Sovereign-bank nexus in Poland. The case of duration risk and its implications for banking activity

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Abstract

Aim: The article tackles the issue of the duration risk of banks' sovereign debt portfolio, identifies its determinants, and presents its implications for banking activity.

Methodology: We employ qualitative and quantitative data analysis (including OLS regression).

Results: It has been shown that banks increase the exposure to duration risk at the time when rates are about to increase, and decrease this exposure at the time, when they are about to fall. In other words, they increase their vulnerability to duration risk when it poses a threat, and decrease it, when it presents a chance for rising valuation of bonds.

Implications and recommendations: The sovereign-bank nexus in Poland affects the deposit and lending policy of Polish banks, with the duration risk serving as an amplifying tool.

Originality/value: We are the first to calculate PLN denominated sovereign bond portfolio's duration of distinct financial subsectors in Poland. Moreover, we indicate the main drivers of this risk along with its impact on actions taken by banks.

Keywords: sovereign debt, banks, interest rates, duration, risk

1. Introduction

Banks present one of (if not the) most important source of demand for sovereign debt, at least in Poland, where they hold over 50% of locally issued bonds and bills. The growing role of these assets could be attributed to a need for a stable source of (fixed) income obtained at a low credit risk. Regulatory issues are of importance too, however, including the liquidity and capital requirements, and – first of all – the construction of the banking tax (where sovereign and sovereign guaranteed debt is excluded from the tax base). All in all Polish banks hold 24,4% of sovereign and sovereign guaranteed (mostly issued by BGK and PFR[1]) bonds as of March 2025 (NBP, 2025, p. 36). In real terms the PLN 666bn sovereign debt held by Polish banks could be compared to roughly 18% of GDP making the Polish banking sector exposure towards the sovereign the biggest in the entire EU (both as a percentage of assets and in relation to GDP).

Around 60% of this debt pay fixed (or zero) coupon, which makes it particularly vulnerable to interest rate (or duration) risk, that is the risk of changes in their valuation following shifts in interest rates. That

[1] BGK: Polish Development Bank, PFR: Polish Development Fund.

said, banks who (apart from regulatory reasons) invest in sovereign debt in order to protect themselves from credit risk, at the same time expose themselves to market risk. The changes in the bond portfolio valuation (the accounting issues will be tackled later in the article) impact both banks liquidity (through the value of liquid assets), as well as equity (through other comprehensive income). As such they influence banks deposit (Czaplicki, 2025) and credit policy (Czaplicki, 2022).

It is, therefore, interesting, what kinds of sovereign bonds banks purchase and keep in their portfolios, given their clear influence on the shape of their business. The article tackles this very issue. We show that Polish banks have increased their exposure to duration risk of sovereign debt in 2021-2022, making them more vulnerable to interest rate hikes. Later on, they decreased the respective exposure in 2024-2025, becoming less vulnerable to interest rate cuts. As a result they were more exposed to falling valuation of sovereign debt in earlier years, and have been less exposed to increasing valuation in most recent period. Moreover, this pattern persists throughout the entire period under our study (2010-2025). The reason behind this policy might be the focus on current profits: search for increased yields (upward sloping yield curve in 2021-2022, and downward sloping in 2024-2025), along with regulatory reasons (most of all the introduction of SOT NII in 2024 given the binding SOT EVE requirement)[2].

In order to do this we calculate the Macauley duration of PLN denominated sovereign bonds held by banks from 2010 to 2025 at the end of each month. We compare it to the similar measure for insurance companies, investment funds, pension funds, foreign investors, as well as the entire supply of these instruments. To our knowledge, we are the first ones to present such measure of interest rate exposure for different actors on the Polish financial market. As a second step we conduct quantitative analysis of the drivers of duration risk, pointing at the slope of the sovereign yield curve, as the main driver of banks behaviour. Hence, we identify the duration cycle of Polish banks sovereign bond exposure along with its main determinants, thus fulfilling the aim of our article.

Our article is structured as follows. After the introduction to the subject of the article in Section 1, Section 2 summarises the discussion on the role of sovereign debt in banking. We also provide a literature review of the determinants of banks' duration risk. In Section 3 we elaborate on the methodology utilized in our study. Section 4 contains the results. Firstly we provide stylised facts on the exposure of Polish banks to sovereign debt risk. Then we analyse the determinants of the duration risk of banks' sovereign debt holdings and present the results of model estimates. Finally, we discuss the implications of the sovereign exposure, along with accounting approach to sovereign debt by Polish banks. The article ends with the Summary.

2. Literature Review

2.1. Banks' holdings of sovereign bonds and their implications

The sovereign-bank nexus has a moderate coverage in economic literature. State-issued bonds seem to be regarded as a widely understood ingredient of banks' assets. Three strands of literature emerge, as the links between sovereign debt and banks are concerned: 1) which banks hold them the most, 2) with what purpose, and 3) what are the consequences of increasing debt holdings of credit institutions.

As the buyers of sovereign debt are concerned Bucha, Koetter, and Ohls (2016), who study the German banking sector, emphasise that sovereign debt holdings are larger for weakly capitalised banks, banks that are active on capital markets, and for large banks. Crosignani (2021) points out that low-capital

[2] The Supervisory Outlier Test for Net Interest Income (SOT NII) limits banks exposure to interest risk in the banking book, incentivising them to maintain more fixed income exposure, whereas the Supervisory Outlier Test for the Economic Value of Equity intends to limit banks' exposure to duration risk.

banks use to tilt their government bond portfolio toward domestic securities. Faour and Saad (2025) find that higher quality of domestic institutions in MENA region reduces reliance of banks on domestic sovereign debt, due to increasing holdings of foreign investors. Fratianni and Marchionne (2017) stipulate that the subprime crisis induced asset realocation in banks from loans to government debt. Albertazzi, Becker, and Boucinha (2021) showed that the Asset Purchase Programme in the euro area led to an increase in the share of debt securities in the balance sheet in more fragile economies, in contrast to more stable sectors, where the share of credit increased. Finally, Baselga-Pascual, Loban, and Myllymäki (2025) show that a higher level of impaired loans is a vital driver of increased sovereign debt exposure. This relation gets stronger with increasing rating of this debt.

They underline that the main reason behind these actions is credit risk hedging. Indeed, Abinzano, Corredor, and Mansilla-Fernandéz (2022) find that holding sovereign debt improves the level of banks' credit risk. Arellano and Ramanarayanan (2012) point out that long-term debt provides a hedge against future fluctuations in spread (thus immunising banks to the interest rate risk on the banking book[3]). Huynh (2025), who analyses the Vietnamese banking sector, indicates that the purchases of the securities issued by the domestic government lower banks risk exposure, in particular at times of crisis and uncertainty.

There is one caveat to this analysis – if it comes to the crisis – it should not be induced by defaulting sovereign. Brunnermeier et al. (2016) propose a model of the sovereign-bank "diabolic loop" pointing out that (at time of sovereign debt crisis) defaults on sovereign debt reduce perceived solvency of domestic banks forcing them to curtail their lending activity. Gennaioli, Martin, and Rossi (2014) find that the mechanism leading to this is the destruction of the balance sheet of domestic, leveraged banks. Farhi and Tirole (2018) point at feedback loops between sovereign and banking insolvency. Altavilla, Pagano, and Simonelli's (2017) empirical analysis of 226 euro-area banks from 2007 to 2015 indicates the significant impact a sovereign stress has on lending to domestic private sector. Bottero, Lenzu, and Mezzanotti's (2020) empirical analysis confirms these conclusions, showing that the mechanism through which the shock to the sovereign portfolio of banks following the 2010 Greek bailout was passed on to Italian firms was credit contraction. De Bruyckere et al. (2013) indicate that not only direct exposure to sovereign debt caused problems. They find two other crucial mechanisms through which the sovereign exposure affected banks: government guarantees and collateral.

That said, the economic literature focuses on the impact of sovereign problems on banks' actions. However the (growing) exposure to government debt may also impact banks at more stable times, when bonds valuation changes not due to the risk of default, but due to shifting interest rates. As follows we will tackle the issue of banks' duration risk as a missing piece in the puzzle related to the sovereign-bank nexus.

2.2. Banks' duration risk

Due to the prolonged period of ultra-loose monetary policy conducted in the world after the Global Financial Crisis (2007-09), most studies focus on the impact of low interest rates on the behavior of banks. Among them, the analysis of asset credit risk dominates. In this respect, the research covers in particular the lending and lending activities of banks (the US sector was studied by (among others) Buch, Eickmeier, and Prieto (2014) and Dell'Ariccia, Laeven, and Suarez (2017)), while only individual articles deal with changes in the structure of securities (portfolio rebalancing). Wang (2023) showed that large banks in the US and Japan adjusted the structure of their debt portfolios as a result of their central banks' asset purchase programmes. Koijena et al.(2021) pointed at the asset portfolio duration, however not as an explained, but as an explanatory variable of the change in the composition of the

[3] At the same time it increases banks' vulnerability to the (market) duration risk, however.

assets portfolio of banks in the euro area. Finally, the issue of bond maturities (in the euro area) was raised by Bubeck, Maddaloni and Peydró (2020), but only as part of the robustness checks.

Krainer and Paul (2023) emphasised (analysing the case of the banking crisis in the US in 2023) that the strength of the impact of the portfolio rebalancing channel depends on the shape of banking regulations. Bottero, Lenzu, and Mezzanotti (2020) highlighted that those banks that had lower capital or a less stable funding structure reacted to the decline in the valuation of debt instruments to a greater extent. Delis and Kouretas (2011) showed that (in the euro area in 2001-2008) less capitalised banks had a greater propensity to take higher risks as a consequence of falling interest rates. Peydró, Polo, and Sette (2021) showed that institutions with limited capital resources (in Italy) tend to change their portfolio structure from loans to bonds, in crisis periods, which reduces the effectiveness of monetary policy. Finally, Czaplicki (2024) presented an empirical analysis of US-American banking sector in 2009-2023, pointing out that during periods of loose monetary policy, banks extend the maturity of assets to improve interest income. In the monetary tightening phase, the opposite happens. As a result, when rates are low, the duration risk of banks' portfolio increases, and similarly – it falls when rates go higher.

In the end, a separate strand of literature (less important from the point of view of this paper) could be found, focusing on the duration of banks liabilities. The previously mentioned analysis of Bubeck, Maddaloni and Peydró (2020) pointed to the role of deposit structure in banks' response to changes in monetary policy (in the Eurozone, banks that relied more on retail deposits for financing were more sensitive). The role (structure) of financing of banking activities as a result of changes in monetary policy was also emphasised by Angeloni, Faia, and Lo Duca (2015), who pointed at the importance of growing financial leverage to the increase of risk after interest rate cuts. Jiang et al. (2023) and Drechsler, et al. (2023) underlined the role of uninsured deposits in the analysis of the duration of the entire bank's balance sheet. The importance of the stability of the deposit side was also indicated by Drechsler, Savov, and Schnabl (2017) – for the USA – and Heider, Saidi, and Schepens (2019) – for the Eurozone.

3. Methodology

The article employs both quantitative, as well as qualitative research methods. The former serve to show the scale of Polish financial sector sovereign debt holdings, along with their main characteristics (including duration and the share of fixed / floating rate instruments), as well as accounting approach of banks to the sovereign debt, all between 2010 and 2025.

In this article we calculate Macauley duration using raw data on each and every issue of sovereign bonds held by Polish financial institutions between January 2010 and April 2025. It is a measure of the weighted average time it takes for a bond's cash flows to be received, and is expressed in years. It provides a key metric for understanding a bond's sensitivity to interest rate changes. However, it is not as popular among risk managers as effective duration (it estimates how much the bond's price will change for a given shift in the benchmark yield curve, considering potential changes in the bond's cash flows) or basis point value (percentage change in the value or rate of a financial instrument). We utilise the former measure due to the limited availability of data for each issue, along with the scarcity of fixings at the end of each month, especially for earlier period under analysis.

Finally, we construct a simple model describing changes to the Macauley duration of Polish financial institutions' (including banks') sovereign debt holdings. We run linear regression using Ordinary Least Squares (OLS) estimators controlling the impact of the slope of the yield curve using both macrofinancial as well as financial sector-specific data.

4. Results

4.1. Polish financial sector sovereign debt holdings and their structure

Since 2015 Polish banks' credit expansion has been halted. At the same time, however, the economy expanded. As a result the banking sector faced an increasing stream of deposits. Moreover, increasing capital requirements (due to Basel III / CRD IV – CRR reforms) forced banks to issue more debt (Tier II and later MREL) and retain more earnings (pay less dividends). It all led to a constant growth of their balance sheet, resulting in a fairly stable assets/GDP ratio of 90-100%, whereas the credit/GDP ratio fell from 60 to 40% in 2025. Thus, the lending to the private sector has been replaced by the lending to the public one, which increased both in relation to GDP, as well as a share in total banks' assets (see Figure 1).

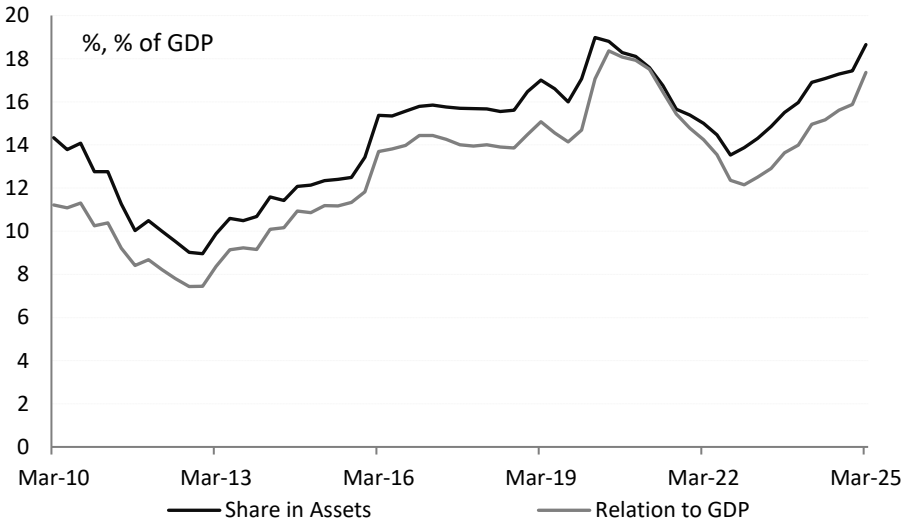


Fig. 1. Sovereign debt holdings of Polish banks in relation to total assets and GDP

Source: Ministry of Finance, author's own calculations.

PLN denominated sovereign bonds were particularly attractive from the banks' standpoint, as they were (regulatory) riskless (in terms of credit risk), and very liquid, which was necessary to maintain the newly introduced (short-term) liquidity requirements (Liquidity Coverage Ratio, LCR). Lending to the public sector has been also catalysed by the introduction of the banking tax in February 2016, as the base of the tax consisted of bank's assets with exception of treasury bonds. The increasing demand of banks for public debt has been met by shifting supply, as the government decided to issue more PLN denominated debt, thereby reducing the exposure to foreign investors. As a result, the share of banks in sovereign bonds issued on the domestic market increased from 32.7% at the end of 2015 to 52% as of the end of April 2025 (see Figure 2 below)

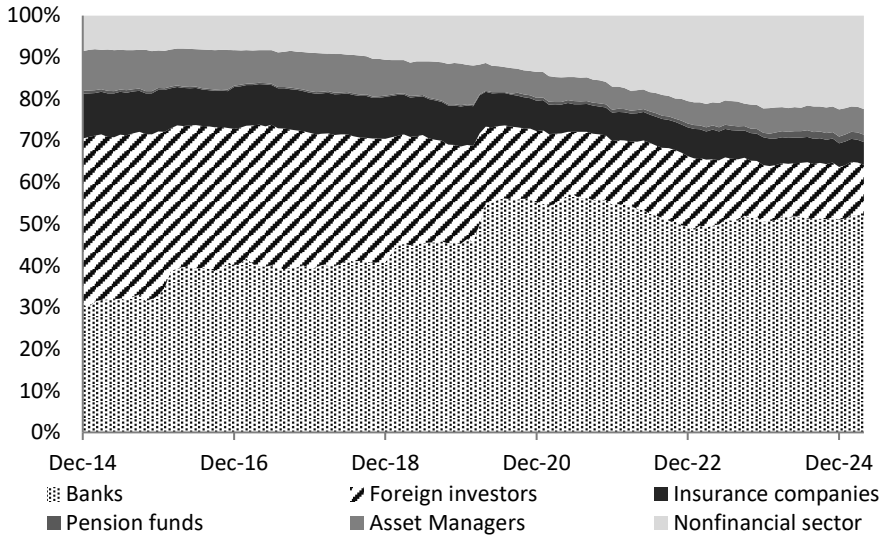


Fig. 2. Structure of domestic sovereign debt market in Poland by the type of investors

Source: Ministry of Finance, author's own calculations.

In no time sovereign debt became a vital source of liquidity for banks, overtaking central bank's bills (see Figure 3), and started to provide hefty, and relatively stable income, due to increasing share of fixed coupon bonds in the mix (see Figure 4).

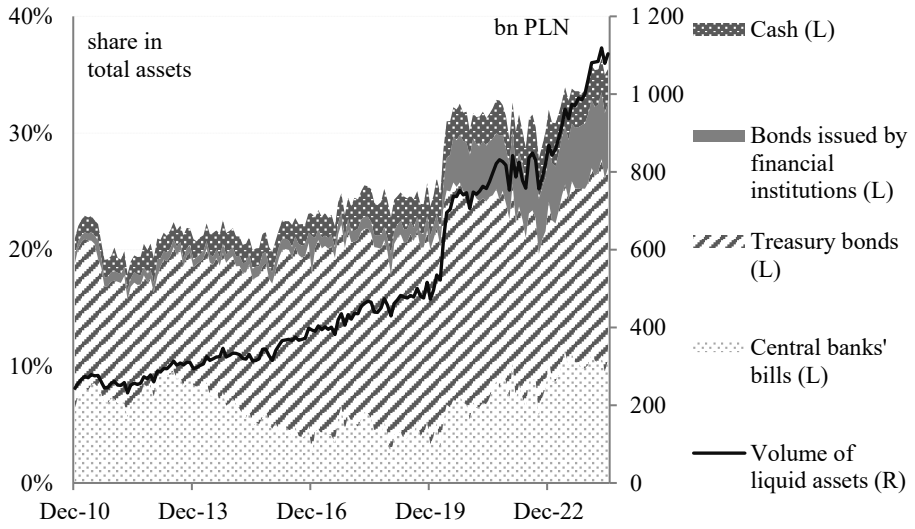


Fig. 3. Size and structure of banks' liquid assets in 2010-2024

Source: National Bank of Poland, Polish Financial Supervision Authority, author's own calculations.

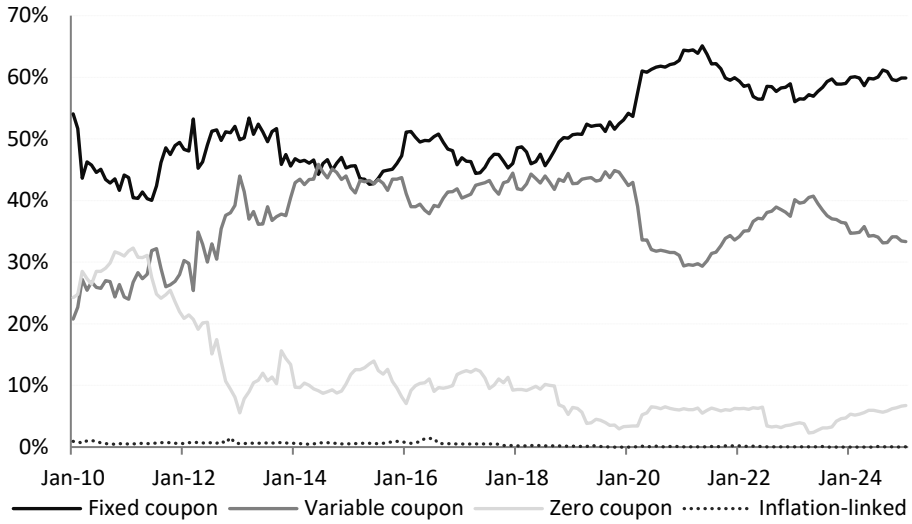


Fig. 4. Structure of bank held PLN sovereign debt by the type of coupon

Source: Ministry of Finance, author's own calculations.

Banks, however, did not use the entire revenue generating potential of treasuries, as they have constantly been choosing bonds with shorter duration (than other institutions in particular, and market supply in general, see Figure 5). In 2024 this stance has been supported by the introduction of SOT NII requirement forcing banks to stabilise their net interest income, whilst at the same time (due to the SOT EVE requirement) they were obliged to limit the impact the adjustments of bond valuation have on their equity capital. In earlier years, however they might have followed the current interest (coupon) paid, not the re/devaluation potential (in this respect, Polish banks behave in a similar manner to their US-American counterparts, see Czaplicki (2024)).

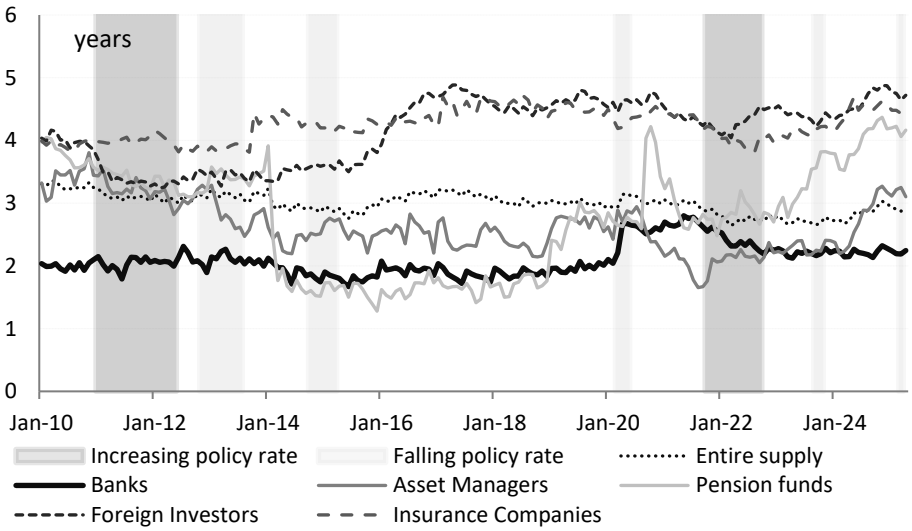


Fig. 5. Duration of PLN denominated sovereign bonds held by financial institutions in Poland

Source: Ministry of Finance, author's own calculations.

On the other hand, other financial institutions like asset managers or pension funds, along with foreign investors seem to follow an opposite approach to banks. They increase the exposure to duration risk, when they expect rate cuts, whereas before rate hikes, they decrease the duration of their bond holdings. As follows, we will check, if these observations are confirmed by quantitative analysis.

4.2. Modelling the drivers of the duration of sovereign debt in different types of financial institutions

That said, we run linear regression using Ordinary Least Squares (OLS) estimators controlling the impact of the monthly changes of the slope of the yield curve on monthly changes to duration of sovereign debt holdings of distinct financial entities using both macrofinancial, as well as financial sector-specific data. We calculated duration using the data provided by Ministry of Finance on holders of domestically issued sovereign debt (at the end of each month), along with the specific series of securities, which we then put together with specific rate fixings. As the controlling variables are concerned we understand that the overall duration of domestically issued treasuries should have a vital influence on the final choice of each financial subsector. Moreover, we want to check, if the changes to current policy rate (represented by the POLONIA interest rate[4]), along with the expectations for future path of interest rates (represented by the slope of the IRS curve) are of any importance. Table 1 contains the description of the variables utilised in the models, along with their sources.

Table 1. Variables and their sources

Variable	**Source**
Duration of sovereign debt by financial sector and in total	Own calculation on the basis of data provided by the Ministry of Finance
Changes to the slope of the yield curve (difference between the yield on 5Y treasuries and the reference rate of the NBP)	Own calculation on the basis of data provided by the National Bank of Poland, and Refinitiv
Changes to POLONIA interest rate	Own calculation on the basis of data provided by National Bank of Poland
Changes to the slope of the IRS curve (difference between 1Y IRS and WIBOR O/N)	Own calculation on the basis of data provided by Refinitiv

Descriptive statistics for the variables used in the estimations are reported in Table 2. For each variable, the measures of central tendency as well as the total number of observations are shown. All the variables are stationary and follow a normal distribution.

Table 2. Descriptive statistics

	Mean	Median	Max.	Min.	Std. Dev.	Jarque-Bera (prob.)	ADF* (prob.)	Obs.
Change of the duration (banks)	0.00115	-0.02217	0.4616	-0.1582	0.09494	0.0000	0.0000	183
Change of the duration (asset managers)	-0.00119	-0.00337	0.4957	-0.3754	0.15455	0.0158	0.0000	183
Change of the duration (foreign investors)	0.00376	-0.00064	0.2352	-0.2001	0.08420	0.0236	0.0011	183
Change of the duration (pension funds)	0.00105	-0.00476	1.4464	-1.4798	0.22546	0.0000	0.0000	183
Change of the duration (insurance companies)	0.00320	-0.00359	0.6206	-0.2177	0.10239	0.0000	0.0000	183
Change of the duration (supply)	-0.00204	-0.0267	0.1996	-0.2724	0.06674	0.0041	0.0005	183
Change of the slope of the yield curve	-0.01318	-0.01000	1.2000	-1.8790	0.34252	0.0000	0.0000	183
Change of the slope of the IRS curve	0.01125	0.00000	1.2100	-1.4800	0.41169	0.0000	0.0003	184
Change of POLONIA rate	-0.00044	-0.00355	1.6410	-0.9830	0.28674	0.0000	0.0065	184

[4] POLONIA interest rate, also known as the Polish Overnight Index Average (POLONIA), is a benchmark interest rate in Poland that reflects the average interest rate on overnight deposits traded among a panel of banks. It is the operational target of monetary policy in Poland.

The model specification is presented below:

$$\Delta duration_{i,t} = C + \alpha \times \Delta duration\_total_t + \beta \times \Delta slopeYC_t \times + \gamma \times X_{t-n} + \mu_i + \varepsilon_t \quad (1)$$

where the subscripts of i and t denote financial subsector and time period, respectively. Δduration (Macauley duration) is the weighted average time to maturity, where the weights are the present values of each cash flow relative to the bond's total present value (its price). Δduration_total is the duration of the entirety of domestically issued treasury bonds held by investors. ΔslopeYC is the slope of the yield curve calculated as a difference between yield on 5-year treasuries and the main policy rate of the National Bank of Poland (reference rate) representing the interest on 7-day central bank bills.

To improve the validity of our results we run the models for different types of financial institutions for the entire period (January 2010-April 2025), and later on we do this splitting the period into two separate halves (January 2010-December 2017 and January 2018-April 2025). The choice of these periods has been impacted by the availability of the data. The results of our estimations are presented in Tables 3 and 4 (qq stands for the quarterly change of the variable).

Table 3. Results of the model specifications

Dataset	Time lag	Dependent variable: duration of PLN denominated treasuries held by:				
		2010-2025				
		Banks	Asset Managers	Pension Funds	Insurance Companies	Foreign Investors
Constant		0.0036 (0.0049)	0.0026 (0.0106)	0.0049 (0.0155)	0.0054 (0.0066)	0.005 (0.0049)
ΔDuration_total(qq)$_t$	0	104.4943*** (7.8239)	96.0345*** (17.0297)	145.6266*** (24.9117)	75.4598*** (10.6660)	69.4355*** (7.8140)
ΔDuration_total(qq)$_t$	-1	-0.0104 (0.0773)	0.1302 (0.1683)	0.0614 (0.2463)	-0.0270 (0.1054)	0.1158 (0.0772)
ΔPOLONIA(qq)$_t$	0	0.0029 (0.0156)	-0.0230 (0.0339)	-0.0387 (0.0496)	0.0065 (0.0212)	0.0106 (0.0155)
ΔPOLONIA(qq)$_t$	-1	0.0409*** (0.0153)	-0.0247 (0.0334)	-0.0701 (0.0488)	0.0127 (0.0209)	-0.0109 (0.0153)
ΔSlopeYC (qq)$_t$	0	0.0601*** (0.0186)	0.0506 (0.0404)	0.0678 (0.0591)	0.0025 (0.0253)	-0.0871*** (0.0185)
ΔSlopeYC(qq)$_t$	-1	0.0171 (0.0178)	-0.0654* (0.0387)	-0.0747 (0.0566)	0.0525** (0.0242)	0.0152 (0.0177)
ΔSlopeIRS(qq)$_t$	0	-6.2677** (2.4066)	-6.0806 (5.2383)	0.0204 (7.6628)	1.6426 (3.2808)	9.0976*** (2.4036)
ΔSlopeIRS(qq)$_t$	-1	0.0959 (2.7210)	14.7205** (5.9227)	12.3159 (8.6639)	-4.3143 (3.7095)	-7.7656*** (2.7176)
No. of observations		182	182	182	182	182
R^2		0.5492	0.1794	0.1901	0.2787	0.4281
F-Snedecor test (1)		0.0000	0.0000	0.0000	0.0000	0.0000
LM test (2)		0.4784	0.2271	0.0664	0.0600	0.3370
Breusch-Pagan-Godfrey test (3)		0.0971	0.0311	0.3319	0.3658	0.3296

Source: Author's own calculations. ***, **, * denotes significance at 1%, 5%, and 10% test levels; respectively; standard errors are in parentheses. (1) Reports p-values for the null hypothesis that the variances of two or more populations are equal. (2) Reports p-values for the null hypothesis that there is no heteroskedasticity in the data. (3) Reports p-values for the null hypothesis that there is no serial correlation of any order.

Table 4. Results of the alternative model specifications

Dataset	Time lag	Dependent variable: duration of PLN denominated treasuries held by:									
		2010-2017					2018-2025				
		Banks	Asset Managers	Pension Funds	Insurance Companies	Foreign Investors	Banks	Asset Managers	Pension Funds	Insurance Companies	Foreign Investors
Constant		0.0008 (0.0081)	-0.0074 (0.0165)	-0.0143 (0.017)	0.0108 (0.0108)	0.0048 (0.0071)	0.0092* (0.0052)	0.0086 (0.0131)	0.0298 (0.026)	0.0013 (0.0081)	0.0011 (0.0068)
$\Delta Duration\_total(qq)_t$	0	94.7850*** (11.6859)	107.5398*** (23.6475)	204.8473*** (24.4606)	81.9092*** (15.5650)	71.2803*** (10.2406)	129.5355*** (9.7047)	73.7349*** (24.4678)	57.7441 (48.6533)	75.2309*** (15.0746)	71.8123*** (12.8051)
$\Delta Duration\_total(qq)_t$	-1	-0.0529 (0.1152)	0.0259 (0.2332)	0.5283** (0.2412)	0.1365 (0.1535)	0.1742* (0.1010)	0.0076 (0.0929)	0.3216 (0.2342)	-0.4953 (0.4657)	-0.2669* (0.1443)	-0.0186 (0.1226)
$\Delta POLONIA(qq)_t$	0	0.0092 (0.0252)	0.0364 (0.0510)	-0.0269 (0.0528)	0.0132 (0.0336)	0.0262 (0.0221)	-0.0057 (0.0172)	-0.0597 (0.0435)	-0.0201 (0.0864)	0.0063 (0.0268)	-0.0077 (0.0227)
$\Delta POLONIA(qq)_t$	-1	0.0509** (0.0251)	0.0696 (0.0508)	0.0022 (0.0526)	0.0375 (0.0334)	-0.0101 (0.0220)	0.0106 (0.0170)	-0.1203*** (0.0428)	-0.1332 (0.0851)	-0.0092 (0.0264)	-0.0093 (0.0224)
$\Delta SlopeYC\ (qq)_t$	0	0.0881** (0.0346)	0.0271 (0.0700)	0.1871** (0.0724)	-0.0399 (0.0461)	-0.0921*** (0.0303)	0.0387** (0.0177)	0.0525 (0.0445)	-0.0235 (0.0886)	0.0253 (0.0274)	-0.0805*** (0.0233)
$\Delta SlopeYC(qq)_t$	-1	0.0244 (0.0368)	-0.0705 (0.0744)	-0.0447 (0.0770)	0.0865* (0.0490)	0.0457 (0.0322)	-0.0066 (0.0167)	-0.0499 (0.0420)	-0.0659 (0.0836)	0.0271 (0.0259)	0.0022 (0.0220)
$\Delta SlopeIRS(qq)_t$	0	-11.7004 (7.0398)	-11.2746 (14.2458)	13.0518 (14.7356)	11.8447 (9.3767)	-2.5051 (6.1692)	-3.4707 (2.0911)	-3.7448 (5.2721)	0.6917 (10.4834)	-0.8512 (3.2481)	10.5812*** (2.7591)
$\Delta SlopeIRS(qq)_t$	-1	11.2655 (7.4786)	-9.1556 (15.1337)	1.9029 (15.654)	-11.3558 (9.9611)	-9.8542 (6.5537)	-0.4384 (2.3597)	22.6838*** (5.9494)	8.8949 (11.8301)	-0.9381 (3.6654)	-6.4227** (3.1136)
No. of observations		94	94	94	94	94	88	88	88	88	88
R^2		0.4892	0.2609	0.4882	0.2850	0.4901	0.7304	0.2489	0.0702	0.3569	0.4221
F-Snedecor test (1)		0.0000	0.0008	0.0000	0.0003	0.0000	0.0000	0.0028	0.6514	0.0000	0.0000
LM test (2)		0.1589	0.0295	0.0318	0.0190	0.1690	0.3961	0.3071	0.5990	0.9550	0.7910
Breusch-Pagan-Godfrey test (3)		0.4126	0.2581	0.0199	0.2221	0.4860	0.0003	0.1489	0.9177	0.0223	0.1218

Source: Author's own calculations. ***, **, * denotes significance at 1%, 5%, and 10% test levels; respectively; standard errors are in parentheses. (1) Reports p-values for the null hypothesis that the variances of two or more populations are equal. (2) Reports p-values for the null hypothesis that there is no heteroskedasticity in the data. (3) Reports p-values for the null hypothesis that there is no serial correlation of any order.

The model estimations from Tables 3 and 4 show a visible (mostly – in 14 out of 15 cases – statistically significant) relation between changes to duration of PLN denominated treasury bonds held by specific financial subsectors and the changes of the duration of the general supply of these bonds. It should not wonder, as the specific policy of the Ministry of Finance determining the parameters of bonds it issues impacts the bonds the financial sector (can buy and eventually) purchases. What is more interesting is the impact the changes to different interest rates-related variables have.

In case of banks, the changes to the duration of their sovereign bond holdings are impacted (in a statistically significant manner) positively both by the changes to the policy targeted rate (POLONIA), as well as the slope of the yield curve. It suggests that the banking sector follows the current trends in rates with a desire to earn more now (due to higher coupon) rather than in the future (due to changes in valuation). Positive relation with the changes of the slope of the yield curve means, that with an upward sloping curve banks decide to purchase longer bonds to earn higher coupon. At the same time they expose themselves to a bigger extent to the duration risk, which is likely to materialise, when rates start to increase and the value of their portfolio falls. At the same time, the interest rate expectations (changes to the difference between 1Y PLN interest rate swap and the overnight WIBOR (Warsaw Interbank Offered Rate) do have a negative (but not significant in all specifications) impact confirming the above conclusions. That said, the results of the quantitative models confirm the earlier observations from the qualitative analysis (as banks are concerned).

The foreign investors seem to behave completely different to banks, as they follow the short-term interest rate expectations, not the current interest on bonds. It indicates that they value more the changes to the valuation than coupon payments. In case of other industries the results are inconclusive.

4.3. Banks' accounting approach to sovereign debt holdings

Changes to the valuation of bond portfolio (may) have an impact on income statement, equity capital, or none at all, depending on their accounting classification. Below we tackle this issue in case of banks and elaborate on the implications of banks deposit and lending activity.

Changing market interest rates have a clear influence on the value of fixed coupon bonds. If you can obtain assets paying you higher coupon, you value them more (and the other assets, which pay you lower coupon, fixed previously, are valued less). However, it is not exactly the case of financial institutions (in particular banks), as they follow some specific accounting approaches. Figure 6 provides one of the best illustrations of this issue. As the Polish central bank policy rate increased from 0.1% in September 2021 to 6.75% in September (6.50 in July) 2022, the market value of sovereign bonds held by banks decreased significantly (by over 11%, when we adjust for the change in nominal value of bonds). The book value, however decreased "only" by less than 5%.

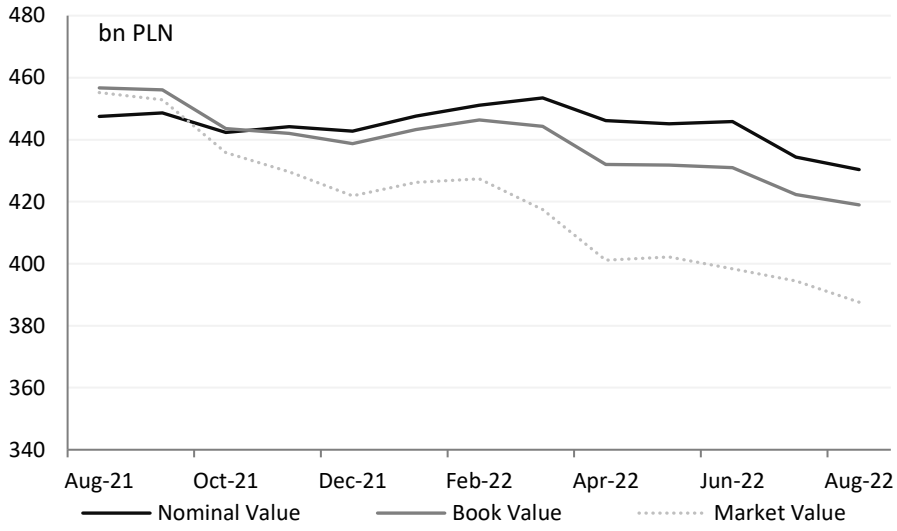


Fig. 6. The value of banks sovereign debt holdings in 2021/22 by different measures

Source: NBP (2022).

The reason for such a discrepancy is the accounting classification of sovereign bond holdings by banks. As a matter of fact, according to the International Financial Reporting Standards there are three portfolios (by accounting approach) a bank can classify its assets to (incl. treasury bonds):

- FVPL (Fair Value through Profit % Loss: changes in the fair value of assets/liabilities are recognised directly in the income statement),
- FVOCI (Fair Value through Other Comprehensive Income: changes in fair value are recorded in "Other Comprehensive Income" which is part of equity capital),
- AC (Amortised Cost: the initial cost is adjusted over time to reflect the impact of interest, principal repayments, and other factors, providing a more accurate representation of the asset's or liability's true cost or value over its lifespan)

FVPL usually represents the part of bonds held for trading. The liquidity portfolio (or held for sale) is usually valued by FVOCI. Finally, if an entity (e.g. a bank) intends to hold assets until their maturity they are measured at AC. Figure 7 shows that an increasing share of bonds on books of Polish banks is held to maturity and therefore valued at amortised cost, making their valuation nonresponsive to changes in market rates. That said only ~40% of bonds held by banks (vs. ~76% in early 2018) are valued at fair value, as of Spring 2025. However, if we take into consideration that the share of sovereign issued debt in banks' assets has been steadily increasing, we may come to the conclusion that the changes in its valuation are still of an importance.

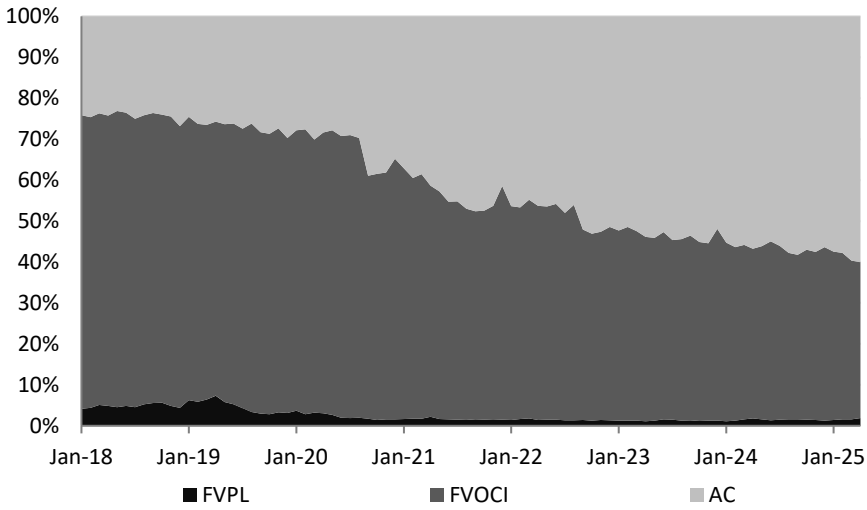


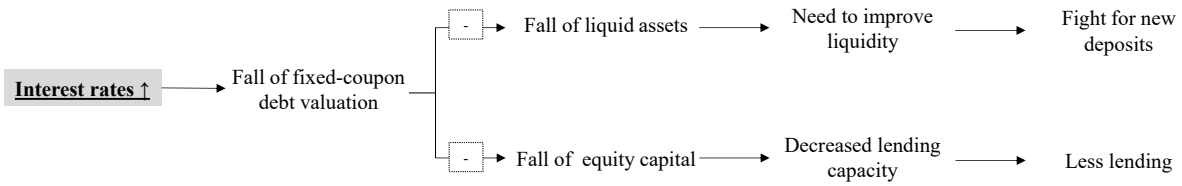
Fig. 7. The structure of banks' bond holdings by accounting approach (2018-2025)

Source: Polish Financial Services Authority, author's own calculations.

4.4. Implications for banking business of sovereign debt duration

Changes of the valuation of sovereign bonds portfolio have a visible impact on banking activity. There are two main channels through which this influence occurs: bank's liquidity, and solvency. As the earlier is concerned, sovereign bonds are considered as one of the most liquid assets. That said, as their value decreases the (overall) bank's liquidity plummets. It becomes more important (and visible), when liquidity regulations (e.g. Basel III's Liquidity Coverage Ratio) apply. In such a case banks have to look for new funding to improve their liquidity position, which has been documented on the example of the Polish banking sector by Czaplicki (2025), who pointed out that banks with falling regulatory liquidity tend to offer higher interest on household deposits. The need to increase liquid assets may also well lead to weaker lending, as free capacity is used to improve liquid assets.

As the bank's solvency is concerned, it can be impacted either immediately or with a delay. In the first case, the valuation of AFS portfolio is recognized through other comprehensive income, which is a part of equity capital. In the latter case the revaluation/devaluation of HFT portfolio is recorded through income statement, therefore it at least decreases retained earnings (another source of equity capital) or in extreme cases leads to direct losses. Keeping all that in mind, changes of equity impact the lending capacity of a bank (the capacity to grant new credit given constraints imposed by regulatory requirements. Czaplicki (2022) shows that the free lending capacity has a direct and statistically significant impact on overall bank lending in Poland. Graph 1 sums up the above described transmission channels for the scenario of increasing rates. In this particular case high duration of bonds has a strengthening effect on the transmission of monetary policy, supporting it at the time of rate hikes.



Graph 1. The transmission of changes to interest rates via fixed-coupon debt valuation

Source: Author's own elaboration.

5. Discussion and Conclusions

Tightening banking regulation in the European Union (and particularly in Poland) has likely led to increasing role of sovereign debt in banks' assets, as lending to public sector replaced lending to the private one. In such a situation new risks gained on importance, including duration risk, that is the risk of change in valuation of a fixed-coupon bond due to changes in market interest rates.

In this article we have shown, on the basis of the Polish banking sector, that banks increase not only their exposure to sovereign debt, but also to the related duration risk. Importantly – in opposition to foreign investors, whilst purchasing treasuries, banks follow the current interest (coupon) paid, as the main factor behind the acquisition of a bond. Despite having a positive impact in their (interest) income, such policy increases banks' vulnerability, as it exposes them to the duration risk.

Due to this risk, banks that seem to be overly liquid and solvent may momentarily lose their edge on deposit market and shrink their lending capacity. That said, it is important (from regulatory, and supervisory perspective) to limit this negative exposure and promote a more countercyclical approach. Keeping that in mind, the most recent actions taken in the European Union (introduction of SOT NII given the boundaries of SOT EVE) might have been procyclical, at least in case of Polish banks.

Keeping all that in mind, changes in market value are reflected on books, only when a bank follows a specific accounting approach (FVOCI), whereas banks decrease the share of these instruments in overall mix. From this standpoint it would be beneficiary to identify the reasons behind such a behaviour, and to indicate the main drivers of the choice behind specific accounting policy.

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