and Mispricing Regressions (2008m8-2022m8)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A: Explanatory Variable $\triangle$UFR									
$\triangle$UFR	0.207***	0.169**	0.170**	0.180**	0.177**	0.161***	0.165***	0.164***	0.157**
	(3.69)	(2.55)	(2.54)	(2.60)	(2.55)	(2.61)	(2.69)	(2.64)	(2.07)
N	169	169	169	169	169	169	169	169	169
R_a^2	0.209	0.319	0.317	0.321	0.319	0.327	0.327	0.323	0.281
Panel B: Explanatory Variables $\triangle$UFR$_-$ and $\triangle$UFR$_+$									
$\triangle$UFR$_-$	0.204***	0.196***	0.200***	0.238***	0.237***	0.185***	0.192***	0.200***	0.228***
	(3.11)	(4.33)	(4.56)	(3.83)	(3.75)	(3.01)	(3.22)	(3.33)	(3.31)
$\triangle$UFR$_+$	0.208***	0.166**	0.167**	0.174**	0.171**	0.159**	0.163**	0.162**	0.151*
	(3.41)	(2.34)	(2.33)	(2.42)	(2.37)	(2.45)	(2.52)	(2.45)	(1.90)
N	169	169	169	169	169	169	169	169	169
R_a^2	0.204	0.316	0.313	0.318	0.317	0.323	0.323	0.319	0.279
Rates	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
T. Debt	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Vol	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
EPU	No	No	No	No	Yes	Yes	Yes	Yes	Yes
RPI	No	No	No	No	No	Yes	Yes	Yes	Yes
Liquidity$_1$	No	No	No	No	No	No	Yes	Yes	Yes
Liquidity$_2$	No	No	No	No	No	No	No	Yes	Yes
Year FE	No	No	No	No	No	No	No	No	Yes

Note: This table regresses changes in the inflation mispricing series on changes of the pension funds' funding measure of Klingler and Sundaresan (2019) on a monthly basis for the period 2008m8 to 2022m8. The monthly estimates of UK pension funds aggregate assets and liabilities come from the Pension Protection´s Fund PPF 7800 Index. Regression controls include LIBOR - OIS spread, the 25Y to 1Y nominal Gilt curve slope, the 25Y to 1Y UK RPI inflation swap curve slope, the total ratio of UK linkers and Gilts to GDP, the MOVE bond volatility index, the UK FTSE volatility index (IVIUK), the log of the UK´s Economic Policy Uncertainty Index, last two RPI inflation measures, the US Treasury Liquidity Index (GVLQUSD) as proxy for global treasury market liquidity, the 10-year bid-ask spread of gilts and linkers as proxy for local market liquidity and year fixed effects. All variables are in first differences, with the exception of the log of the UK Economic Policy Uncertainty Index and the last two month RPI percentage changes.

Table 5: Mispricing and Pension-LDI Orderflow: Time-series Regressions

	(1)	(2)	(3)	(4)
Panel A: Pension Funds & LDIs				
Nominal OF	0.122**			0.094*
	(2.39)			(1.86)
Linker OF		-0.226***		-0.216***
		(-4.86)		(-4.69)
Inflation Swap OF			0.034**	0.032*
			(1.96)	(1.86)
N	1131	1131	1131	1131
R^2	0.004	0.020	0.002	0.024
Panel B: LDIs				
Nominal OF	0.090***			0.072**
	(2.63)			(2.14)
Linker OF		-0.154***		-0.140***
		(-4.54)		(-4.14)
Inflation Swap OF			0.055***	0.048***
			(4.41)	(3.81)
N	1131	1131	1131	1131
R^2	0.005	0.018	0.015	0.032
Panel C: Pension Funds				
Nominal OF	0.053			0.046
	(1.16)			(1.01)
Linker OF		-0.093***		-0.091***
		(-2.71)		(-2.65)
Inflation Swap OF			0.018	0.018
			(1.17)	(1.18)
N	1131	1131	1131	1131
R^2	0.000	0.005	0.000	0.005

Note: This table regresses the aggregate mispricing measure on nominal gilt, linker and inflation swap orderflows of the LDI-P sector (panel A), and for LDIs (panel B) and pension funds (panel C) separately. T-statistics in parentheses are based on robust standard errors. Asterisks denote significance levels (* p<0.1, ** p<0.05, *** p<0.01).

Table 6: Mispricing and Pension-LDI Orderflow: Time-series Regressions with Macroeconomic Shocks

	(1)	(3)	(5)
	Pension Funds & LDIs	LDIs	Pension Funds
Nominal OF	0.094*	0.073**	0.045
	(1.86)	(2.18)	(0.98)
Linker OF	-0.215***	-0.141***	-0.087**
	(-4.64)	(-4.16)	(-2.53)
Inflation Swap OF	0.032*	0.048***	0.018
	(1.88)	(3.79)	(1.16)
RPI Shock	-6.127	-4.944	-4.651
	(-0.38)	(-0.31)	(-0.29)
CPI Shock	-1.504	0.468	-1.747
	(-0.08)	(0.02)	(-0.09)
MP Target Shock	-1.940	-2.208*	-1.918*
	(-1.60)	(-1.76)	(-1.71)
MP Path Shock	1.054	1.224	0.920
	(0.75)	(0.91)	(0.66)
N	-0.002	-0.008	-0.004
R^2	(-0.22)	(-0.78)	(-0.39)

Note: This table regresses the aggregate mispricing measure on nominal gilt, linker and inflation swap orderflows of the LDI-P sector (panel A), and for LDIs (panel B) and pension funds (panel C) separately. As additional controls, we include RPI and CPI announcements (Swanson and Williams (2014)) as well as shocks to monetary policy target and path (Braun, Miranda-Agrippino, and Saha (2022); Swanson (2021)). T-statistics in parentheses are based on robust standard errors. Asterisks denote significance levels (* p<0.1, ** p<0.05, *** p<0.01).

Table 7: Mispricing and Pension-LDI Orderflow: Panel Regressions at the Bond Pair – Day Level

	(1)	(2)	(3)	(4)	(5)	(6)
	Pension Funds & LDIs		LDIs		Pension Funds	
Nominal OF	0.016	0.014	0.022**	0.014**	0.015	0.014
	(1.50)	(1.45)	(2.84)	(2.48)	(1.29)	(1.29)
Linker OF	-0.027**	-0.019**	-0.022**	-0.012	-0.019**	-0.012**
	(-2.81)	(-2.27)	(-2.34)	(-1.45)	(-2.78)	(-2.47)
Inflation Swap OF	0.033*	0.016	0.051**	0.017*	0.023	0.013
	(2.15)	(1.39)	(2.95)	(1.86)	(1.68)	(1.24)
N	10765	10765	10765	10765	10765	10765
R^2	0.004	0.345	0.007	0.344	0.002	0.344
Maturity FE	Yes	Yes	Yes	Yes	Yes	Yes
Day FE	No	Yes	No	Yes	No	Yes

Note: This table regresses the inflation mispricing series on nominal Gilt, linker and inflation swaps LDI-P orderflow. The dataset is collapsed at the day-bond level, and covers the period is 2018m1-2022m6. The regressions include maturity specific fixed effects and day fixed effects. T-statistics in parentheses are based on robust standard errors, using two-way clustering at the day and dealer level. Asterisks denote significance levels (* p<0.1, ** p<0.05, *** p<0.01).

Table 8: Mispricing and Pension-LDI Orderflow: Panel Regressions at the Maturity Segment – Day Level

	(1)	(2)	(3)	(4)	(5)	(6)
	Pension Funds & LDIs		LDIs		Pension Funds	
Nominal OF	0.051***	0.045**	0.041***	0.026*	0.036**	0.044***
	(2.64)	(2.28)	(3.01)	(1.86)	(2.10)	(2.65)
Linker OF	-0.089***	-0.066***	-0.057***	-0.042***	-0.052***	-0.046***
	(-6.38)	(-4.28)	(-4.65)	(-3.19)	(-4.84)	(-3.98)
Inflation Swap OF	0.045***	0.026**	0.037***	0.006	0.040***	0.026**
	(4.15)	(2.41)	(3.08)	(0.57)	(3.77)	(2.52)
N	5735	5735	5735	5735	5735	5735
R^2	0.008	0.296	0.005	0.293	0.005	0.295
Maturity FE	Yes	Yes	Yes	Yes	Yes	Yes
Day FE	No	Yes	No	Yes	No	Yes

Note: This table regresses the inflation mispricing series on nominal Gilt, linker and inflation swaps LDI-P orderflow. The dataset is collapsed at the day-maturity level, and covers the period is 2018m1-2022m6. The regressions include maturity specific fixed effects and day fixed effects. T-statistics in parentheses are based on robust standard errors, using two-way clustering at the day and dealer level. Asterisks denote significance levels (* p<0.1, ** p<0.05, *** p<0.01).

Table 9: Swap Rates and Pension-LDI Orderflow: Panel Regressions

	(1)	(2)	(3)	(4)	(5)	(6)
	Pension Funds & LDIs		LDIs		Pension Funds	
Nominal OF	-0.000	0.002*	-0.002	-0.001	0.002	0.002***
	(-0.14)	(1.77)	(-1.50)	(-0.64)	(1.10)	(2.80)
Linker OF	0.005***	0.001	0.004***	0.002**	0.003***	0.001
	(3.02)	(1.55)	(2.73)	(2.18)	(2.84)	(1.54)
Inflation Swap OF	0.001	0.002***	0.002*	0.001	0.001	0.001*
	(1.45)	(2.89)	(1.95)	(1.53)	(0.75)	(1.76)
N	5735	5735	5735	5735	5735	5735
R^2	0.002	0.733	0.003	0.732	0.001	0.733
Maturity FE	Yes	Yes	Yes	Yes	Yes	Yes
Day FE	No	Yes	No	Yes	No	Yes

Note: This table regresses inflation swap rates on LDI-P nominal Gilt, linker and inflation swaps orderflow. The dataset is collapsed at the day-bond level, and covers the period is 2018m1-2022m6. The regressions include maturity specific fixed effects and day fixed effects. T-statistics in parentheses are based on robust standard errors, using two-way clustering at the day and dealer level. Asterisks denote significance levels (* p<0.1, ** p<0.05, *** p<0.01).

Table 10: Nominal Yields and Pension-LDI Orderflow: Panel Regressions

	(1)	(2)	(3)	(4)	(5)	(6)
	Pension Funds & LDIs		LDIs		Pension Funds	
Nominal OF	-0.003	-0.003***	-0.002	-0.002**	-0.002	-0.003***
	(-1.23)	(-3.78)	(-1.27)	(-2.42)	(-1.24)	(-4.39)
Linker OF	0.003	0.000	0.001	-0.001	0.003*	0.001**
	(1.54)	(0.20)	(0.30)	(-0.84)	(1.81)	(2.03)
Inflation Swap OF	-0.003*	0.001	-0.001	0.001	-0.003**	0.000
	(-1.80)	(1.43)	(-0.34)	(1.16)	(-2.10)	(0.96)
N	5735	5735	5735	5735	5735	5735
R^2	0.000	0.883	-0.001	0.883	0.001	0.883
Maturity FE	Yes	Yes	Yes	Yes	Yes	Yes
Day FE	No	Yes	No	Yes	No	Yes

Note: This table regresses nominal gilt yields on LDI-P nominal Gilt, linker and inflation swaps orderflow. The dataset is collapsed at the day-bond level, and covers the period is 2018m1-2022m6. The regressions include maturity specific fixed effects and day fixed effects. T-statistics in parentheses are based on robust standard errors, using two-way clustering at the day and dealer level. Asterisks denote significance levels (* p<0.1, ** p<0.05, *** p<0.01).

Table 11: Real Yields and Pension-LDI Orderflow: Panel Regressions

	(1)	(2)	(3)	(4)	(5)	(6)
	Pension Funds & LDIs		LDIs		Pension Funds	
Nominal OF	0.000	-0.003**	0.001	-0.001	-0.002	-0.003***
	(0.09)	(-2.25)	(0.40)	(-0.70)	(-0.69)	(-2.95)
Linker OF	-0.004	-0.002*	-0.006***	-0.004***	-0.001	0.001
	(-1.59)	(-1.78)	(-2.60)	(-3.89)	(-0.42)	(0.78)
Inflation Swap OF	-0.004**	-0.001	-0.003	-0.001	-0.003*	0.000
	(-2.19)	(-0.79)	(-1.34)	(-0.69)	(-1.84)	(0.05)
N	5735	5735	5735	5735	5735	5735
R^2	0.000	0.835	0.001	0.835	-0.000	0.835
Maturity FE	Yes	Yes	Yes	Yes	Yes	Yes
Day FE	No	Yes	No	Yes	No	Yes

Note: This table regresses real yields (using inflation-linked bonds) on LDI-P nominal Gilt, linker and inflation swaps orderflow. The dataset is collapsed at the day-bond level, and covers the period is 2018m1-2022m6. The regressions include maturity specific fixed effects and day fixed effects. T-statistics in parentheses are based on robust standard errors, using two-way clustering at the day and dealer level. Asterisks denote significance levels (* p<0.1, ** p<0.05, *** p<0.01).

Table 12: Breakeven inflation and Pension-LDI Orderflow: Panel Regressions

	(1)	(2)	(3)	(4)	(5)	(6)
	Pension Funds & LDIs		LDIs		Pension Funds	
Nominal OF	-0.003	-0.000	-0.003**	-0.001	-0.000	0.000
	(-1.49)	(-0.04)	(-2.10)	(-0.58)	(-0.28)	(0.41)
Linker OF	0.008***	0.002**	0.007***	0.003***	0.004***	0.001
	(4.37)	(2.30)	(4.36)	(3.30)	(3.14)	(1.03)
Inflation Swap OF	0.002	0.002**	0.002**	0.001*	0.000	0.001
	(1.40)	(2.45)	(2.01)	(1.77)	(0.33)	(0.89)
N	5735	5735	5735	5735	5735	5735
R^2	0.004	0.684	0.006	0.685	0.001	0.684
Maturity FE	Yes	Yes	Yes	Yes	Yes	Yes
Day FE	No	Yes	No	Yes	No	Yes

Note: This table regresses bond breakeven inflation (linker - Gilt yield) on LDI-P nominal Gilt, linker and inflation swaps orderflow. The dataset is collapsed at the day-bond level, and covers the period is 2018m1-2022m6. The regressions include maturity specific fixed effects and day fixed effects. T-statistics in parentheses are based on robust standard errors, using two-way clustering at the day and dealer level. Asterisks denote significance levels (* p<0.1, ** p<0.05, *** p<0.01).

Table 13: Transactions at the Linker, Nominal Bond and Inflation Swap Markets

Firm-Day-Maturity Level		
One Market	42,609	86.08%
Two Markets	6,754	13.64%
Three Markets	135	0.27%
	49,498	100%

Note: This table collapses the dataset at the firm-day-maturity level, and allocates these units into three categories depending on whether the given unit contains trades from one, two or all three markets (linker, nominal bond and inflation swap markets). Panel B presents statistics at the transaction level, and shows the number of trades across the three categories. The time period is 2018m1-2022m6.

Table 14: Hedge Fund Repo Volume by Maturity, 2018m1-2022m8

(£ trillions)		
0-1 day	11.33	36.2%
1 day - 1 month	18.59	59.3%
1 month - 1 year	0.48	1.5%
Open	0.93	3.0%
	31.33	100%

Note: This table summarises total repo trading volume (in £trillions) over the period 2018m1-2022m8 for hedge funds that are active in the gilt market during this period. The sample is from the SMMD dataset.

Table 15: Hedge Funds Trading Following a Rise in Mispricing

	(1)	(2)	(3)	(4)	(5)	(6)
	Nominal OF		Linker OF		Inflation Swap OF	
Mispricing	-0.083***	-0.105***	0.087**	0.097**	-0.009	0.020
	(-6.17)	(-4.61)	(2.31)	(2.61)	(-0.54)	(0.92)
N	10783	10783	10783	10783	10783	10783
R^2	0.008	0.009	0.002	0.045	0.004	0.124
Maturity FE	Yes	Yes	Yes	Yes	Yes	Yes
Day FE	No	Yes	No	Yes	No	Yes

Note: This table regresses measures of linker, Gilt and inflation swaps orderflow on time-varying measures of mispricing. The dataset is collapsed at the day-bond level, and covers the period 2018m1-2022m6. The different columns correspond to different regression specifications with various combinations of fixed effects summarised at the bottom of the table. T-statistics in parentheses are based on robust standard errors, using two-way clustering at the day and dealer level. Asterisks denote significance levels (* p<0.1, ** p<0.05, *** p<0.01).

Table 16: Average Mispricing Statistics (Time To Maturity <2Y)

Mean	Median	S.Dev	Min	Max	Median Pairs	Total Pairs	N
-0.08	0.02	0.52	-1.88	1.66	1	3	823

Notes: This table presents summary statistics of the weighted mispricing series between January 2018 and August-2022 for bond pairs with a remaining time to maturity below 2 years. N corresponds to the number of days.

Table 17: Mispricing Duration

Bond Pair		Mispricing Duration (+)				Mispricing
Isins	#trading days	mean	median	min	max	mean
GB00B4YRFP41:GB00BBDR7T29	424	20	7	1	113	-0.02
GB00BL68HG94:GB00B1Z5HQ14	399	47	44	20	82	-0.32
GB00BFWFPL34:GB00B85SFQ54	89	89	89	89	89	0.94

Note: The table contains all the bond pairs with a maturity below 2 years at any point in time during the period 2018m1-2022m8. The Mispricing Duration (+) section summarizes the average, median, minimum and maximum number of days the mispricing of the corresponding bond pair stayed continuously above 0. The Mispricing section summarizes the mean mispricing of the corresponding bond pair during the period. The mispricing is measured in percentage terms (-0.32 means -0.32%).

Table 18: Costs of Swap Trading

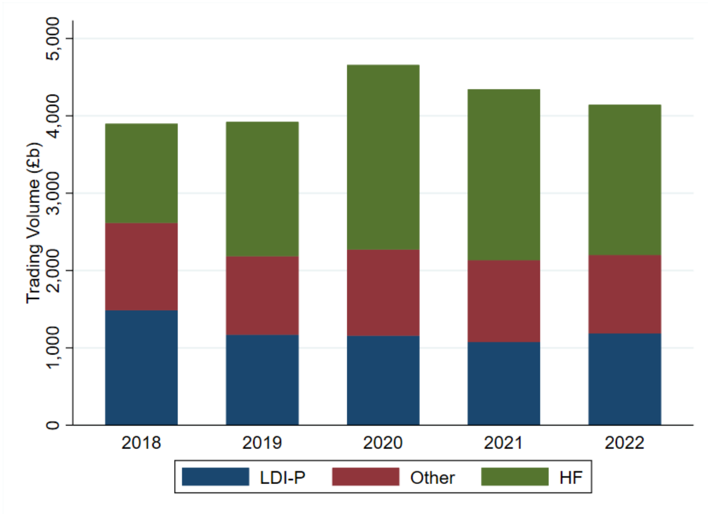
	(1)	(2)	(3)	(4)	(5)
Panel A: Investors Buying Inflation					
I_{HF}	0.531	1.317**	0.798	1.394	2.005*
	(0.45)	(2.05)	(0.83)	(1.25)	(1.76)
$I_{Cleared}$	0.917	1.000	2.354***	2.479**	3.267*
	(1.06)	(0.87)	(2.81)	(2.22)	(1.87)
N	9684	9674	9674	9537	9485
R_a^2	0.058	0.087	0.090	0.185	0.189
Panel B: Investors Selling Inflation					
I_{HF}	0.880	0.754	1.018	0.872	2.159**
	(0.82)	(0.86)	(1.12)	(1.03)	(2.46)
$I_{Cleared}$	0.701	0.996	1.547	2.183	3.388
	(0.74)	(0.80)	(1.25)	(1.48)	(1.57)
N	7300	7292	7292	7141	7082
R_a^2	0.285	0.301	0.303	0.333	0.322
Day#Mat FE	Yes	Yes	Yes	Yes	Yes
Investor FE	No	Yes	Yes	No	No
Coun FE	No	No	Yes	No	No
Day#Coun FE	No	No	No	Yes	Yes
Month#Investor	No	No	No	Yes	Yes
Investor#Coun	No	No	No	No	Yes

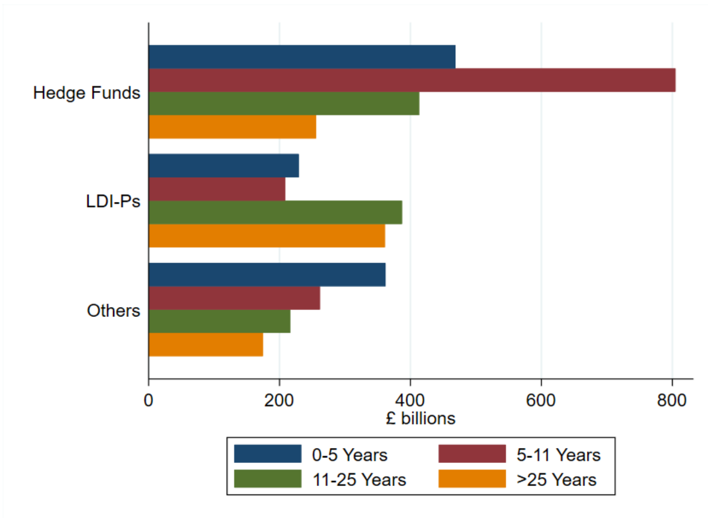
Note: Panel A of this table summarizes the costs of buying the floating leg of an inflation swap in the UK Market. In panel A, the variable Y corresponds to the basis point deviation from the median rate that all investors in the data set pay for buying inflation and the variable X is a dummy indicating whether the investor is a hedge fund (Dummy=1). In panel B, the variable Y corresponds to the basis point deviation from the median rate that all investors in the data set receive for selling inflation. The dummy $I_{Cleared}$ marks central cleared trades. The fixed effects considered include interactions of day of trade, month, maturity bucket, investor and counterparty.

Figures

Figure 1: Trading Activity in the UK Gilt Market by Client Type

(a) Trading Volume by Client Type



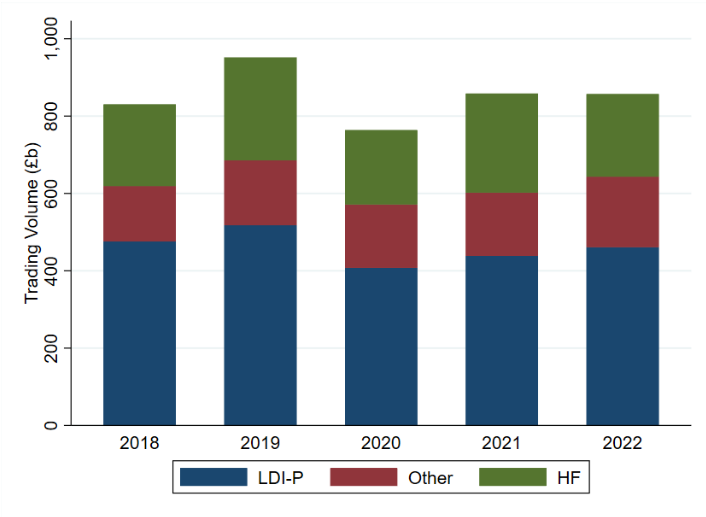


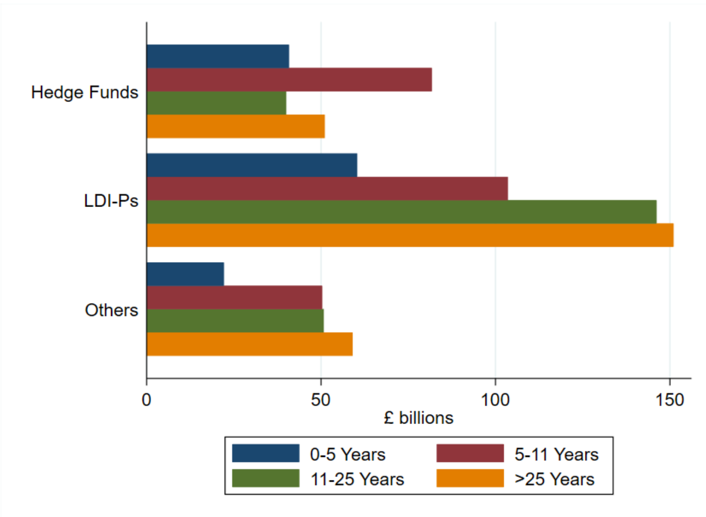
(b) Trading Volume by Client Type and by Maturity

Note: this Figure presents summary statistics on the UK gilt market. Panel A shows the total trading volume in £ billions by client type. Panel B shows the breakdown across four maturity segments.

Figure 2: Trading Activity in the UK Inflation-Linked Gilt Market by Client Type

(a) Trading Volume by Client Type



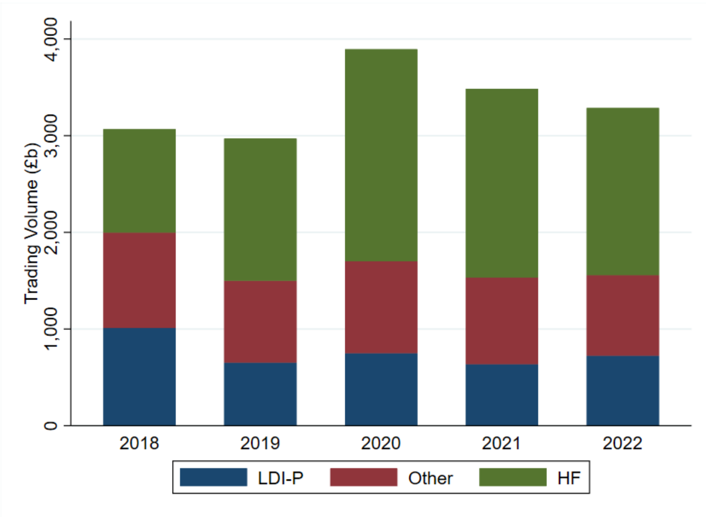


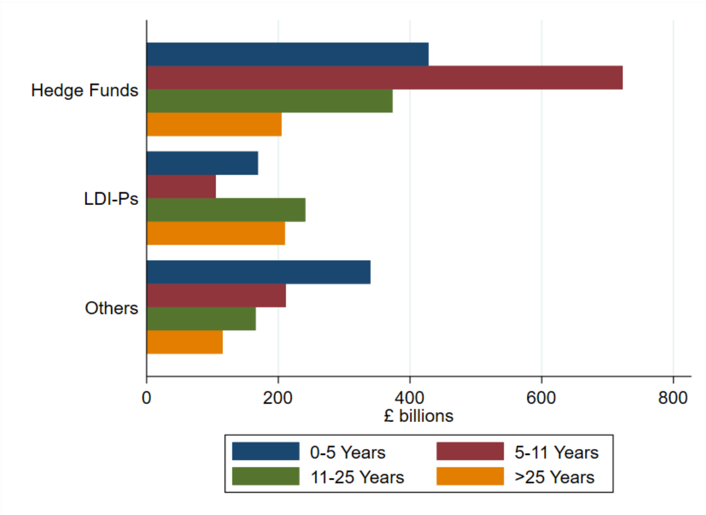
(b) Trading Volume by Client Type and by Maturity

Note: this Figure presents summary statistics on the UK inflation-linked gilt market. Panel A shows the total trading volume in £ billions by client type. Panel B shows the breakdown across four maturity segments.

Figure 3: Trading Activity in the UK Conventional Gilt Market by Client Type

(a) Trading Volume by Client Type



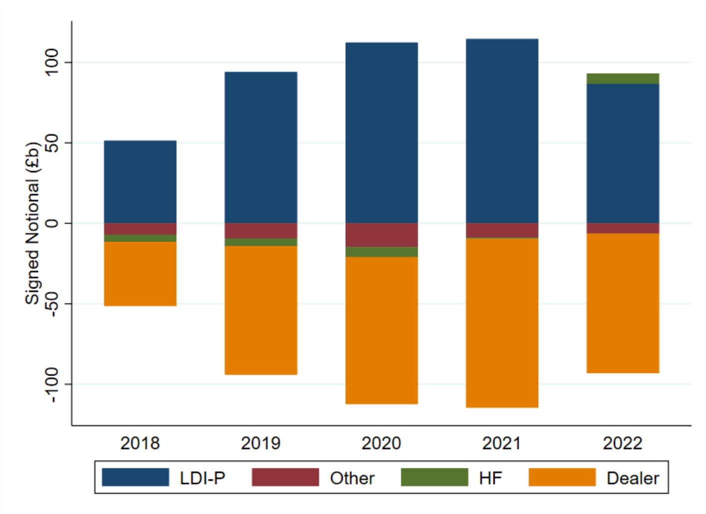


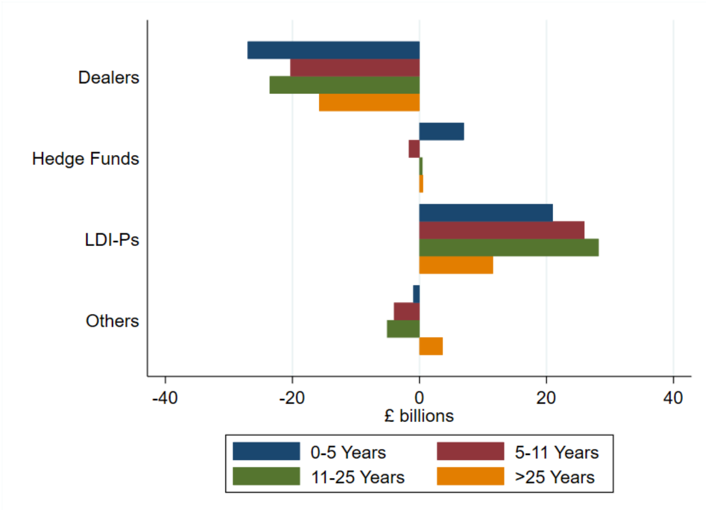
(b) Trading Volume by Client Type and by Maturity

Note: this Figure presents summary statistics on the UK conventional (nominal) gilt market. Panel A shows the total trading volume in £ billions by client type. Panel B shows the breakdown across four maturity segments.

Figure 4: Positioning in the UK Inflation Swap Market by Client Type

(a) Total Net (Signed) Notional by Client Type





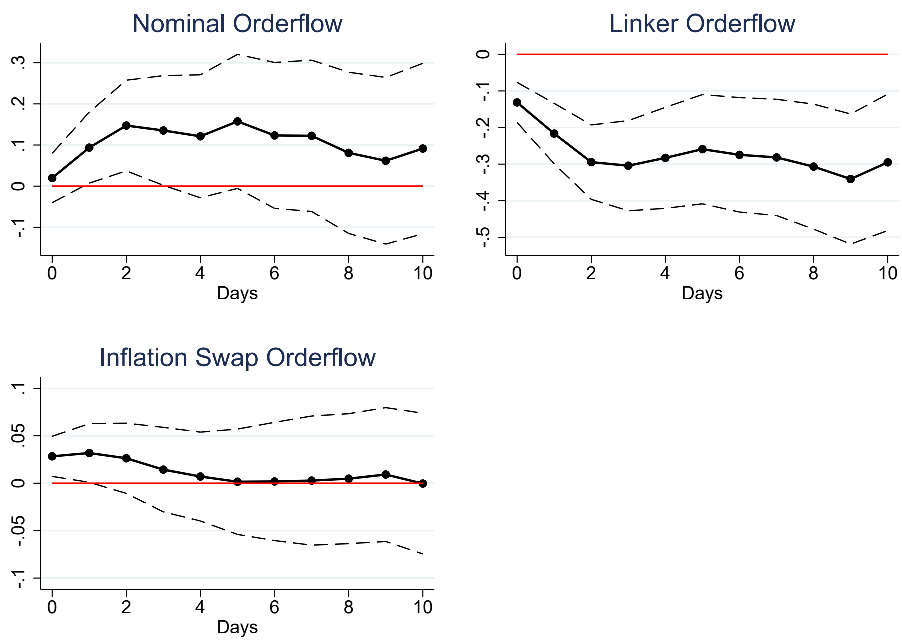
(b) Net (Signed) Notional by Client Type and by Maturity

Note: this Figure presents summary statistics on the UK inflation swap market. We aggregate contract-level data on swaps (with the floating rate linked to RPI), obtained from Unavista and DTCC – two of the largest EMIR trade repositories. Panel A shows the total net (signed) notional in £ billions by client type. Panel B shows the breakdown across four maturity segments.

Figure 5: **Average Mispricing Series**

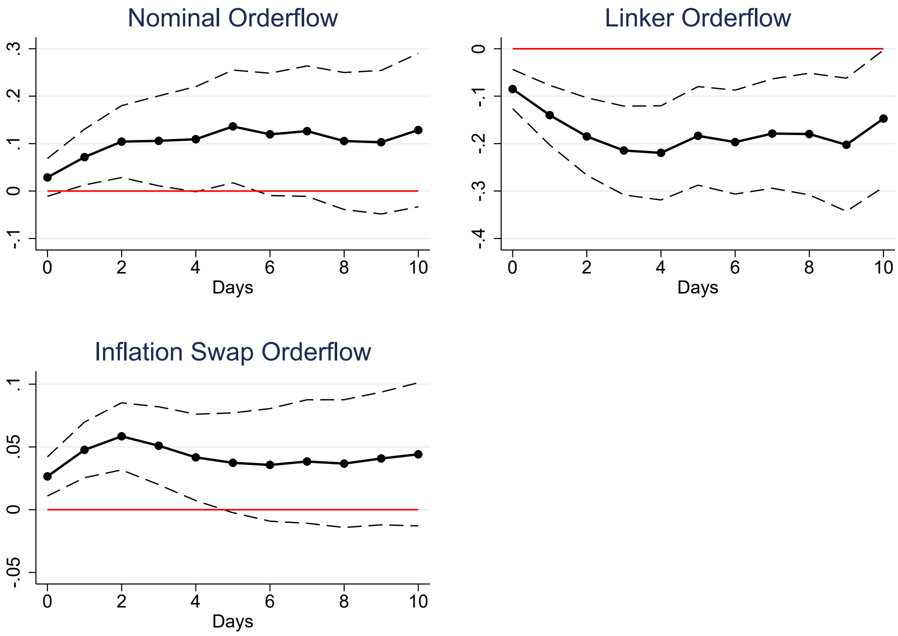
Note: The graph represents the aggregated mispricing between January-2018 to August-2022. The aggregated mispricing series corresponds to a weighted average of the difference in price between the UK Nominal Gilts observed market prices and their synthetic prices. The difference in prices are weighted by the total outstanding issuance of the linked bond used to calculate the synthetic price.

Figure 6: Mispricing and Pension-LDI Orderflow: Time-series Regressions over Longer Horizons

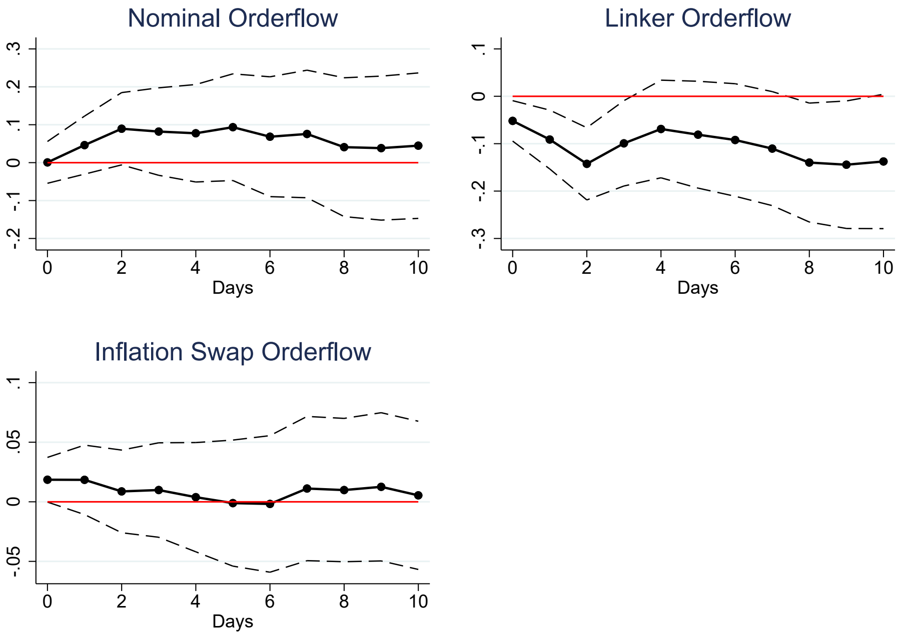


Note: this Figure presents summary statistics on the UK Swap Inflation Market. Panel A shows the gross traded notional (total notional) in £ billions by client type. Panel B shows the same graph excluding GEMM Banks.

Figure 7: Time-series Regressions over Longer Horizons: Pension vs LDI Orderflow



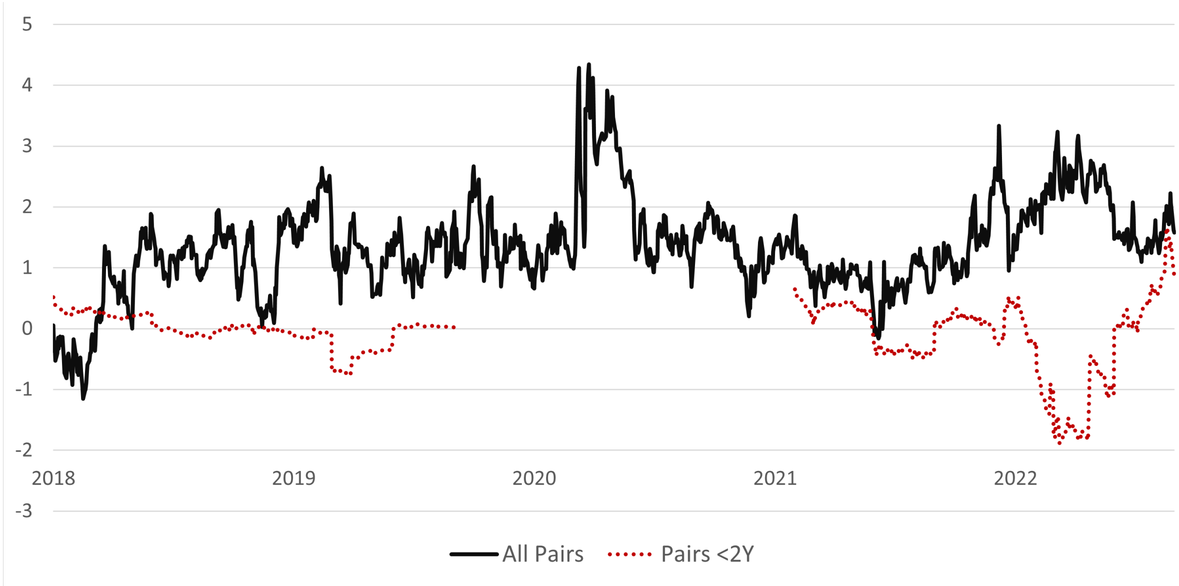
(a) LDIs



(b) Pension Funds

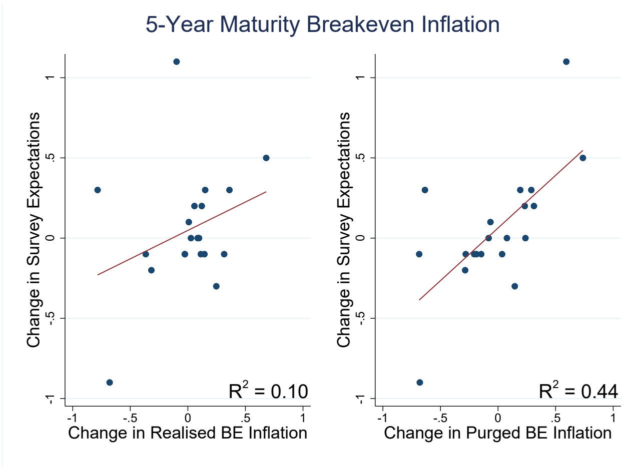
Note: this Figure presents summary statistics on the UK Swap Inflation Market. Panel A shows the gross traded notional (total notional) in £ billions by client type. Panel B shows the same graph excluding GEMM Banks.

Figure 8: **Average Mispricing Series**

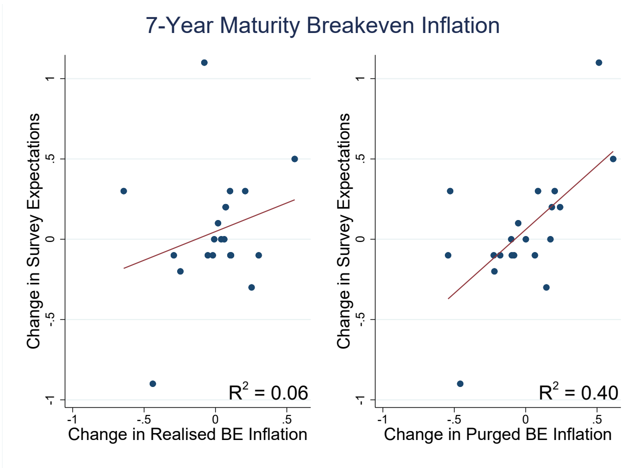


Note: The continuous line represents the aggregated mispricing between 2018m1-2022m8 for all bond-pairs available. The dotted line represents the mispricing series for all the bond pairs that had a remaining maturity below 2 years at any point in time during the period 2018m1-2022m8. The empty sections of the dotted lines represents periods for which there were no bond-pairs with a remaining maturity below 2 years. The mispricing is expressed in percentage terms (2 refers to 2%).

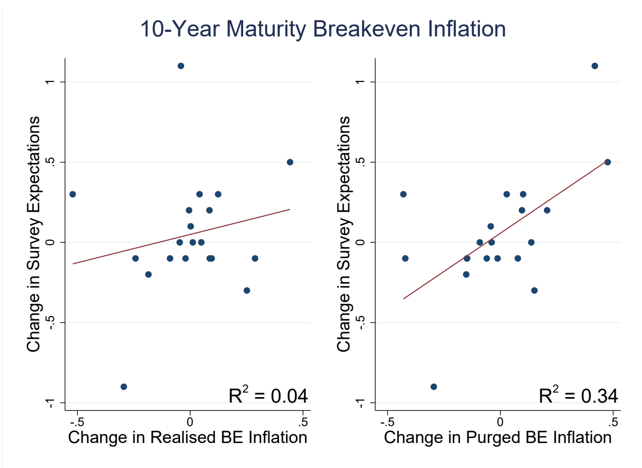
Figure 9: Breakeven Inflation vs Survey Expectations: Purging out LDI-Pension Orderflow



(a) 5-year Breakeven Inflation



(b) 7-year Breakeven Inflation



(c) 10-year Breakeven Inflation

Note: This Figure shows the median expected inflation of the Bank of England Inflation Attitudes and the UK gilt bond breakeven inflations at 5-year, 7-year and 10-year horizons (quarter frequency).

A Appendix

A.1 Mispricing Calculation

The mispricing measure calculated for each UK Gilt-linker bond pair consists on the price difference between the actual market price of the Gilt bond and the its synthetic replication price, per £100 of nominal Gilt face value exposure at each trading day, as described in (Fleckenstein, Longstaff, and Lustig, 2014). The synthetic replication price is constructed by taking 1) a position in the linker bond (UK inflation linked bond) that most closely matches the maturity and coupon dates of the target nominal Gilt bond, 2) swapping at time-0 the future floating inflation indexed cashflows of this linker bond using RPI inflation swaps, 3) matching any differences between the converted cashflows and the target nominal cashflows using long and/or short positions in UK Treasury Strips , 4) calculating the yield to maturity of this synthetic nominal bond and finally 5) pricing the exact target nominal Gilt bond using the previously calculated yield to maturity.

The (1) linker bond position is sized in such a quantity that it represents at each trading day (t_0) the same £100 of nominal exposure of the target nominal Gilt bond over which coupons C and principal P will be paid, with the difference that flows will be indexed by inflation. Since a £100 face value exposure in a linker bond represents at time t_0 a nominal exposure of $100 * \frac{I_{t0}}{I_{issue}}$, where I_0 and I_{issue} represent the inflation index of the linker bond at trading date t_0 and the linker issue date respectively, the face value of the replication strategy position in the linker bond at each trading date is equal to $100 * \frac{I_{issue}}{I_{t0}}$ so to start with an equivalent nominal face value of 100. This position has a market value numerically equivalent to the (real) price of the bond ex-inflation. In paralell, the replication strategy (2) takes positions in RPI inflation swaps at trading day t_0, converting each future unknown floating cashflow $C * \left(100 * \frac{I_{issue}}{I_{t0}}\right) * \frac{I_C}{I_{issue}}$ into a certain nominal cashflow $C * 100 * (1 + Swap_{Tc})^{Tc}$. Where $(1 + Swap_{Tc})^{Tc}$ represents the fixed payment of the RPI swaps for the period between the strategy inception date (t_0) and the cashflow (C) date. The counterparty of the swap will receive the floating inflation $\left(\frac{I_C}{I_{t0}}\right)$. The swap position calculation takes into account the indexing lag of each linker bond (3 months, 8 months). To take into account that the certain nominal quantities of step (2) do not necessarily match exactly the nominal amounts of the target Gilt bond cashflows C_{target}, the replication strategy (3) takes Strip positions to fill each one of the gaps $100 * C_{target} - 100 * (1 + Swap_{Tc})^{Tc}$. The resulting synthetic cashflows at each trading day t0 end up being the same in nominal terms as the target nominal Gilt cashflows.

To account for any small matching differences in relation to the timing of the replicating cashflows and the target cashflows, the calculation (4) takes from the synthetic structure price the implicit yield to maturity and (5) uses this yield to price the target bond. The difference between this last price and the quoted market price of the nominal Gilt bond represents the mispricing for each Gilt-linker bond pair. This calculating is repeated for each trading date t_0 to obtain a time series of the mispricing.

A.2 Extended Monthly Analysis of Mispricing and Pension Funds: Bond Pairs

Bond Pairs used in the extended monthly analysis starting in August 2008 until August 2022.

Table A.1: Monthly Analysis Bond Pairs

Nominal	Inflation L.	Mismatch (Days)	Maturity	N (Months)
GB0008921883	GB0009036715	42	2013	60
GB00B7F9S958	GB00B0V3WQ75	76	2017	66
GB00B4YRFP41	GB00BBDR7T29	76	2019	73
GB00BL68HG94	GB00B1Z5HQ14	70	2023	29
GB00BFWFPL34	GB00B85SFQ54	31	2024	50
GB00BL68HJ26	GB00BYY5F144	51	2026	27
GB00B16NNR78	GB00B128DH60	15	2027	169
GB00BFX0ZL78	GB00BZ1NTB69	73	2028	51
GB00BL68HH02	GB0008932666	92	2030	28
GB00BZB26Y51	GB00B1L6W962	76	2037	70
GB00BJQWYH73	GB00BGDYHF49	73	2041	32
GB00B1VWPJ53	GB00B3MYD345	15	2042	158
GB00B84Z9V04	GB00B7RN0G65	60	2044	119
GB00B06YGN05	GB00B0CNHZ09	15	2055	169

Note: This table summarizes the main mispricing statistics for each pair of bonds considered in the extended mispricing monthly series running from August-2008 to August-2022. Mismatch corresponds to the number of days mismatch between the nominal and inflation linked bond maturities. N correspondes to the number of observation days in the sample of each matched pair.

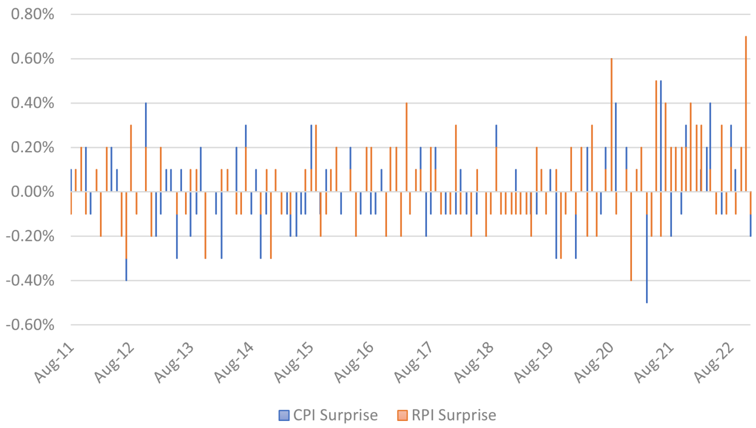
A.3 Inflation News

As a measure of inflation shocks, we use the surprise component of UK inflation releases following the methodology proposed by Gurkaynak, Sack, and Swanson (2005). Specifically, we use the inflation surprise of the UK CPI ex Energy, Food, Alcohol and Tobacco (UKHCA9IQ Index, yoy) and the UK RPI (UKRPXYOY Index, yoy). The inflation surprise is defined as the actual inflation announcement less the median figure of the Bloomberg´s markets participant survey. A positive inflation surprise indicates that the actual inflation was above the market participants expectations. For the UK CPI Index we have 12 announcements per year, 137 announcements from August-2011 till December-2022 and an average positive surprise of +0.01% during the same period. For the UK RPI series we also have 12 announcements per year, 137 announcements from August 2011 until December 2022 and an average positive surprise of +0.03% during the same period. The positive surprise indicates that on average the actual inflation figures were above market participants´ expectations.[33]

Figure A.1 below shows the UK CPI and RPI inflation surprises for the period 2011m8-2022m12.

[33] Additionally, we also experimented with integrating both CPI and RPI surprises into a unique surprise index following the weighting scheme described by Swanson and Williams (2014).

Figure A.1: Inflation Surprise Series



Note: The figure plots the time-series of the CPI and RPI surprise series, covering the period 2011m8-2022m12.

During the period prior to 2021 the average CPI surprise was close to 0%. For the period 2021-2022 the average CPI surprise was close to 0.10%. Table-A.2 below. The RPI surprises show similar dynamics. Prior to 2021 the average RPI surprise was around 0.01%, while it increased to 0.15% during the period 2021-2022.

Table A.2: Average Inflation Surprise

	CPI Surprise	RPI Surprise
2011-2020	-0.004%	0.005%
2021-2022	0.096%	0.150%
Whole Sample	0.014%	0.031%

Note: The table presents the mean of the time-series of the CPI and RPI surprise series, covering the period 2011m8-2022m12 ("Whole Sample") as well as subperiod.

A.4 Hypothesis: Fast Mispricing Episodes

In this section we investigate whether the average duration of the mispricing episodes could be short enough to preclude the execution of the arbitrage strategy. In the context of the UK gilt market, this could be an impediment for institutional investors that take investment decisions through a more complex and slow process.

For the period 2018m1-2022m8 studied, as shown in Table A.3 below, there are only 5 bond pairs out of the 12 bond pairs for which the mispricing stayed positive for 100 days or more. This reduces the investment universe over which investors with a slower investment reaction could have taken action over the period 2018m1-2022m8, but does not fully explain the low proportion of trades observed in section 6.

Table A.3: **Mispricing Duration**

Bond Pair		Mispricing Duration (+)				Mispricing
Isins	#trading days	avg	median	min	max	mean
GB00B06YGN05:GB00B0CNHZ09	1179	49	4	1	577	4.56
GB00B16NNR78:GB00B128DH60	1179	1179	1179	1179	1179	2.87
GB00B1VWPJ53:GB00B3MYD345	1179	10	3	1	107	-0.03
GB00B4YRFP41:GB00BBDR7T29	424	20	7	1	113	-0.02
GB00B84Z9V04:GB00B7RN0G65	1179	10	3	1	106	-0.24
GB00BFWFPL34:GB00B85SFQ54	1036	340	146	6	869	0.95
GB00BFX0ZL78:GB00BZ1NTB69	1060	1060	1060	1060	1060	3.27
GB00BJQWYH73:GB00BGDYHF49	658	28	5	1	211	1.22
GB00BL68HG94:GB00B1Z5HQ14	603	99	44	20	286	-0.07
GB00BL68HH02:GB0008932666	581	581	581	581	581	4.11
GB00BL68HJ26:GB00BYY5F144	567	567	567	567	567	1.50
GB00BZB26Y51:GB00B1L6W962	1179	11	4	1	110	0.27

Note: The table contains all the bond pairs during the period 2018m1-2022m8. The Mispricing Duration (+) section summarizes the average, median, minimum and maximum number of days the mispricing of the corresponding bond pair stayed continuously above 0. The Mispricing section summarizes the mean mispricing of the corresponding bond pair during the period. The mispricing is measured in percentage terms (0.27 means 0.28%).

A.5 Background on Steepener/Flattener Strategies

Discretionary hedge funds tend to invest in bonds by trying to anticipate the future evolution of the yield curve. They take bets accordingly in order to profit from future yield movements. Among the different strategies used by investors, one set of strategies called "steepeners" and "flatteners" try to exploit the future movement of the spread between the short end and long end of yield curves.

When investors expect the yield curve to steepen in the future, the can position themselves to profit from this future movement by shorting a long duration bond and buying a duration matched amount in a short duration bond, strategy called "steepener" (Henderson, 2004; Naik, Devarajan, Nowobilski, Sébastien Page, and Pedersen, 2016). The position is duration neutral, it will only be affected by the relative movement between the short and long end of the curve and not be by the future (parallel) movements of the entire curve. The main costs of this strategy are the negative roll-down effect from the short position and the carry. Steepeners are a way of betting against beta in the rates market with a high sharp ratio of around 0.81 in the US Treasury market (Frazzini and Pedersen (2014)). When investors expect the yield curve to flatten in the future, they can profit by taking a "flattener", which consists of shorting a short duration bond and buying a duration matched amount of a long duration bond (Henderson, 2004). This strategy benefits from the positive roll down effect coming from the long duration bond.

In the recent context of central banks QE and QT programmes, Xing (2018) suggests that curve flatteners reflect a view of accommodative policy where assets continue to increase in value and volatility is suppressed, while curve steepeners express a view of higher future term premium and increased volatility.

Other related strategy in the bond space are butterflies, these strategies allow investors to bet on the future curvature of yield curves by buying/selling at one maturity point of the curve and doing the opposite direction trades in two equidistant points (Henderson, 2004). Brooks and Moskowitz (2017) find that carry differences across countries are a significant return predictor for butterfly as well as steepener/flattener strategies.

A.6 Bank of England Inflation Attitudes Survey

Since august 2001, the Bank of England conducts on a quarter basis a survey across people aged 16-75 in United Kingdom on topics such as interest rates, inflation expectations, and public attitudes towards the Monetary Policy Committee process of the Bank of England. The survey questions cover inflation expectations, the impact of inflation on the daily life, expectations about interest rates and their impact on the daily life, as well as perceptions about the Bank of England´s job of controlling inflation. In the context of inflation perceptions, the survey publishes the median of past 12 months expectations, future 12 months, one year ahead 12 months expectations and 5 years expectations. For further details, see Wardlow (2001) and BoE (2023).

A.7 Additional Tables and Figures

Table A.4: **Average Mispricing by Day and Month**

This table summarizes the average mispricing series by day and month of the year, for the period January-2018 to August-2022. The mispricing corresponds to a weighted average of the difference in price between the UK Nominal Gilts observed market prices and their synthetic prices.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1		1.41	1.04	2.26	1.35	1.34	0.93	1.43	1.32	1.64	1.54	1.49	1.43
2	0.71	1.23	1.09	2.46	0.26	0.76	0.79	1.45	1.52	1.95	1.40	1.52	1.26
3	0.72	1.77	1.54	1.84	1.19	0.86	1.08	1.34	1.50	1.95	1.31	1.21	1.36
4	1.01	1.82	1.37	1.64	1.85	1.04	1.27	1.33	1.57	1.59	1.35	1.00	1.40
5	0.78	1.08	0.76	1.67	2.18	1.40	1.11	1.38	1.22	1.30	1.32	1.08	1.27
6	1.38	0.87	0.95	1.87	2.10	1.41	1.10	1.28	1.50	1.32	1.05	1.49	1.36
7	1.44	1.18	1.37	2.30	1.46	0.95	1.03	1.43	1.59	1.65	0.91	1.61	1.41
8	0.98	1.24	1.28	2.06	0.90	0.96	1.15	1.21	1.25	1.38	0.91	2.19	1.29
9	0.87	0.80	1.94	1.49	1.40	0.90	1.04	1.15	1.25	1.57	0.96	1.86	1.27
10	1.02	1.37	2.58	0.96	1.24	1.13	1.24	1.22	1.41	1.47	1.32	1.69	1.39
11	1.19	1.87	2.05	1.50	1.88	1.22	1.05	1.28	1.41	1.12	1.25	1.60	1.45
12	0.99	1.24	1.13	1.37	2.05	1.62	0.97	1.31	1.38	0.97	0.96	1.62	1.30
13	1.44	1.12	1.13	1.30	1.61	1.44	1.22	1.19	1.27	1.31	0.68	1.59	1.28
14	1.35	1.44	0.88	2.12	1.32	1.08	1.20	1.43	1.37	1.45	0.55	1.75	1.33
15	0.87	1.24	1.05	1.87	1.63	1.24	1.06	1.39	1.52	1.16	0.82	1.62	1.29
16	0.87	0.65	1.36	1.51	1.78	1.48	1.09	1.37	1.34	1.29	0.97	1.39	1.26
17	1.06	1.71	1.73	1.61	1.51	1.24	1.36	1.29	1.30	0.94	1.22	1.49	1.37
18	1.13	1.84	1.38	0.96	1.83	0.98	1.19	1.39	1.50	0.96	1.17	1.20	1.30
19	0.80	0.89	0.94	1.23	1.81	1.03	0.98	1.51	1.46	1.27	0.97	1.57	1.20
20	1.39	0.87	1.98	1.66	1.68	1.11	1.24	1.20	1.31	1.22	0.64	1.59	1.32
21	1.59	1.27	1.64	2.21	1.41	1.02	1.18	1.25	1.49	1.18	0.65	1.61	1.38
22	0.95	1.23	1.32	2.43	1.72	1.06	1.25	1.26	1.72	1.27	1.05	1.09	1.36
23	0.82	0.84	2.01	1.63	1.55	1.00	1.31	1.07	1.56	1.46	0.77	1.06	1.26
24	1.23	1.53	2.39	1.67	1.42	0.94	1.46	1.22	1.60	1.78	1.24	1.33	1.49
25	1.28	1.61	2.22	1.32	1.51	0.87	1.49	1.34	1.85	1.74	1.27		1.50
26	0.93	0.94	1.82	1.24	1.90	1.05	1.31	1.25	1.84	1.58	1.23		1.37
27	1.57	0.91	1.99	1.80	1.72	1.08	1.26	0.87	1.66	1.51	1.02	1.34	1.39
28	1.70	1.17	1.74	2.39	1.47	1.10	1.31	1.08	1.48	1.87	0.84	1.69	1.49
29	1.04		1.48	2.13	1.64	1.22	1.33	1.13	1.40	1.88	1.28	1.10	1.42
30	0.90		2.40	1.47	1.73	1.09	1.32	1.50	1.63	1.59	1.17	1.26	1.46
31	0.98		2.51		1.71		1.22	1.22		1.61		1.29	1.50
Mean	1.10	1.26	1.58	1.73	1.57	1.12	1.18	1.28	1.47	1.45	1.06	1.46	

Note: This table summarizes the average mispricing series by day (first column) and month of the year (first row), for the period 2018m1-2022m8.

Table A.5: Mispricing and Pension-LDI Orderflow: Panel Regressions at the Bond Pair – Day Level with Issuances

	(1)	(2)	(3)	(4)	(5)	(6)
	Pension Funds & LDIs		LDIs		Pension Funds	
Nominal OF	0.016	0.014	0.022**	0.014**	0.015	0.014
	(1.50)	(1.45)	(2.87)	(2.48)	(1.28)	(1.28)
Linker OF	-0.027**	-0.019**	-0.022**	-0.011	-0.019**	-0.012**
	(-2.78)	(-2.25)	(-2.31)	(-1.41)	(-2.78)	(-2.45)
Inflation Swap OF	0.033*	0.017	0.051**	0.016*	0.023	0.013
	(2.16)	(1.44)	(2.96)	(1.80)	(1.67)	(1.26)
Nom. Bond Iss.	-0.011	-0.045	-0.010	-0.043	-0.010	-0.044
	(-0.31)	(-1.19)	(-0.27)	(-1.12)	(-0.26)	(-1.15)
Linker Iss.	-0.009	-0.080*	-0.001	-0.078	-0.010	-0.082*
	(-0.22)	(-1.86)	(-0.02)	(-1.77)	(-0.22)	(-1.87)
N	10765	10765	10765	10765	10765	10765
R^2	0.004	0.345	0.006	0.345	0.002	0.345
Maturity FE	Yes	Yes	Yes	Yes	Yes	Yes
Day FE	No	Yes	No	Yes	No	Yes

Note: This table regresses the inflation mispricing series on nominal Gilt, linker and inflation swaps LDI-P orderflow. The dataset is collapsed at the day-bond level, and covers the period 2018m1-2022m8. The regressions include maturity specific fixed effects and day fixed effects. T-statistics in parentheses are based on robust standard errors, using two-way clustering at the day and dealer level. Asterisks denote significance levels (* p<0.1, ** p<0.05, *** p<0.01).

Table A.6: Mispricing and Pension-LDI Orderflow: Panel Regressions Controlling for Primary Issuance

	(1)	(2)	(3)	(4)	(5)	(6)
	Pension Funds & LDIs		LDIs		Pension Funds	
Nominal OF	0.050***	0.045**	0.040***	0.026*	0.036**	0.044***
	(2.64)	(2.27)	(2.99)	(1.84)	(2.10)	(2.63)
Linker OF	-0.090***	-0.065***	-0.057***	-0.042***	-0.052***	-0.045***
	(-6.38)	(-4.20)	(-4.65)	(-3.14)	(-4.83)	(-3.91)
Inflation Swap OF	0.045***	0.026**	0.037***	0.006	0.040***	0.026**
	(4.14)	(2.40)	(3.06)	(0.53)	(3.77)	(2.53)
Nom. Bond Iss.	0.020	-0.011	0.020	-0.010	0.021	-0.011
	(0.54)	(-0.31)	(0.51)	(-0.27)	(0.57)	(-0.30)
Linker Iss.	-0.001	-0.076	-0.005	-0.082	-0.006	-0.080
	(-0.01)	(-1.42)	(-0.09)	(-1.52)	(-0.11)	(-1.49)
N	5735	5735	5735	5735	5735	5735
R^2	0.008	0.295	0.005	0.293	0.005	0.295
Maturity FE	Yes	Yes	Yes	Yes	Yes	Yes
Day FE	No	Yes	No	Yes	No	Yes

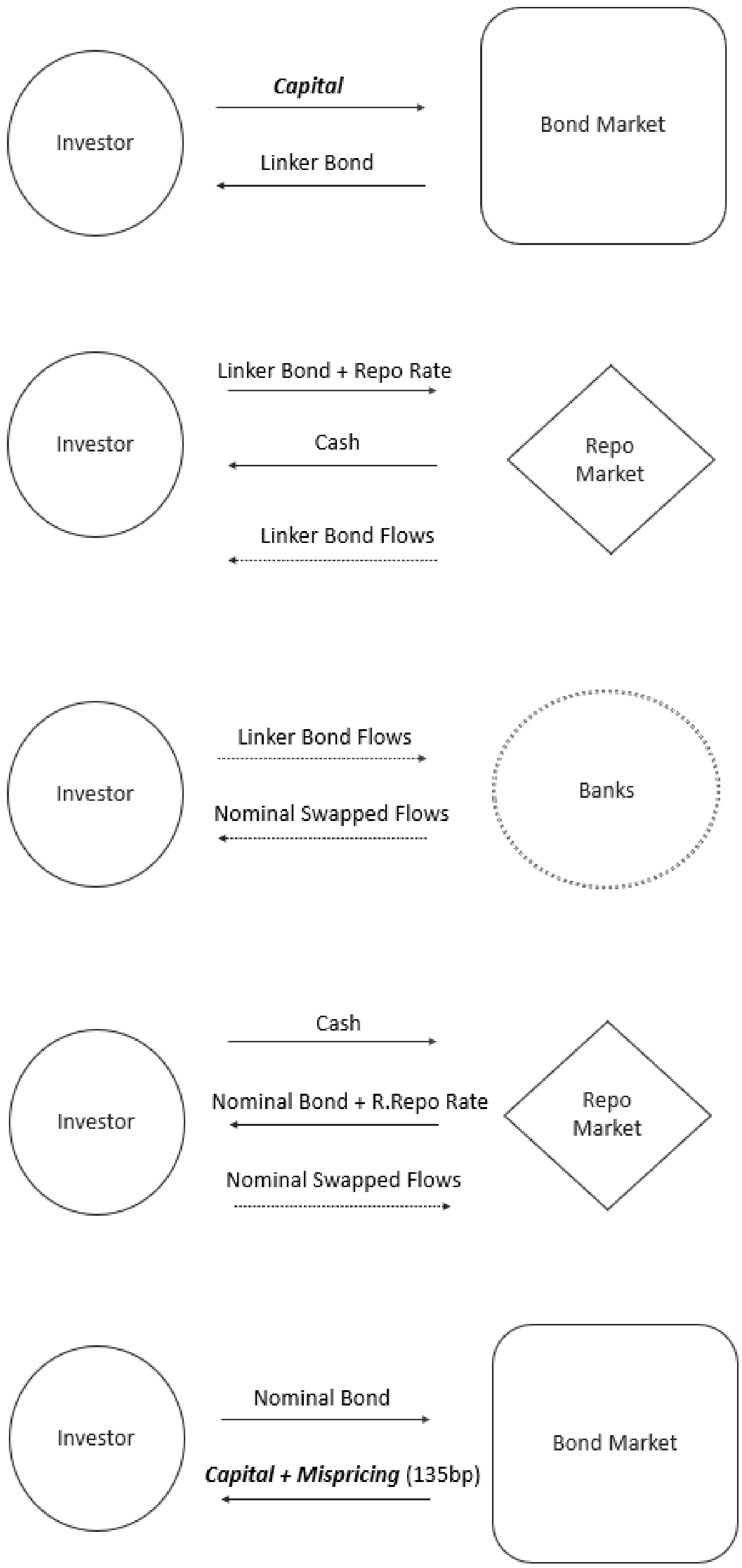
Note: This table regresses the inflation mispricing series on nominal Gilt, linker and inflation swaps LDI-P orderflow. The dataset is collapsed at the day-bond level, and covers the period 2018m1-2022m6. The regressions include maturity specific fixed effects and day fixed effects. T-statistics in parentheses are based on robust standard errors, using two-way clustering at the day and dealer level. Asterisks denote significance levels (* p<0.1, ** p<0.05, *** p<0.01).

Table A.7: Mispricing and Pension-LDI Orderflow: Panel Regressions Controlling for Primary Issuances and BoE Asset Purchases

	(1)	(2)	(3)	(4)	(5)	(6)
	Pension Funds & LDIs		LDIs		Pension Funds	
Nominal OF	0.053***	0.045**	0.043***	0.026*	0.037**	0.044***
	(2.78)	(2.28)	(3.21)	(1.86)	(2.18)	(2.63)
Linker OF	-0.089***	-0.065***	-0.057***	-0.041***	-0.051***	-0.045***
	(-6.33)	(-4.19)	(-4.61)	(-3.12)	(-4.77)	(-3.89)
Inflation Swap OF	0.044***	0.026**	0.036***	0.006	0.040***	0.026**
	(4.11)	(2.40)	(3.02)	(0.54)	(3.77)	(2.52)
Nom. Bond Iss.	0.010	-0.013	0.009	-0.011	0.011	-0.012
	(0.26)	(-0.34)	(0.23)	(-0.30)	(0.29)	(-0.33)
Linker Iss.	-0.008	-0.077	-0.012	-0.083	-0.013	-0.081
	(-0.13)	(-1.44)	(-0.21)	(-1.54)	(-0.23)	(-1.51)
BoE Asset Purchases	0.043	0.017	0.044	0.018	0.044	0.015
	(1.45)	(0.53)	(1.48)	(0.57)	(1.45)	(0.48)
N	5735	5735	5735	5735	5735	5735
R^2	0.009	0.295	0.006	0.293	0.005	0.295
Maturity FE	Yes	Yes	Yes	Yes	Yes	Yes
Day FE	No	Yes	No	Yes	No	Yes

Note: This table regresses the inflation mispricing series on nominal Gilt, linker and inflation swaps LDI-P orderflow. The dataset is collapsed at the day-bond level, and covers the period 2018m1-2022m6. The regressions include maturity specific fixed effects and day fixed effects. T-statistics in parentheses are based on robust standard errors, using two-way clustering at the day and dealer level. Asterisks denote significance levels (* p<0.1, ** p<0.05, *** p<0.01).

Figure A.2: **Strategy with Short Selling**



Note: This diagram represents the transactions that an investor who does not hold the nominal Gilt would need to execute in order to implement the full inflation arbitrage strategy between linkers and nominal Gilts.

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