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Euro Macro Themes

Negative rates: A non-linear dilemma for European banks

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- **The detrimental impact of negative rates on European banks has been a topic of widespread research, but the non-linearity of this exposure and the associated cost implications have not received as much attention.**
- **The ability of European banks to pass through policy rate cuts to retail deposits, and hence offset potentially lower returns on assets, falls materially when rates go below zero. This leads to negative rate convexity of bank lending margins, with the fall in margins accelerating as policy rates go into negative territory.**
- **Negative convexity, to current and future levels of rates, means that banks are implicitly short interest rate floor options on front-end rates. As a result, banks are negatively impacted not just by lower rate levels but also by higher rate volatility.**
- **This is significant for policymaking, as negative rates impose an additional cost on banks in the form of short positions on rate optionality. Policy makers should weigh this cost, among others, against the cumulative benefits of negative rates.**
- **Banks looking to mitigate the impact of low rates should consider being long rate volatility, alongside any long duration positions, to counter negative convexity.**
- **Similarly, equity investors that are overweight banks (see *Banks – For the braves, buy the Brexit dip*, 23 October 2019 for the Barclays Equity Research view on European bank equities), but would like protection against losses if rates move lower, could buy interest rate floor options as a hedge.**

Negative rates have a non-linear impact

The impact of negative rates on bank profitability in the euro area has been a widely discussed and well-researched topic over the past few years, since the ECB cut policy rates into negative territory in 2014. However, while there has been a lot of focus on quantifying the impact of rate cuts on banks at negative levels, the non-linearity of this exposure has not received as much attention.

The core issue associated with negative rates arises from the unequal pass-through of rate changes on the asset and liability side of bank balance sheets when rates are below zero

The core issue associated with negative rates arises from the unequal pass-through of rate changes on the asset and liability side of bank balance sheets when rates are below zero (see *European Bank Strategy: Negative rates and euro area banks: the problem and the solutions*, 3 October 2019). In large part this is because interest rates on customer deposits at banks, specifically retail deposits, tend to be floored at zero. Banks are therefore unable to adequately offset lower returns on assets with lower funding costs. As a result, not only does profitability fall as rates rally, but this relationship is also non-linear around zero.

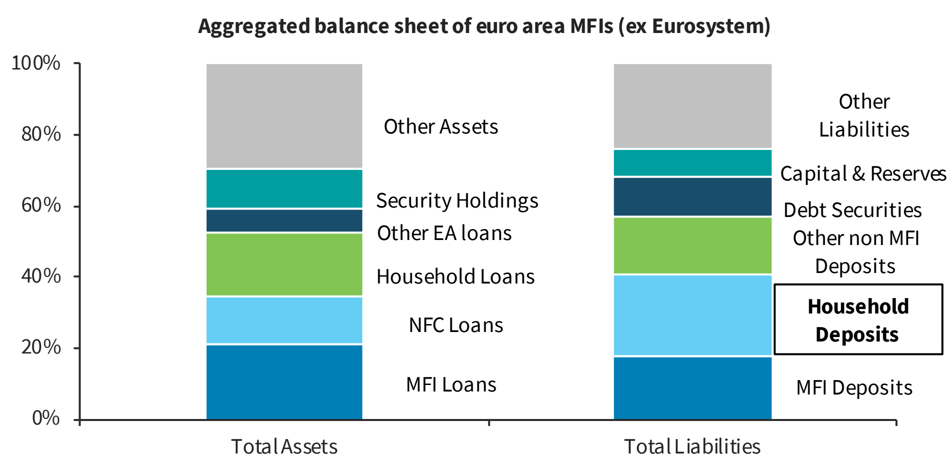
To test this hypothesis, we analyse lending margins for banks in major euro area countries and find evidence of negative convexity to short rates – i.e. lending margins have tended to fall more and more sharply as policy rates have gone below zero. In line with this, we find that euro area bank equity indices have also exhibited negative convexity at low rates.

Bank profitability prospects are not only affected by current negative rate levels, but also by expectations of how long rates are likely to stay negative. Consequently, they are effectively short interest rate floor options, on front-end rates. In support of this, we find that the performance of euro area bank indices, relative to aggregate euro area equity indices, have been fairly correlated with premiums of interest rate floor options over the past few years.

This of significance for policy making not just in the euro area but also in other regions where policy rates are close to, but still above zero. Extended periods of negative rates impose an additional cost on banks, measured by the short rate optionality, which needs to be taken into account when assessing the implications of negative rates. For banks themselves, the analysis indicates that the embedded short optionality may require structural hedging, not just against the level of rates but also against the volatility in rates.

FIGURE 1

Household deposits constitute a sizeable portion of the liabilities of euro area MFIs



Note: Data as 31 July 2019. Source: ECB, Barclays Research

Floor on bank deposit rates leads to negative rate convexity

Deposits form a sizeable portion of euro area MFI balance sheets

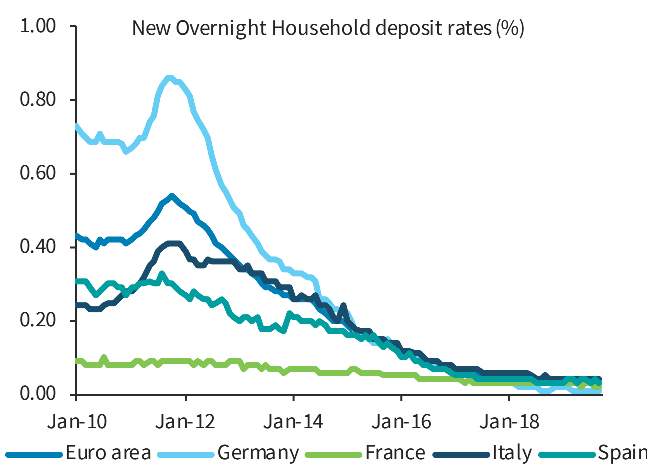
Household deposits constitute around 23% (or roughly €7.6tn) of the total liabilities of MFIs

In Figure 1, we show an overview of the aggregated balance sheet of euro area MFIs (monetary financial institutions). Household deposits constitute a significant portion of the total liabilities of MFIs, with a share of around 23% (or roughly €7.6tn). Euro area banks have so far been unable to pass on negative policy rates to these household deposits. This is particularly true for overnight deposits, which constitute 55% of the total household deposits (or about €4.25tn) and have been floored at just above zero across major euro countries over the recent past (Figure 2). In fact, the problem of low pass through of negative rates may not just be restricted to household deposits. For instance, Figure 3 shows that the average rates on overnight NFC deposits have also stayed positive, in the euro area, with only German MFIs being able to charge negative rates to corporations so far.

Returns on the assets side, on the other hand, offer higher sensitivity to changes in rates, even at negative policy rate levels. For instance, loans to NFCs and households, which constitute about 30% of the assets held by euro area MFIs, have fairly positive yields (Figures 4 and 5). These, therefore, show sensitivity to rate moves, and have scope to fall if

FIGURE 2

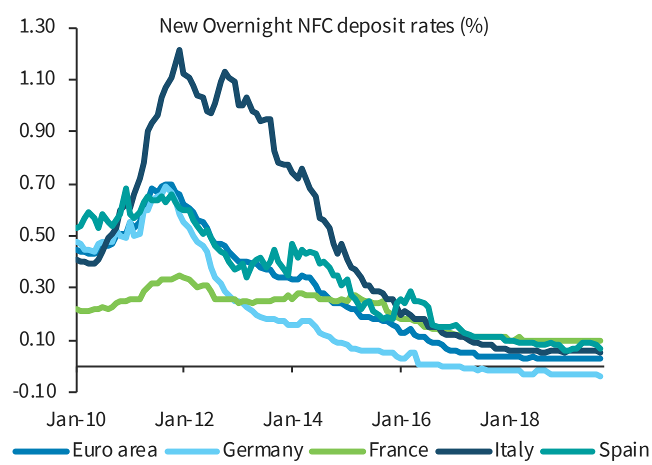
Overnight household deposit rates have been floored



Source: ECB, Haver Analytics, Barclays Research

FIGURE 3

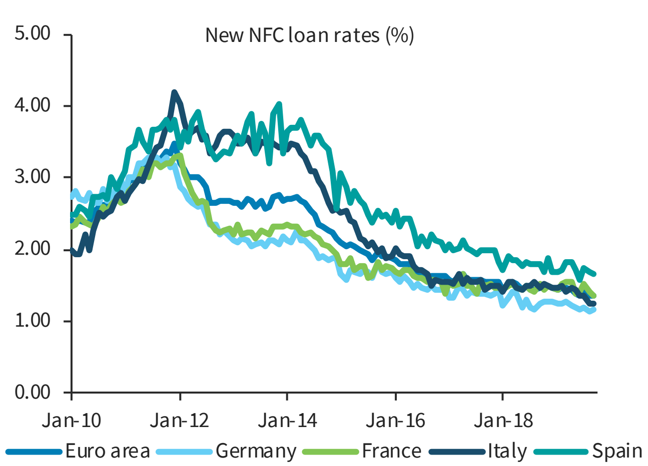
Even NFC deposit rates have been positive in most countries



Source: ECB, Haver Analytics, Barclays Research

FIGURE 4

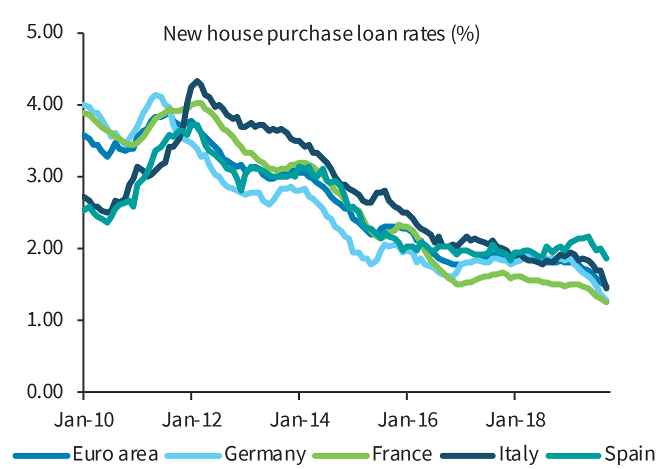
MFI loan rates are fairly positive and…



Source: ECB, Haver Analytics, Barclays Research

FIGURE 5

…exhibit more sensitivity to rate cuts



Source: ECB, Haver Analytics, Barclays Research policy rates fall further (for a detailed analysis regarding pass through of rates cuts in a negative rates environment see *European Bank Strategy: Negative rates and euro area banks: the problem and the solutions*, 3 October 2019).

Lending margins of euro area MFIs have negative convexity

With rates on a sizeable portion of deposits floored at zero, the offset to lower income from lower costs is not available to the same extent at negative rate levels

In a positive rates environment, while a drop in interest rates tends to lower the future returns on loans (as well as other assets) for a bank, it also reduces the rate paid on the deposits (and other liabilities) held by the bank. Consequently, a drop in future earnings is in part offset by a fall in future costs. However, with interest rates on a sizeable portion of deposits being floored at zero, this offset to income from lower costs is not available to the same extent when policy rates turn negative. Therefore, the negative impact of a rates rally, on banks, increases when rates fall below zero. In other words, bank margins tend to suffer from negative convexity at low rate levels.

Lending margins for MFIs have shown negative convexity, falling faster as short rates have turned negative

To verify this, we look at aggregate MFI lending margins on new loans for house purchases and to NFCs (non-financial corporations) in major euro area countries[1]. We fit these margins using short rates (3m Euribor), long term rates (EUR 10y swap) and squared values of the short rates (Figure 6). Since banks typically lend for longer terms and borrow for shorter terms, the lending margin is likely to be dependent on the spread between long and short term rates. Figure 6 shows that this has been the case, at least in core euro area countries. More importantly for our analysis, however, lending margins in general have been inversely dependent on the squared value of short rates. In other words, lending margins for MFIs have shown negative convexity, falling faster as short rates have turned negative.

Negative convexity is also observed in financial institutions' pricing

Similarly, forward looking measures such as prices of bank stocks have also shown negative convexity at low rate levels. In Figure 7, we regress the ratio of Euro Stoxx Banks Index (SX7E) to Euro Stoxx 50 Index against long tenor rates (10y swap), short rates (3m Euribor) and a 0% floorlet on short rates. A 0% floorlet has a value of 0 when 3m Euribor rates are positive and value of -1 * 3m Euribor when the rate is negative.

The offsetting effect of short rates on euro area bank stock indices is largely absent at negative rate levels

As expected, the banks index (relative to the aggregate index) has tended to decrease when long term rates have rallied but increase when short term rates have rallied. However, the negative dependency on the floorlet indicates that this offsetting effect of short rates is absent at negative rate levels. In other words, the pricing of European banks has also been negatively and non-linearly affected as policy rates have turned negative.

FIGURE 6

Euro area bank lending margins have shown negative convexity

	Lending margins															
	Germany				France				Italy				Spain			
	Loans for Home Purchase		Loans to NFCs		Loans for Home Purchase		Loans to NFCs		Loans for Home Purchase		Loans to NFCs		Loans for Home Purchase		Loans to NFCs	
Variable	Coeff	T-stat	Coeff	T-stat	Coeff	T-stat	Coeff	T-stat	Coeff	T-stat	Coeff	T-stat	Coeff	T-stat	Coeff	T-stat
EUR 10y swap	0.63	25.9**	0.23	9.0**	0.48	9.1**	0.07	3.2**	0.24	5.5**	0.13	3.1**	-0.48	8.2**	-0.45	6.8**
3m Euribor	-0.34	7.8**	-0.07	1.5	-0.38	3.9**	-0.20	5.1**	0.02	0.3	0.26	3.5**	0.32	3.0**	0.24	2.0**
(3m Euribor)^2	-0.06	9.7**	-0.03	4.2**	-0.05	3.2**	0.03	4.5**	-0.03	2.1**	-0.06	5.2**	-0.01	0.7	-0.01	0.5
Constant	1.18	34.6	1.17	32.9**	1.12	14.8**	1.12	36.5**	1.09	17.3**	0.85	14.4**	2.21	26.7**	2.33	24.6**
R-squared	94%		65%		71%		23%		54%		59%		50%		49%	

Note: Regression from 2004 onwards, using monthly data. Source: ECB, Haver Analytics, Barclays Research

[1] Lending margins are measured by the ECB as the difference between MFIs' interest rates on new business loans and a weighted average interest rate on new deposits from households and non-financial corporations

Banks have implicit short interest rate volatility exposure

Outlook for banks are not only impacted by the current rate levels but also by expectations of how long rates are likely to be low or negative. Banks are therefore not just negatively exposed to the spot 0% floorlet (as described in the above section), but also to floorlets in the future. In effect, banks have a short exposure to interest rate floor options.

Banks are implicitly short interest rate floor options and therefore have short rate vol exposure

In Figure 8 we plot the ratio of Euro Stoxx Banks Index (SX7E) to Euro Stoxx 50 index (SX5E) against the price of EUR 5y interest rate floors struck at 0%. As seen, this ratio has been highly correlated to the price of the floor with the R-squared of the fit being over 65%. This indicates that banks are indeed implicitly short interest rate floor options.

Interest rate floor options

Interest rate floors are a commonly traded interest rate options product. A typical interest rate floor in EUR consists of a series of floorlets (or options) on the 3m Euribor, with each floorlet expiring three months after the previous one. Each floorlet, in turn, is an option on the 3m Euribor that on expiry pays a linearly increasing payout if the rate is below the strike rate (K) and zero if the rate is above the strike. For instance, a EUR 5y floor with strike rate of 0% consists of 3m*3m, 6m*3m, …54m*3m, 57m*3m receiver options (floorlets), each struck at 0%. Like other vanilla options, the price of an interest rate floor increases as implied, or expected, volatility of rates increases.

Short vol exposure imposes an additional cost and may require hedging

The present value of the cost for banks is more than the loss that could eventually be incurred if rates remained negative, but unchanged

The price of an option is composed of two parts: expected payout if rates stay unchanged until expiry (known as *intrinsic value*) and the expected gain from any volatility in rates until expiry (*time value*). Therefore, a short optionality exposure means that the actual cost imposed on banks is in fact more than the loss that could eventually be incurred if rates remained negative, but unchanged, over time.

This increase in cost, from short optionality, should also be considered when evaluating the net benefits of negative rates

Policymakers, in our view, should take this cost – effectively arising from the future volatility in rates – into account when assessing the net benefits of negative policy rates. While the tiering system implemented by the ECB helps alleviate this cost, the current level of exempted reserves (at about €800bn) is only a tiny fraction of the total amount of household deposits at the Eurosystem level. Further measures, such as an increase in the multiplier or the

FIGURE 7

Negative rates have had an adverse impact on euro area banks

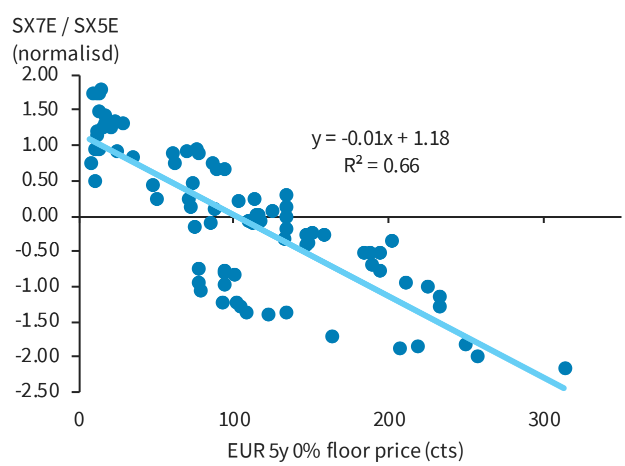
Regression of SX7E Banks Index / SX5E Euro-Stoxx Index (monthly frequency, since 2011, ratio has been normalised)

Variables	Coefficient	T-stat
EUR 10y swap (%)	0.95	7.5**
EUR 3m Euribor (%)	-0.45	2.2**
EUR 3m Floorlet (%)	-2.47	5.8**
Constant	-0.91	5.0**
R-squared	79.3%	

Note: Regression uses average monthly data. Source: Bloomberg, Barclays Research

FIGURE 8

Interest rate floor prices can help explain the variation in the outlook for banks



Note: Data is with monthly frequency. Source: Bloomberg, Barclays Research remuneration rate of exempt reserves, may therefore be needed. However, such changes likely have to be carefully calibrated to avoid any undue implications (see *Swiss tiering has not convinced the market*, 12 September 2019). In addition, a clear and effective communication that limits uncertainty on the evolution of policy rates, may also help by reducing undue volatility in rates.

The total short vega exposure of all euro area banks may be quite large

For the banks themselves, the embedded short optionality means that they are not just exposed to future levels of rates but also to future volatility in short rates. Higher volatility increases the price of interest rate floors and is negative for banks. In rates options parlance, banks are short vega. By using the historical beta of the SX7E index to the 5y 0% strike interest rate floors, we roughly estimate that the short vega position may be in the range of €1-2bn/abpv vega for the banks in the index. For all the banks in the euro area, the exposure is even larger.

This is a sizeable amount of vega exposure, compared with the size of the entire rates options market. To provide context, the vega exposure of the outstanding USD callable notes – which is one of the biggest sources of options in rates – is likely around a few hundred million (USD). While the large short vega exposure may limit the amount that banks can hedge in the rates volatility market, rates options should nonetheless be an active tool to mitigate the impact of negative rates, in our view.

Negative convexity is not unique to the euro area

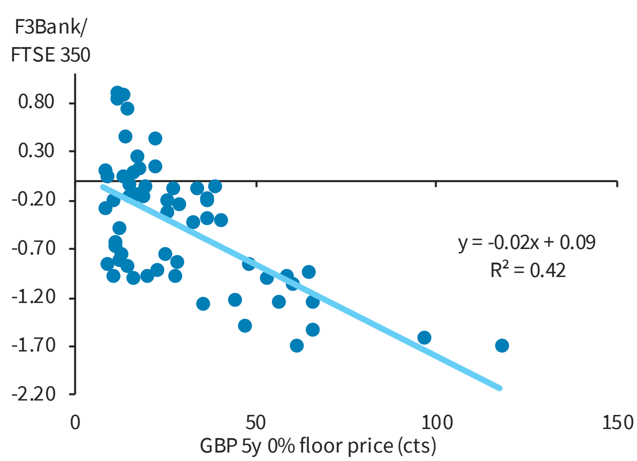
The non-linear impact of low rate levels is not unique to the euro area. For instance, UK financial institutions likely also have negative convexity to rates, even though policy rates are still positive there. Figure 9 shows that the ratio of the FTSE 350 Banks Index (F3BANK on Bloomberg) to the FTSE 350 Index has been negatively correlated to the price of GBP 5y 0% interest rate floors. Similarly, a regression of this ratio with long tenor rates, short rates and the price of 0% floors, shows that the relative performance of UK banks may have largely been a function of rate curve levels and rate optionality, since 2015.

Banks in the UK may also be feeling the effect of negative convexity due to low rate levels

This suggests that even though rates in the UK are still positive, banks have already started feeling the effect of negative convexity due to low rate levels. Further rate cuts, especially into negative territory, would likely only increase this cost from short optionality and should be taken into account when evaluating the net impact of lower rates in the UK.

FIGURE 9

UK bank indices have been inversely impacted by the price of GBP 0% interest rate floors



Note: Data is of monthly frequency. Source: Bloomberg, Barclays Research

FIGURE 10

Rate levels along with the probability of negative rates have affected UK banks

Regression of F3Bank Index/ FTSE 350 Index (monthly frequency, since 2015, ratio has been normalised)

Variables	Coefficient	T-stat
GBP 10y swap (%)	0.974	7.9**
GBP 3m Libor (%)	-1.923	10.1**
GBP 5y 0% floor (cts)	-0.013	6.3**
Constant	-0.357	1.5
R-squared	84.94%	

Source: Bloomberg, Barclays Research

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