Solvency and wholesale funding cost interactions at UK banks

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Objective and Motivation

Objective

We empirically investigate the interaction between solvency and the cost of funding at UK banks.

Motivation

- During the financial crisis, significant losses brought into question their ability to continue to meet their regulatory capital requirements.
- Market uncertainty over the solvency of banks significantly increased the cost at which banks were able to access funds.

Background

Previous attempts to model bank funding costs can broadly be separated into one of two camps:

- market-based approach[1]
- balance sheet-based approach[2]

In the UK, we have a highly concentrated banking sector, giving rise to a very small number of cross sections.

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[1]Schmitz, Sigmund, and Valderrama (2016)
[2]Aymanns, Caceres, Daniel, and Schumacher (2016)

Framework

We use *CDS premia* as a proxy for banks marginal cost of funding.

Our explanatory variables are[3]

- Firm leverage - market-based leverage ratio defined as

$$\text{MBLR} = \frac{\text{Market Value of Equity}}{\text{Book Value of Assets}}$$

- The risk free rate - the daily yield on the 5-year gilt
- Share price volatility - the daily 30-day share price volatility series
- Liquidity - bid-ask spread of the CDS quotes
- Market-wide volatility - the daily VFTSE Index

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[3]Collin-Dufresne, Goldstein and Martin (2001), Blanco, Brennan and Marsh (2005), Longstaff, Mithal, and Neis (2005)

The relationship between MBLR and CDS premia
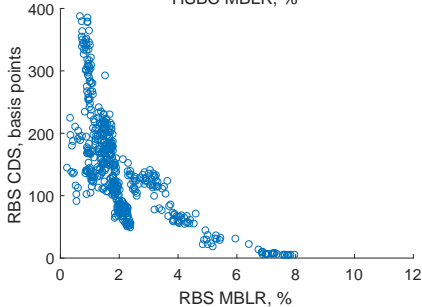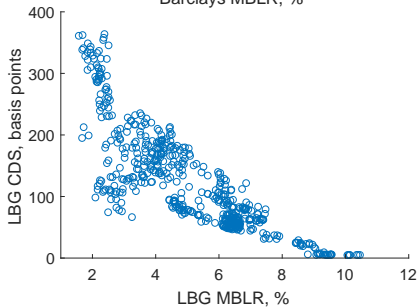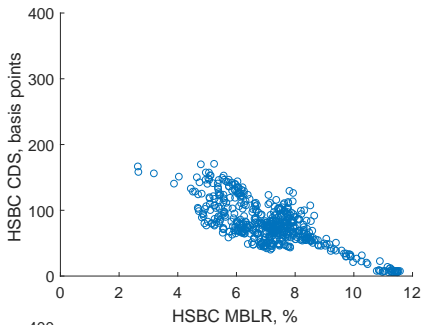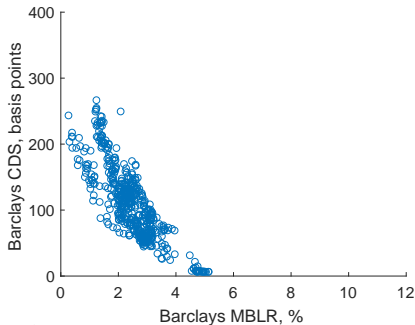
Model 1

Linear fixed effects model

$$\Delta\text{CDS}_{it} = \alpha_i + \beta'\Delta\text{MBLR}_{it} + \delta'\Delta Z_{it} + e_{it},$$

where $Z_{it} =$

$\{\text{Risk Free Rate}_t, \text{Bid Ask Spread}_{it}, \text{VFTSE}_t, \text{Share Price Volatility}_{it}\}.$

Model 2

Panel threshold model (Hansen (1999)) with threshold r

$$\Delta\text{CDS}_{it} = \alpha_i + \beta_1'\Delta\text{MBLR}_{it}I(\text{MBLR}_{it} < r) + \beta_2'\Delta\text{MBLR}_{it}I(\text{MBLR}_{it} \geq r)$$
$$+ \delta'\Delta Z_{it} + e_{it},$$

where $Z_{it} =$

$\{\text{Risk Free Rate}_t, \text{Bid Ask Spread}_{it}, \text{VFTSE}_t, \text{Share Price Volatility}_{it}\}$.

Model 3

Panel smooth transition model (González, Teräsvirta, van Dijk (2005)) with the logistic function, $g(\cdot)$

$$\Delta \text{CDS}_{it} = \alpha_i + \beta_1' \Delta \text{MBLR}_{it} + \beta_2' \Delta \text{MBLR}_{it} g(\text{MBLR}_{it}; \gamma, c)$$
$$+ \delta' \Delta Z_{it} + e_{it}$$
$$g(\text{MBLR}_{it}; \gamma, c) = (1 + \exp(-\gamma(\text{MBLR}_{it} - c)))^{-1}$$

where $Z_{it} =$
$\{\text{Risk Free Rate}_t, \text{Bid Ask Spread}_{it}, \text{VFTSE}_t, \text{Share Price Volatility}_{it}\}$.

Estimation

- We conduct our analysis using a panel comprised of the four largest UK banks: Barclays, HSBC, LBG, RBS.

- We aggregate the daily series to weekly frequency.

- We estimate the models over both the full sample (2007-2016) and rolling windows (130 observations).

Full Sample Estimation Results

Estimated Coefficients of MBLR

Linear		Threshold		ST	
ΔMBLR	−9.93	ΔMBLR < 2.45%	−28.92	ΔMBLR	−31.58
	(−5.13)		(−4.75)		(−9.44)
		ΔMBLR ≥ 2.45%	−6.46	ΔMBLR*$g(q; \gamma, c)$	25.09
			(−3.98)		(7.28)

For ST, $c = 2.42\%$ and $\gamma = 4.18 \times 10^{8}$.

- A 100 bps drop in MBLR leads a 9.93 bps increase in CDS spreads.

Full Sample Estimation Results

Estimated Coefficients of MBLR

Linear		Threshold		ST	
ΔMBLR	−9.93	ΔMBLR < 2.45%	−28.92	ΔMBLR	−31.58
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			(−3.98)		(7.28)

For ST, $c = 2.42\%$ and $\gamma = 4.18 \times 10^{8}$.

- When the MBLR level is below 2.45%, a 100 bps drop in MBLR leads a 28.92 bps increase in CDS spreads.
- When the MBLR level is above 2.45%, a 100 bps drop in MBLR leads a 6.46 bps increase in CDS spreads.

Full Sample Estimation Results

Estimated Coefficients of MBLR

Linear		Threshold		ST	
ΔMBLR	−9.93	ΔMBLR < 2.45%	−28.92	ΔMBLR	−31.58
	(−5.13)		(−4.75)		(−9.44)
		ΔMBLR ≥ 2.45%	−6.46	ΔMBLR*$g(q; \gamma, c)$	25.09
			(−3.98)		(7.28)

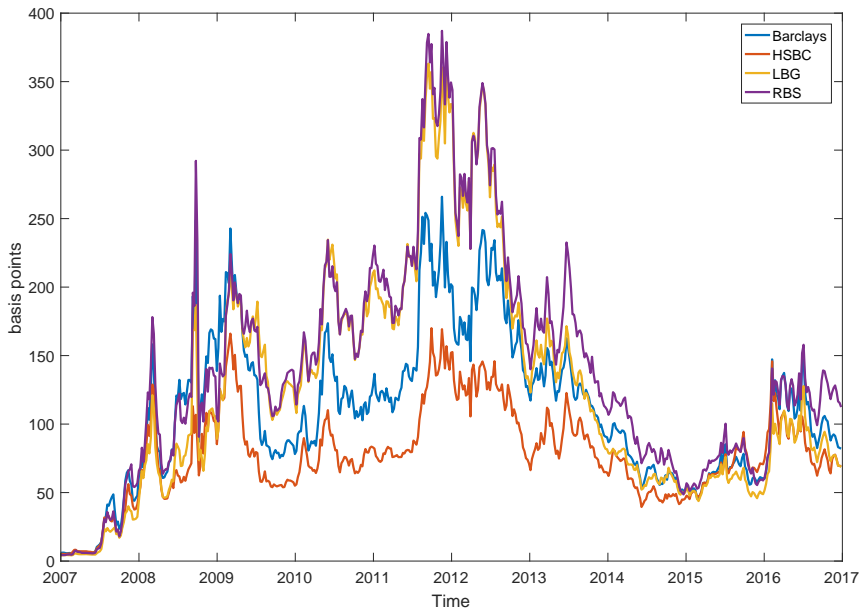For ST, $c = 2.42\%$ and $\gamma = 4.18 \times 10^8$.

- For the *least solvent* bank, a 100 bps drop in MBLR leads a 31.58 bps increase in CDS spreads.
- For the *most solvent* bank, a 100 bps drop in MBLR leads a 6.49 bps (31.58-25.09) increase in CDS spreads.
- For the rest of the banks, the impact of MBLR on CDS spreads in the range of 6.49 bps to 31.58 bps - only when smooth transition models does not reduce to a threshold model.

Full Sample Estimation Results

Estimated Coefficients of the Exogenous Variables

	Linear	Threshold	ST
ΔRisk Free Rate	−32.07	−30.90	−30.44
	(−5.51)	(−6.73)	(−12.64)
ΔBid-Ask Spread	2.94	2.89	2.89
	(5.11)	(5.60)	(14.87)
ΔVFTSE	0.57	0.52	0.50
	(14.72)	(1.99)	(5.29)
ΔShare Price Volatility	0.062	0.03	0.026
	(1.66)	(0.52)	(0.86)

The evolution of CDS premia

Subsample Results for the Smooth Transition Model

Net CDS premia impact of 100bps drop in MBLR on

|	the least solvent bank	the most solvent bank
mid-2007 to end-2009 (financial crisis)	9.23	3.28
mid-2009 to end-2011 (sovereign debt crisis)	192.35	5.89
mid-2013 to end-2015 (post sovereign debt crisis)	70.34	4.80
mid-2014 to end-2016 (most recent sample)	52.89	8.51
2007 - 2016	31.58	6.49

Bank of England Stress Test

- Bottom-up

- Seven largest banks of the UK

- In-house modeling of feedback and amplification mechanisms

Can we explore the interaction between solvency and wholesale funding costs of the banks in stress test?

How do we use these results in stress testing?

- Firms provide their estimated leverage ratios in stress.

- Under some assumptions, we evaluate firms' MBLRs.

- We use historical or stress scenario values for the other variables in the model.

2016 Stress Test Results by the ST Model - subsample mid-2014 to end-2016
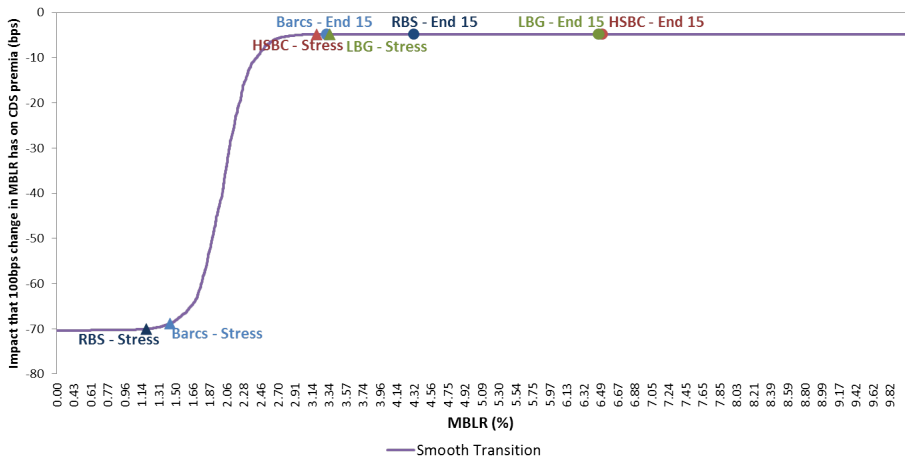
Concluding Remarks

- This paper aims to empirically investigate the link between the solvency of UK banks' and their marginal funding cost of funding.

- We employ a suite of models to explore this relationship.

- We find strong evidence that the relationship is indeed non-linear and as expected, the linear model falls short of fully capturing this relationship.

- Our results show that a negative shock to a bank's perceived solvency is associated with an increase in its marginal cost of wholesale funding.

Appendix: Data and variable selection

We use CDS premia in weekly frequency as a proxy for marginal wholesale funding cost Our explanatory variables are as follow:

- For risk free rate we use the five-year gilt rate.
    - Constitutes the risk neutral drift in the firms valuation process. Expected relationship (-)
- For credit risk we use the market-based leverage ratio.
    - Firms market value over total assets. A proxy for firm leverage. Expected relationship (-)
- For liquidity risk we use the bid-ask spread.
    - The difference between the daily bid and daily ask CDS quotes proxies the liquidity risk CDS premia are due. Expected relationship (+)
- Market-wide volatility
    - Proxies the uncertainty of the broader economic environment over firms economic prospers. Expected relationship (+)
- Share price volatility
    - Proxies the firm specific uncertainties over their economic prospects. Expected relationship (+)

How do we use these results in stress testing?

- Firms provide their Tier 1 leverage ratio (Tier 1 capital/Exposure).

- Under some assumptions, we evaluate firms book leverage (Shareholders equity/Total Assets).

- Under some assumptions, we evaluate Price-to-Book Ratio.

- We apply book leverage to price-to-book ratio to evaluate MBLR.

- For the banks not included in this analysis, the average UK bank price-to-book ratio is applied to their book leverage ratio.

- We use historical or stress scenario values for the other variables in the model.